21. MEDNARODNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH

13.–15. november 2013, Portorož, Slovenija

21st INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY

13–15 November 2013, Portorož, Slovenia

PROGRAM IN KNJIGA POVZETKOV

PROGRAM AND BOOK OF ABSTRACTS

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IN TEHNOLOGIJE, LJUBLJANA

21. MEDNARODNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH /
21st INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY

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D. Nolan – BlueScope steel, Avstralija
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VSEBINA – CONTENTS

Legenda – Legend:

NKM Napredni kovinski materiali, polimeri, keramika in kompozitni materiali – Synthesis of advanced metallic, polymeric, ceramic and composite materials
MS Modeliranje in simulacija procesov in tehnologij – Mathematical modeling and computer simulation of processes and technologies
TO Toplotna obdelava – Thermal treatment
RN Razvoj naprednih proizvodnih tehnologij – Development of advanced manufacturing technologies
KD Korozija in degradacija materialov – Corrosion and degradation of materials
TP Tanke plasti in površine – Thin films and surfaces
NN Nanoznanost in nanotehnologije – Nanosciences and nanotechnologies
VT Vakuumska tehnika – Vacuum technique and technology

VP Vabljena predavanja – Invited papers
GP Govorni prispevki – Oral
MR Mladi raziskovalci – Young scientists

21. MEDNARODNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH, 13. – 15. NOVEMBER 2013
21ST JUBILEE CONFERENCE ON MATERIALS AND TECHNOLOGY, 13–15 NOVEMBER, 2013

	WEDNESDAY, 13th November		THURSDAY, 14th November		FRIDAY, 15th November	
09:00	Opening ceremony	09:00	Plenary lecture – **Kraljič**		09:00	Plenary lecture – **Ferraris**
09:20	Plenary lecture – **Dražič**	09:40	Golubev	Open discussion (in Slovene language):	09:40	Invited lecture – **Podgornik**
10:00	**Coffee Break**	09:55	Cagala	**Status of metallic materials and metallurgy in Slovenia**	10:00	Invited lecture – **Žagar**
10:20	Address to the young researchers session	10:10	Beno	Speakers: **dr. Peter Kraljič** - McKinsey & Company	10:20	**Coffee Break**
10:30	Majerič – Le Gentil	10:25	Oral	**dr. Stojan Sorčan** - Minister for Education, Science and Sport	10:40	Kovačič M. / Jenko M.
10:50	Pasak – Kovačič A.	10:40	Skotnicova	**Andrej Gradišnik** - Metal Ravne C.E.O.	10:55	Eker / Markoli
11:10	Frunza – Poniku	10:55	Lichy	**dr. Peter Cvahte** – Impol	11:10	Klesa / Šuštaršič
10:30	Pileček – Richaud	11:10	**Coffee Break**		11:25	Dzugan / Jenko D.
11:50	Štrekelj – Strokova	11:30	Psiuk	**dr. Tomaž Savšek** – TPV **dr. Franci Demšar** – director of ARRS	11:40	Urbanek / Conradi
12:10	**LUNCH BREAK**	11:45	Bednarova	Invited: C.E.O.-s of developement departments in metals manufacturing industry: director of ARRS, Rector of University of Ljubljana and Maribor, Media.	11:55	Ierardi / Kožuh
13:40	Plenary lecture – **Blanpain**	12:00	Raić		12:10	**Coffee Break**
		12:15	Borovinšek		12:30	Zafošnik / Hnizdil
14:20	Richtarech – Murillo	12:30	Omanović	Moderators of the discussion are director of Institute of Metals and Technology, **dr. Matjaž Godec** and Head of the department for Materials and Metalurgy **ass. prof. Jožef Medved**	12:45	Konopik / Duchek
14:40	Hočevar – Azim	12:45	Kramar		13:00	Ozgowicz / Kubina
15:00	Žužek – Kafexhiu	13:00	Sarioglu		13:15	Krejci / Bruna
15:20	Chabičovsky – Bilek		**LUNCH BREAK**		13:30	Korbas / Podani
15:40	**Coffee Break**	14:00	**Excursion to Škocijan caves**		13:45	Martinek / Slama
16:00	Nasser – Dlouhy	20:00			14:00	Savilov / Grajcar
16:20	Pečko – Meštanek				14:15	/ Schafer
16:40	Arshad – Hauserova				14:30	Closing Ceremony with Light Lunch
17:00	Kostevšek – Koležnik					
17:20	Kvapil – Aišman					
17:40	**Coffee Break**					
18:00	Vancura – Rozman					
18:20	Perdih – Mramor					
18:40	Liu – Pondelak					
19:00	Rudež – Štefančič					
19:20	Benzigar – Lawrence					
20:00	**Poster Session**					
20:30 – 21:30	**Cocktail Party**					

PROGRAM 21. MEDNARODNE KONFERENCE O MATERIALIH IN TEHNOLOGIJAH
21st INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY: PROGRAM

SREDA – WEDNESDAY 13. 11. 2013		
	Predsedujoči – Chair: M. Godec, V. Leskovšek, B. Markoli	
9:00	**ODPRTJE – OPENING CEREMONY – Director IMT Godec**	
9:20	Goran Dražić Laboratory for materials chemistry, National Institute of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia DO WE NEED TO SEE ATOMS?	NKM
10:00	**Odmor – Break**	
10:20	**Address to the young researchers session**	
	Predsedujoči – Chair: S. Pejovnik, M. Jenko, B. Markoli, G. Dražić	
10:30	[1]Peter Majerič, [1,3]Rebeka Rudolf, [1]Ivan Anžel, [2]Jelena Bogović, [2]Srečko Stopić, [2]Bernd Friedrich [1]Faculty of Mechanical Engineering, Maribor, Smetanova 17, 2000 Maribor, Slovenia, [2]IME Process Metallurgy and Metal Recycling, RWTH University Aachen, Intzestrasse 3, Germany, [3]Zlatarna Celje d.d., Kersnikova 19, 3000 Celje, Slovenia SYNTHESIS OF NiTi/Ni-TiO_2 COMPOSITE NANOPARTICLES VIA ULTRASONIC SPRAY PYROLYSIS	NN
10:40	Adrien Le Gentil[1], Francis Baillet[1], Raphaël Boichot[1] [1]SIMaP, 1130 rue de la Piscine, BP 75, 38402 St Martin d'Hères CEDEX, France IMPACT OF A THIN CHROMIUM FILM EVOLUTION ON THE DAMPING OF A SILICA RESONATOR	TP
10:50	Matej Pašák, Roman Čička, Pavel Bílek, Peter Jurči, Ľubomír Čaplovič Institute of Materials Science, Faculty of Materials Science and Technology, Slovak University of Technology, Paulinska 16, 917 24 Trnava, Slovak Republic STUDY OF PHASE TRANSFORMATIONS IN Cr-V TOOL STEEL	MS
11:00	Aljaž Kovačič[1], Matej Borovinšek[1,2], Matej Vesenjak[1,3], Zoran Ren[1,4] [1]University of Maribor, Faculty of Mechanical Engineering, Smetanova 17, 2000 Maribor, Slovenia COMPUTATIONAL CHARACTERIZATION OF LOTUS-TYPE POROUS IRON	NKM
11:10	Raluca C. Frunză[1,2], Brigita Kmet[1], Marko Jankovec[3], Marko Topič[3], Barbara Malič[1] [1]Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia, [2]Jožef Stefan International Postgraduate School, Ljubljana, Slovenia, [3]Faculty of Electrical Engineering, University of Ljubljana, Tržaška cesta 25, 1000 Ljubljana, Slovenia Ta_2O_5-RICH THIN FILMS FOR TRANSPARENT ELECTRONIC DEVICES	TP
11:20	Besnik Poniku, Igor Belič, Monika Jenko Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia NEURAL NETWORK AS A TOOL FOR AUTOMATIC PEAK IDENTIFICATION IN AUGER ELECTRON SPECTROSCOPY	NKM
11:30	Vít Pileček, Filip Vančura, Hana Jirková, Bohuslav Mašek University of West Bohemia in Pilsen, Research Centre of Forming Technology, Univerzitni 22, 306 14 Pilsen, Czech Republic MATERIAL-TECHNOLOGICAL MODELLING OF DIEFORGING FOR COMPONENTS FROM 42CrMoS4 STEEL	TO
11:40	Emmanuel Richaud Arts et Métiers ParisTech, CNRS, PIMM UMR 8006, 151 boulevard de l'Hôpital, 75013 Paris, France ON THE USE OF OXIDATION INDUCTION TIME FOR QUANTIFYING RESIDUAL STABILIZERS DURING POLYOLEFINS THERMAL OXIDATION (P)	KD

11:50	Neva Štrekelj[1], Iztok Naglič[1], Aleš Nagode[1], Tonica Bončina[2], Franc Zupanič[2], Boštjan Markoli[1] [1]Faculty of Natural Sciences and Engineering, University of Ljubljana, Aškerčeva 12, Slovenia [2]Faculty of Mechanical Engineering, University of Maribor, Smetanova 17, Slovenia HEAT TREATMENT OF QUASICRYSTALLINE Al-Mn-Be-Cu ALLOY	NKM
12:00	Natalia Strokova, Savilov Serguei, Lunin Valery Chemistry Department, M.V. Lomonosov Moscow State University, Leninskie gory, 1-3, Moscow, 119991, Russia STUDY OF ADSORPTION CAPACITY OF NANOSTRUCTURED CARBON MATERIALS ON DIFFERENT TYPES OF ELECTROLYTES IN SUPERCAPACITORS	NN
12:10 – 13:40 ODMOR ZA KOSILO – LUNCH BREAK		
	Predsedujoči – Chair: S. Pejovnik, M. Jenko, E. Žagar, M. Torkar	
13:40	Bart Blanpain High Temperature Processes and Industrial Ecology[1], Department of Metallurgy and Materials Engineering, KU Leuven, Kasteelpark Arenberg 44 – Box 2450, B-3001 Leuven, Belgium HIGH TEMPERATURE ENGINEERING OF METALLURGICAL SLAGS IN A FRAMEWORK OF SUSTAINABLE INORGANIC MATERIALS MANAGEMENT	NKM
14:20	Dana Bolibruchová, Jozef Macko, Lukáš Richtárech University of Žilina, Faculty of Mechanical Engineering, Department of Technological Engineering, Univerzitná 1, 010 26 Žilina, Slovakia POSSIBILITIES OF ELIMINATION THE HIGHER AMOUNT OF IRON IN SECONDARY AlSi6Cu4 ALLOY (EN AC 45000)	MS
14:30	Noé-Verner Murillo-Gutiérrez, Florence Ansart, Jean-Pierre Bonino, Marie-Jöelle Menu, Marie Gressier, Noé-Verner Murillo-Gutiérrez Université de Toulouse UPS-INP-CNRS, Institut Carnot CIRIMAT, 118, Route de Narbonne, 31062 – Toulouse CEDEX 09, France HYBRID SOL-GEL COATINGS DOPED WITH CERIUM FOR CORROSION PROTECTION OF MAGNESIUM ALLOYS	TP
14:40	Matej Hočevar[1], Monika Jenko[1], Matjaž Godec[1], Damjana Drobne[2] [1]Institute of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia, [2]Department of Biology, Biotechnical Faculty, University of Ljubljana, Večna pot 111, SI-1000 Ljubljana, Slovenia THE INFLUENCE OF SURFACE PROPERTIES ON THE ADHESION OF BACTERIA TO UNCOATED AND SILVER COATED STAINLESS STEEL	NKM
14:50	Rezaul Azim, Mohammad Tariqul Islam Institute of Space Science (ANGKASA), Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Malaysia DESIGN OF WIDEBAND PLANAR ANTENNA ON EPOXY RESIN REINFORCED WOVEN GLASS MATERIAL	NKM
15:00	Borut Žužek, Franc Vodopivec, Bojan Podgornik, Monika Jenko, Matjaž Godec Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia EFFECT OF CARBIDE PARTICLES DISTRIBUTION ON CREEP DEFORMATION ACTIVATION ENERGY	NKM
15:10	Fevzi Kafexhiu, Franc Vodopivec Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia PRIMARY CREEP ANALYSIS OF SIMULATED HAZ FOR TWO 9-12% Cr STEELS	NKM
15:20	Martin Chabičovský, Miroslav Raudenský Heat Transfer and Fluid Flow Laboratory, Faculty of Mechanical Engineering, Brno University of Technology, Technická 2, 616 69 Brno, Czech Republic MEASUREMENT TECHNIQUES OF SPRAY COOLING HOMOGENEITY	TO

15:30	Pavel Bílek, Peter Jurči, Mária Hudáková, Ľubomír Čaplovič, Michal Novák Institute of Materials Science, Faculty of Materials Science and Technology in Trnava, Slovak University of Technology in Bratislava, Paulínská 16, 917 24 Trnava, Slovak Republic. TRIBOLOGY OF CrAg7N – COATINGS DEPOSITED ON VANADIS 6 LEDEBURITIC TOOL STEEL	TP
15:40	**ODMOR – BREAK**	
	Predsedujoči – Chair: S. Pejovnik, B. Podgornik, J. Šetina, D. Steiner Petrovič	
16:00	Ali Nasser, Ahmed. El-Desouky, Ahmed A. El-Moniem, Ali Nasser Egypt Japan university of science and technology, 21934, New Borg El Arab city, Alexandria, Egypt, P.O. Box 179 DEVELOPMENT OF TUNGSTEN CARBIDES NANO COMPOSITES FOR ULTRA HARD MATERIALS APPLICATIONS "SYNTHESIS AND CHARACTERIZATION"	NKM
16:10	Jaromir Dlouhy, Daniela Hauserova, Zbyšek Novy COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republi CARBIDE MORPHOLOGY AND FERRITIC GRAIN SIZE AFTER ACCELERATED CARBIDE SPHEROIDISATION AND REFINEMENT (ASR) OF C45 STEEL	TO
16:20	Darja Pečko[1], Kristina Žužek Rožman[1], Nina Kostevšek[1], Spomenka Kobe[1] [1]Jožef Stefan Institute, Department for Nanostructured Materials ELECTRODEPOSITED HARD MAGNETIC $Fe_{50}Pd_{50}$ NANOWIRES SYNTHESISED FROM THE AMMONIUM CITRATE BASED BATH	NN
16:30	Petr MěšŽánek, Vladislav Laš University of West Bohemia, Universitni 8, 30614, Pilsen, Czech Republic MODELING OF MICRO-DAMAGE OF E-GLASS/EPOXY COMPOSITE	NKM
16:40	M. Shahid Arshad[1], Kristina Žužek Rožman[1], Saso Sturm[1], Matej Komelj[1], Paul J. McGuiness[1], Spomenka Kobe[1,2] [1]Jožef Stefan Institute, Department of nano-structured materials K7, Ljubljana, Slovenia, [2]Center of Excellence on Nanoscience and Nanotechnology (CENN Nanocenter), Ljubljana, Slovenia DIFFERENT ENERGY CONTRIBUTIONS ON MAGNETIC DOMAIN CONFIGURATIONS IN ELECTRODEPOSITED CoPt NANOWIRES	NN
16:50	Daniela Hauserova, Jaromir Dlouhy, Zbysek Novy COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republic ACCELERATED CARBIDE SPHEROIDISATION AND REFINEMENT (ASR) OF C45 STEEL DURING CONTROLLED ROLLING	TO
17:00	Nina Kostevšek, Kristina Žužek Rožman, Sašo Šturm, Spomenka Kobe Department for nanostructured materials, Jožef Stefan Institute, Jamova 39, Ljubljana, Slovenia HYBRID FePt/Au NANOPARTICLES WITH A COMBINED MAGNETO-PHOTOTHERMAL EFFECT	NN
17:10	Mitja KoleŽnik, JoŽef Medved, Aleš Nagode Naravoslovnotehniška fakulteta, Aškerčeva cesta 12, 1000 Ljubljana EFFECTS OF TEMPERING TREATMENT ON MECHANICAL PROPERTIES IN MARTENSITIC STEELS WITH HIGH CHROMIUM CONTENT	NKM
17:20	Jiří Kvapil, Jaroslav Horský Heat Transfer and Fluid Flow Laboratory, Faculty of Mechanical Engineering, Brno University of Technology, Technická 2, 616 69 Brno, Czech Republic INFLUENCE OF QUALITY SURFACE ON THERMAL CONTACT RESISTANCE AT HIGHER TEMPERATURES	MS
17:30	Mašek B., Aišman D., Jirková H. University of West Bohemia, Czech Republic INFLUENCE OF THE ORIGINAL MICROSTRUCTURE OF LOW ALLOYED STEEL ON THE PROPERTIES AFTER MINI-THIXOFORMING	TO
17:40	**ODMOR – BREAK**	

	Predsedujoči – Chair: S. Pejovnik, B. Podgornik, B. Šarler, D. Steiner Petrovič	
18:00	Bohuslav Mašek, Filip Vančura, David Aišman, Hana Jirková, Martin F.-X. Wagner University of West Bohemia in Pilsen, Research Centre of Forming Technology – FORTECH, Univerzitní 22, 306 14 Pilsen, Czech Republic MINI-THIXOFORMING OF VARIOUSLY MODIFIED STATES OF TOOL STEEL X210Cr12	TO
18:10	Rozman N.[1], Škrlep L.[1], Cerc Korošec R.[2], Gaberšček M.[3], Živec P.[4], Sever Škapin A.[1] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, Ljubljana, Slovenia, [2]Faculty of Chemistry and Chemical Technology, University of Ljubljana, Aškerčeva 5, Ljubljana, Slovenia, [3]National Institute of Chemistry, Ljubljana, Hajdrihova 19, Slovenia, [4]TRC JUB d.o.o., Dol pri Ljubljani 28, 1262 Dol pri Ljubljani, Slovenija THE EFFECT OF SELECTED SYNTHESIS PARAMETERS ON THE STRUCTURAL AND FUNCTIONAL PROPERTIES OF NANOCRYSTALLINE TiO_2	NN
18:20	Peter Perdih,[a] David Pahovnik,[a] Ema Žagar*,[a] [a] National Institute of Chemistry, Hajdrihova 19, 1001 Ljubljana, Slovenia CHITOSAN-*GRAFT*-POLY(SODIUM-L-GLUTAMATE): SYNTHESIS AND APPLICATION	NKM
18:30	Katarina Mramor, Robert Vertnik and BoŽidar Šarler CO BIK, Tovarniška c. 26, 5270 Ajdovščina, Štore Steel, Železarska c. 3, 3220 Štore, Univerza v Novi Gorici, Vipavska 13, 5000 Nova Gorica, Inštitut za kovinske materiale in tehnologije, Lepi pot 11, 1000 Ljubljana, Univerza v Novi Gorici, Vipavska 13, 5000 Nova Gorica, CO BIK, Tovarniška c. 26, 5270 Ajdovščina, SIMULATION OF CONTINUOUS CASTING OF STEEL UNDER THE INFLUENCE OF EXTERNAL MAGNETIC FIELD BY USING LOCAL RADIAL BASIS FUNCTION COLLOCATION METHOD	MS
18:40	Qingguo Liu[1], Božidar Šarler[1,2,3] [1]University of Nova Gorica, Nova Gorica, Slovenia, [2]IMT, Ljubljana, Slovenia, [3]Center of Excellence BIK, Solkan, Slovenia IMPROVED NON-SINGULAR METHOD OF FUNDAMENTAL SOLUTIONS FOR TWO-DIMENSIONAL ISOTROPIC ELASTICITY PROBLEMS	MS
18:50	Andreja Pondelak[1], A. Sever Škapin[1], M. Klanjšek Gunde[2] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, Ljubljana, Slovenia, [2]National Institute of Chemistry, Ljubljana, Hajdrihova 19, Slovenia THE IMPACT OF pH of PHOTOCATALYTICALLY ACTIVE PRINTING INK ON ITS APPLICATION IN UV EXPOSURE INDICATOR	NN
19:00	Rok Rudež[1], Slavko Bernik[1,2] [1]Jozef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, [2]Center of Excellence NAMASTE, Jamova cesta 39, 1000 Ljubljana CONCENTRATED INKS FOR SCREEN PRINTING THICK-FILM VARISTORS	NKM
19:10	Mateja Štefančič[1], Ana Mladenovič[1], Anton Meden[2], Aljoša Šajna[1], Breda Mirtič[3] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, SI-1000 Ljubljana, Slovenia, [2]Univeristy of Ljubljana, Faculty of Chemistry and Chemical Technology, Aškerčeva cesta 5, SI-1000 Ljubljana, Slovenia, [3]Univeristy of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Geology, Aškerčeva 12, SI-1000 Ljubljana, Slovenia THE INFLUENCE OF NANOPARTICLES ON THE WORKABILITY, SETTING TIME AND MECHANICAL PROPERTIES OF CEMENT PASTES	NN
19:10	Mercy R. Benzigar and Ajayan Vinu Australian Institute for Bioengineering and Nanotechnology, The University of Queensland, 75, Corner College and Cooper Road, Brisbane 4072, QLD, Australia PREPARATION OF MESOPOROUS FULLERENES WITH ORDERED POROUS STRUCTURE FOR ENERGY STORAGE APPLICATION	NN

19:20	Geoffrey Lawrence and Ajayan Vinu Australian Institute for Bioengineering and Nanotechnology, The University of Queensland, 75, Corner College and Cooper Road, Brisbane 4072, QLD, Australia FABRICATION AND APPLICATIONS OF MULTILAYERED LYSOZYME FILMS WITH HIGHLY ORDERED STRUCTURES AND MORPHOLOGIES	NN
19:00	**Poster Session**	
20:00	**Cocktail Party**	

ČETRTEK – THURSDAY 14. 11. 2013		
	Predsedujoči – Chair: M. Godec, J. Medved	
09:00	Plenary lecture - P. Kraljič	
	Dvorana 2	
	Predsedujoči – Chair: E. Žagar, B. Blanpain	
09:40	Golubev Maxim Igorevich Moscow State University, Department of Chemistry, Moscow, Russia POLYPYRROLE AND POLY(3,4-ETHILENEDIOXYTHIOPHENE) COMPOSITES WITH CARBON NANOTUBES FOR IONIC LIQUID BASED SUPERCAPACITORS	NKM
09:55	Michal Cagala, Petr Lichý, Kateřina Skotnicová, Jaroslav Beňo, Marek Břuska, Tomáš Čegan VŠB – Technical University of Ostrava, Faculty of Metallurgy and Material Engineering, 17. Listopadu 15/2172, 708 33, Ostrava, Czech Republic VERIFICATION OF INFLUENCE OF INOCULATION ON COOLING CURVES AND ON MICROSTRUCTURE OF HYPOEUTECTIC ALLOY Al-Si	NKM
10:10	Jaroslav Beňo, Petr Jelínek, Eliška Adámková, František Mikšovský Department of Metallurgy and Foundry Engineering, FMMI, VŠB - Technical University of Ostrava, 17. Listopadu 15/2172, Ostrava – Poruba, Czech Republic CAPITALIZED DEVELOPMENT OF COMPOSITE SALT CORES FOR FOUNDRY APPLICATIONS	NKM
10:25	Imran Oral Necmettin Erbakan University, Ahmet Kelesoglu Faculty of Education, Department of Physics Education, 42090, Konya, Turkey ULTRASONIC PROPERTIES OF EPOXY RESIN/MARBLE WASTE POWDER COMPOSITES	NKM
10:40	Kateřina Skotnicová[1], Valentina M. Kirillova[2], O. I. Zaporozhets[3], Jaromír Drápala[1] [1]VŠB – Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Department of Non-ferrous Metals, Refining and Recycling, Av. 17. listopadu 15, 70833 Ostrava-Poruba, Czech Republic, [2]Baikov Institute of Metallurgy and Materials Science, Russian Academy of Sciences, Leninski prospect 49, 119991 Moscow, Russian Federation, [3]G.V. Kurdyumov Institute for Metal Physics, N.A.S.U., 36 Academician Vernadsky Blvd., UA-252680 Kiev-142, Ukraine INVESTIGATION OF PHYSICAL PROPERTIES OF TUNGSTEN-BASED SINGLE CRYSTALS USING ULTRASONIC METHOD	NKM
10:55	Petr Lichý[1], Jaroslav Beňo[1], Michal Cagala[1], Iveta Vasková[2] [1]VŠB – Technical University of Ostrava, Faculty of Metallurgy and Material Engineering, 17. Listopadu 15/2172, 708 33, Ostrava, Czech Republic, [2]The Technical University of Košice, Letná 9, 042 00, Košice, Slovak Republic THERMOPHYSICAL PROPERTIES AND MICROSTRUCTURE OF MAGNESIUM ALLOYS OF Mg-Al TYPE	NKM
11:10	**ODMOR – BREAK**	
	Predsedujoči – Chair: V. Ierardi, V. Savilov	
11:30	Bronisław Psiuk[1], Roman Wrzalik[2], Kinga Czechowska[1], Małgorzata Osadnik[3], Jacek Szade[2], Teresa Wala[1] [1]Department of Refractory Materials, Institute of Ceramics and Building Materials; Toszecka 99; 44-101Gliwice; Poland, [2]A. Chełkowski Institute of Physics, University of Silesia; Uniwersytecka4; 40-007; Katowice; Poland, [3]Institute of Non Ferrous Metals; Sowińskiego5; 44-100 Gliwice; Poland PEROVSKITE STRUCTURE MATERIALS FOR PHOTOCATALYTIC PROCESSES OBTAINED BY SOLID-STATE REACTIONS	NKM

11:45	Vlasta Bednářová, Petr Lichý, Ivo Lána, Tomáš Elbel Department of Metallurgy and Foundry Engineering, FMMI, VŠB - Technical University of Ostrava, 17. Listopadu 15/2172, Ostrava – Poruba, Czech Republic CAST POROUS METALS WITH REGULAR STRUCTURE AND SOLID SKIN	NKM
12:00	Rebeka Rudolf[1], Karlo T. Raić[2], Zoran Aleksić[3], Monika Jenko[4], Vojkan Lazić[3], Aleksandar Todorović[3], Dragoslav Stamenković[3], Vukoman Jokanović[5] [1]University of Maribor, Faculty of Mechanical Engineering, Maribor, Slovenia, [2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia, [3]University of Belgrade, School of Dentistry, Belgrade, Serbia, [4]Institute of materials and technology, Leti pot 11, Ljubljana, Slovenia, [5]University of Belgrade, VINCA Institute of Nuclear Sciences, Belgrade, Serbia HYDROXYAPATITE COATINGS ON cp-Ti SURFACES PREPARED BY PLASMA SPRAYING	NKM
12:15	Matej Vesenjak[1], Matej Borovinšek[1], Thomas Fiedler[2], Yoshikazu Higa[3], Lovre Krstulović-Opara[4], Shigeru Itoh[3] and Zoran Ren[1] [1]University of Maribor, Faculty of Mechanical Engineering, Maribor, Slovenia, [2]University of Newcastle, School of Engineering, Callaghan, New South Wales, Australia, [3]Okinawa National College of Technology, Nago, Okinawa, Japan, [4]University of Split, Faculty of Electrical Eng., Mech. Eng. and Naval Architecture, Split, Croatia CHARACTERIZATION OF GEOMETRICAL AND MECHANICAL PROPERTIES OF ADVANCED PORE MORPHOLOGY (APM) FOAM ELEMENTS	NKM
12:30	Mario Ascencio, Sasha Omanovic Department of Chemical Engineering, McGill University, 3610 University Street, Montreal, QC, Canada CORROSION MECHANISMS OF WE43 Mg-ALLOY IN A SIMULATED BODY FLUID	KD
12:45	Sabina Kramar[1], Vilma Ducman[1], Miroslava Radeka[3], Snezana Vucetic[2], Jonjaua Ranogajec[2] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, 1000 Ljubljana, Slovenia, [2]University of Novi Sad, Faculty of Technology, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia, [3]University of Novi Sad, Faculty of Technical Sciences,Trg Dositeja Obradovica 6,21000 Novi Sad, Serbia CHARACTERIZATION OF SUBSTRATES FROM TWO CULTURAL HERITAGE OBJECTS AND PREPARATION OF MODELS SUBSTRATES	KD
13:00	Israfil Kucuk, Cevat Sarioglu Marmara University, Dept. of Metallurgical and Materials Engineering, Göztepe kampusu, 34722, kadiköy-istanbul, Turkey THE PITTING CORROSION OF TiN COATED STAINLESS STEEL IN 3 wt.% NaCl SOLUTION	KD
14:00 – 17:00 Excursion to Škocijan caves		

	Dvorana 1
	Predsedujoči – Chair: M. Godec, J. Medved
09:40	Open discussion (in Slovene language): **Status of metallic materials and metallurgy in Slovenia** Speakers: **dr. Peter Kraljič** - McKinsey & Company **dr. Jernej Pikalo** - Minister for Education, Science and Sport **Andrej Gradišnik** - Metal Ravne C.E.O. **dr. Peter Cvahte** – Impol
11:10	**ODMOR – BREAK**
11:20	**dr. Tomaž Savšek – TPV** **dr. Franci Demšar – director of ARRS** **Invited: C.E.O.-s of developement departments in metals manufacturing industry: director of ARRS, Rector of University of Ljubljana and Maribor, Media.** **Moderators of the discussion are director of Institute of Metals and Technology, dr. Matjaž Godec and Head of the department for Materials and Metalurgy ass. prof. Jožef Medved**
14:00 – 17:00 Excursion to Škocijan caves	

PETEK – FRIDAY 15. 11. 2013		
	Predsedujoči – Chair: M. Jenko, B. Podgornik	
9:00	M. Ferraris Politecnico di Torino, Italy JOINING AND INTEGRATION OF ADVANCED MATERIALS	NKM
9:40	B. Podgornik, V. Leskovšek Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia COMPONENT COATINGS - OVERVIEW, PROPERTIES AND CONCERNS IN COATINGS SELECTION	NKM
10:00	David Pahovnik, Peter Perdih, Ema Žagar Laboratory for Polymer Chemistry and Technology, National Institute of Chemistry, Hajdrihova 19, 1001 Ljubljana, Slovenia SYNTHESIS AND APPLICATION OF NOVEL POLYMER CARRIERS FOR DELIVERY OF ACTIVE PHARMACEUTICAL INGREDIENTS	NKM
10:20	**ODMOR – BREAK**	
	Dvorana 1	
	Predsedujoči – Chair: J. Šetina, B. Šarler	
10:40	Miha Kovačič[1], Robert Jager[2] [1]ŠTORE STEEL d.o.o., Železarska cesta 3, SI-3220 Štore, Laboratory for Multiphase Processes, University of Nova Gorica, Vipavska 13, SI-5000, Slovenia [2]ŠTORE STEEL d.o.o., Železarska cesta 3, SI-3220 Štore, Slovenia MODELING OF OCCURRENCE OF SURFACE DEFECTS OF C45 STEEL WITH GENETIC PROGRAMMING	MS
10:55	Gulsum Ad, Sıtkı Eker Physics Department, Ahi Evran University, Kırşehir 40200, Turkey PRESSURE - INDUCED PHASE TRANSFORMATION OF InN: AN AB INITIO CONSTANT PRESSURE STUDY	MS
11:10	Jan Klesa Department of Mechanics, Faculty of Applied Sciences, University of West Bohemia, Univerzitni 22, 306 14 Plzen, Czech Republic USE OF ACTIVE MATERIALS FOR CONTROL OF PROPELLER BLADE TWIST AND ITS INFLUENCE ON PROPELLER EFFICIENCY	MS
11:25	Jan Džugan, Zbyšek Nový, Martina Marešová COMTES FHT Inc., Průmyslová 995, Dobřany, Czech Republic FATIGUE LIFE ENHANCEMENT OF METAL SHEETS MADE OF 34CrNiMo6 STEEL	MS
11:40	Miroslav Urbánek, Filip Tikal COMTES FHT a.s., Prumyslova 995. Dobrany, Czech Republic EFFECTIVE PREPARATION OF NON-LINEAR MATERIAL MODELS	MS
11:55	Vincenzo Ierardi, Giuseppe Firpo, Ugo Valbusa NanoMed labs, Physics Department (DIFI), University of Genova, Largo R. Benzi 10, 16146 Genova, Italy NANOPORES: FABRICTION AND CHARACTERIZATION	NN
12:10	**ODMOR – BREAK**	
	Predsedujoči – Chair: B. Šarler, M. Torkar	
12:30	Boštjan Zafošnik[1], Blaž Florjanič[2], Uroš Božič[2] [1]School of Technologies and Systems, VITES, Na Loko 2, 8000 Novo mesto, Slovenia , [2]University of Ljubljana, Faculty of Mechanical Engineering, Aškerčeva 6, 1000 Ljubljana, Slovenia COMBINING STATISTICAL AND ANN MODEL WITH FINITE ELEMENT METHOD FOR ASSESSING UNDERCUT GEOMETRY STRESS FIELD DURING INJECTION MOLDING PROCESS	MS

12:45	Jan Dzugan, Pavel Konopik, Radek Prochazka COMTES FHT Inc., Průmyslová 995, Dobřany, Czech Republic DETERMINATION OF LOCAL MECHANICAL PROPERTIES FOR FEM SIMULATIONS	MS
13:00	Wojciech Ozgowicz[1], Barbara Grzegorczyk[1], Andrzej Pawełek[2], Andrzej Piątkowski[2], Zbigniew Ranachowski[3] [1]Institute of Engineering Materials and Biomaterials, Silesian University of Technology, Konarskiego 18a, 44-100 Gliwice, Poland, [2]Institute of Metallurgy and Materials Science of Polish Academy of Sciences, 30-059 Cracow, Reymonta St. 25, Poland, [3]Institute of Fundamental Technological Research Polish Academy of Sciences, 02-106 Warsow, Pawinskiego St., Poland THE INFLUENCE OF THE STRAIN RATE ON THE PLC EFFECT AND ACOUSTIC EMISSION IN SINGLE CRYSTALS OF THE CuZn30 ALLOY COMPRESSED AT ELEVATED TEMPERATURE	MS
13:15	Lubomír Houfek[1], Petr Krejčí[1], Zuzana Kolářová[2] [1]Brno University of Technology, Faculty of Mechanical Engineering, Institute of Solid Mechanics, Mechatronics and Biomechanics, Technická 2896/2, 616 69 Brno, Czech Republic, [2]Brno University of Technology, Faculty of Civil Engineering, Institute of Building Structure, Veveří 331/95, 602 00 Brno, Czech Republic PARAMETER IDENTIFICATION OF 3D SIMULATION MODEL OF REAL BUILDING CONSTRUCTION USING MKP IN SYSTEM ANSYS AND GENETIC ALGORITHM	MS
13:30	Martin Korbáš[1], Libor Čamek[2], Milan Raclavský[3] [1]Vítkovice Heavy Machinery a.s., Ruská 2887/101, Vítkovice, Ostrava, Czech Republic, [2]Department of Mettalurgy and Foundry Engineering, FMMI, VŠB – Technical University of Ostrava, 17. listopadu 15/2172, Ostrava – Poruba, Czech Republic, [3]ECOFER s.r.o., Kaštanová 182, 739 61 Třinec, Dolní Líštná, Czech Republic POSSIBILITIES OF INCREASING STEEL PURITY DURING PRODUCTION USING SECONDARY METALLURGY EQUIPMENT	VT
13:45	Petr Martínek, Pavel Podaný, Jan Nacházel COMTES FHT Inc., Prumyslova 995, 334 41 Dobrany, Czech Republic DECREASING OF CARBONITRIDES SIZE AND CONTENT IN AUSTENITIC STEEL BY MEANS OF HEAT TREATMENT	TO
14:00	Serguei V. Savilov, Anthon S. Ivanov, Nikolay B. Cherkasov, Alexander V. Egorov and Valery V. Lunin M.V. Lomonosov Moscow State University, Chemistry Department, 119991, Russia, Moscow, Leninskie Gory, 1-3 PYROLYTIC ROUTE FOR STRUCTURED CARBON FORMS: FROM NANOTUBES TO GRAPHEN	NN
14:30	**Zaključek konference – Closing the Conference**	

	Dvorana 2	
	Predsedujoči – Chair: M. Torkar, V. Leskovšek	
10:40	Monika Jenko, Tadej Kokalj, Nuša Pukšič Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, Slovenia OXIDATION OF Ni 50.74 at% Ti ALLOY	NKM
10:55	B. Šuštaršič[1], I. Paulin[1], M. Godec[1], S. Glodež[2], M. Šori[2], J. Flašker[2], A. Korošec[3] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]University of Maribor, FNM, Koroška cesta 160, 2000 Maribor, Slovenia, [3]Talum, Tovarna aluminija d. d., Tovarniška cesta 10, 2325 Kidričevo, Slovenia MORPHOLOGICAL AND MICROSTRUCTURAL FEATURES OF AL-BASED ALLOYED POWDERS FOR POWDER METALLURGY APPLICATIONS	NKM

11:10	S. Šturm[1], K. Žužek Rožman[1], B. Markoli[2], E. Sarantopoulou[3], Z. Kollia[3], A. C. Cefalas[3] and S. Kobe[1] [1]Department for NanostructuredMaterials, Jožef Stefan Institute, 1000 Ljubljana, Slovenia, [2]Department of Materials and Metallurgy, Faculty of Natural Sciences and Engineering,University of Ljubljana, 1000 Ljubljana, Slovenia, [3]National Hellenic Research Foundation, 11635 Athens, Greece PHYSICO-METALLURGICAL ASPECT OF FORMATION OF CORE–SHELL AND HOLLOW NANOSPHERES	NN
11:25	Darja Jenko[1], Rebeka Rudolf[2,3], Jelena Bogovic[4], Peter Majerič[2], Srečko Stopić[4], Ivan AnŽel[2], Monika Jenko[1], Bernd Friedrich[4] [1] Institute of Metals and Technology, Laboratory for Surface and Structure Characterization of Materials, Lepi pot 11, SI-1000 Ljubljana, Slovenia, 2 Faculty of Mechanical Engineering, University of Maribor, Smetanova ulica 17, SI-2000 Maribor, Slovenia, 3 Zlatarna Celje d.d., Kersnikova 19, SI-3000 Celje, Slovenia, 4 IME Process Metallurgy and Metal Recycling, RWTH Aachen University, Intzestrasse 3, 52072 Aachen, Germany CHARACTERIZATION OF METAL NANOPARTICLES SYNTHESIZED BY ULTRASONIC SPRAY PYROLYSIS BY MEANS OF TRANSMISSION ELECTRON MICROSCOPY	NKM
11:40	M. Conradi[1], M. Zorko[2], A. Kocijan[1], I. Verpoest[3] [1]Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]National Institute of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia, [3]Department of Metallurgy and Materials, K. U. Leuven, Kasteelpark Arenberg 44, 3001 Heverlee, Belgium MECHANICAL PROPERTIES OF NANOSILICA REINFORCED EPOXY COMPOSITES	NKM
11:55	B. KoŽuh - RC Simit	NKM
12:10	**ODMOR – BREAK**	
	Predsedujoči – Chair: M. Conradi, B. Podgornik	
12:30	Milan Hnizdil, Martin Chabicovsky, Miroslav Raudensky Heat Transfer and Fluid Flow Laboratory, Brno University of Technology, Technicka 2896/2, 616 69 Brno, Czech Republic, European Union INFLUENCE OF IMPACT ANGLE AND PRESSURE ON SPRAY COOLING OF VERTICALLY MOVING HOT STEEL SURFACES	TO
12:45	Pavel Suchmann, Dagmar Jandova, Jana Niznanska, Michal Duchek, Tomas Kubina COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republic, VZU PLZEN s.r.o., Tylova 1581/46, 301 00 Plzen, Czech Republic DEEP CRYOGENIC TREATMENT OF H11 HOT WORKING TOOL STEEL	TO
13:00	Tomas Kubina, Jaromir Dlouhy, Michal Kover, Josef Hodek COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republic PREPARATION OF ULTRA FINE-GRAINED COMMERCIALLY PURE TITANIUM WIRES FROM DIFFERENT GRADES BY CONFORM EQUIPMENT AND THEIR THERMAL STABILITY	TO
13:15	Marek Brůna, Lukáš Kucharčík University of Žilina, Faculty of Mechanical Engineering, Department of Technological Engineering, Univerzitná 8215/1, 010 26, Žilina, Slovakia PROGRESSIVE METHOD OF POROSITY PREDICTION FOR ALUMINIUM CASTINGS	TO
13:30	Pavel Podaný, Petr Martínek COMTES FHT Inc., Prumyslova 995, 334 41 Dobrany, Czech Republic DECREASING OF CARBONITRIDES SIZE AND CONTENT IN AUSTENITIC STEEL BY MEANS OF HEAT TREATMENT	TO
13:45	Peter Sláma, Jaromír Dlouhý, Michal Kövér COMTES FHT. a.s., Průmyslová 995, 33441 Dobřany, Czech Republic INFLUENCE OF HEAT TREATMENT ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF ALUMINIUM BRONZE	TO

14:00	Adam Grajcar, Krzysztof Radwański Silesian University of Technology, Institute of Engineering Materials and Biomaterials, 44-100 Gliwice, Konarskiego 18a Street, Poland MICROSTRUCTURAL COMPARISON OF THERMOMECHANICALLY TREATED AND COLD DEFORMED Nb-MICROALLOYED TRIP STEEL	TO
14:15	S. Schäfer, B. Görtz, M. Schauerte, R. Trettin Institute for Building and Materials Chemistry, University of Siegen, 57068 Siegen, Germany INFLUENCING FACTORS ON THE REACTIVITY OF THE SYSTEM CaO/$Ca(OH)_2$ AS MATERIAL FOR THERMOCHEMICAL ENERGY STORAGE	TO
14:30	**Zaključek konference – Closing the Conference**	

POSTERSKA SEKCIJA – POSTER SESSION
SREDA – WEDNESDAY 17. 10. 2012 (19:00 – 20:00)

YR1	Eray Abakay, Ugur Sen, Saduman Sen Department of Metallurgical and Materials Engineering, Engineering Faculty, Sakarya University, Esentepe Campus, 54187 Sakarya THE PROPERTIES OF Nb-Al-N BASED COATINGS FORMED ON AISI 4140 STEEL BY THERMO REACTIVE DIFFUSION TECHNIQUE	TO
YR2	Eliška Adámková, Petr Jelínek, Jaroslav Beňo, František Mikšovský Department of Metallurgy and Foundry Engineering, FMMI, VŠB - Technical University of Ostrava, 17. Listopadu 15/2172, Ostrava – Poruba, Czech Republic WATER SOLUBLE CORES – VERIFYING OF DEVELOPMENT TRENDS	NKM
YR3	Ekrem Altuncu[1], Sedat İric[2], Fatih Ustel[1] Sakarya University, Metallurgical and Materials Engineering Department, 54187, Sakarya Turkey FATIGUE BEHAVIOUR OF A MILD STEEL COATED WITH A WC-Co DEPOSITED BY HVOF SPRAYING	NKM
YR4	Aysun Ayday, Mehmet Durman Sakarya University, Faculty of Engineering, Department of Metallurgical and Materials Engineering, Sakarya, 54187, Turkey EFFECT OF DIFFERENT SURFACE HEAT TREATMENT METHODS ON THE HARDNESS OF AISI 4140 STEEL	TP
YR5	Oana Bălțătescu, Costel Roman, Ioan Carcea Technical University "Gheorghe Asachi" of Iasi-Romania, Department of Materials Science and Engineering, Blvd. Mangeron, No. 59A, 700050, Iasi, Romania METALLIC COMPOSITES FOAMS WITH PARTICLES MADE BY GAS INSUFFLATIONS	NKM
YR6	Jan Bartošek, Robert Zemčík, Tomáš Kroupa NTIS – New Technologies for Information Society, Faculty of Applied Sciences University of West Bohemia, Univerzitní 22, 306 14 Plzeň, Czech Republic NUMERICAL MODEL OF COMPOSITE AIRFOIL SEGMENT WITH PIEZOELECTRIC SENSORS	MS
YR7	F. E. Baştan, G. Ağtaş, G. Erdoğan, Y. Y. Özbek, F. Üstel Sakarya University, Engineering Faculty, Department of Metallurgy and Metarials Engineering, 54187, Esentepe-Sakarya-Turkey ANTIBACTERIAL, MECHANICAL AND MICROSTRUCTURAL PROPERTIES OF PLASMA SPRAYED, SILVER DOPED HYDROXYAPATITE COATINGS	NKM
YR8	Tereza Beckovska (born Kalabova), Frantisek Vlach, Petr Jelinek, Vladimir Tichomirov Brno University of Technology, Faculty of Civil Engineering, Veveri 95, 602 00 Brno, Czech Republic UTILIZATION OF COMPUTER TOOLS FOR MOISTURE AND THERMAL DESIGN OF FLAT ROOFS	MS
YR9	Marek Břuska, Petr Lichý, Jaroslav Beňo, Michal Cagala VŠB – Technical University of Ostrava, Faculty of Metallurgy and Material Engineering, 17. Listopadu 15/2172, 708 33, Ostrava, Czech Republic MICROSTRUCTURE AND PROPERTIES OF HYPOEUTECTIC Al – Si ALLOY DURING REPEATED UTILIZATION	NKM
YR10	J. Burja[1], A. Rozman[2], M. Knap[3] [1]IMT, Lepi pot 11, Ljubljana, [2]METAL RAVNE d.o.o, Koroška cesta 14, Ravne na Koroškem, [3]NTF OMM, UNI-Lj, Aškerčeva 12, Ljubljana CHROMITE SPINEL FORMATION IN STEELMAKING SALGS	NKM

YR11	Tomas Doktor, Daniel Kytyr, Petr Zlamal, Petr Koudelka, Tomas Fila, Ondrej Jirousek Institute of Theoretical and Applied Mechanics, Academy of Sciences of the Czech Republic, Prosecka 76, 190 00, Prague 9, Czech Republic DETERMINATION OF ELASTIC-PLASTIC PROPERTIES OF ALPORAS FOAM AT CELL-WALL LEVEL USING MICROSCALE CANTILEVER BENDING TESTS	NKM
YR12	Daniel Kytyr[1], Tomas Fila[1], Jan Sleichrt[1], Tomas Doktor[2], Martin Sperl[2] [1]Czech Technical University in Prague, Faculty of Transportation Sciences, Konviktska 20, 110 00 Prague 1, Czech Republic, [2]Institute of Theoretical and Applied Mechanics AS CR, v. v. i,. Prosecka 76, 190 00 Prague 9, Czech Republic ASSESSMENT OF POST IMPACT DAMAGE PROPAGATION IN CARBON-FIBRE COMPOSITE UNDER CYCLIC LOADING	NKM
YR13	Raluca Maria Florea, Ioan Carcea Technical University "Gheorghe Asachi" of Iasi-Romania, Department of Materials Science and Engineering, Blvd. Mangeron, No. 59A, 700050, Iasi, Romania GROWTH OF AlN BY REACTIVE GAS INJECTION OF NITROGEN IN AN AlMg MATRIX	NKM
YR14	Ana Gantar[1,4], Lucilia P. da Silva[2,3], Joaquim M. Oliveira[2,3], Alexandra P. Marques[2,3], Nataša Drnovšek[1], Vitor M. Correlo[2,3], Rui L. Reis[2,3], Saša Novak[1,4] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Slovenia, [2]3B's Research group, Biomaterials, Biodegradables and Biomimetics, University of Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, Guimarães, Portugal, [3]ICVS/3B's - PT Government Associate Laboratory, Braga/Guimarães, Portugal, [4] Jožef Stefan International Postgraduate School, Slovenia BIOACTIVE GLASS REINFORCEMENT OF 3D GELLAN GUM SCAFFOLDING MATERIAL	NKM
YR15	Tomas Grigaitis, Kestutis Arlauskas Department of Solid State Electronics, Vilnius University, Sauletekio al. 9, III r., Vilnius, Lithuania OPTICAL AND ELECTRICAL PROPERTIES OF DOPED VARIABLE BAND GAP SiN_x:H	TP
YR16	Sedat İriç[1], Derya İric[2], Ekrem Altuncu[3] [1]Sakarya University, Eng. Faculty, Mechanical Eng. Dept., Sakarya/ Turkey, [2]Kocaeli University, Eng. Faculty, Mechanical Eng. Dept., Kocaeli/ Turkey, [3]Sakarya University, Tech. Fac., Metallurgical and Materials Eng., Sakarya/ Turkey PROPERTIES OF ALUMINIUM-CLADED STEELS FOR HOT FORMING	NKM
YR17	Marja Jerič, Miran Čeh Jožef Stefan Institute, Department for nanostructured materials, Jamova cesta 39, 1000 Ljubljana, Slovenia MOLTEN SALT SYNTHESIS OF Nb DOPED $Sr_3Ti_2O_7$ PLATELET SEEDS	NKM
YR18	R. Karslioğlu[1], M. Akçil[1], H. Akbulut[1], A. Alp[1] [1]Sakarya University, Engineering Faculty, Department of Metallurgical and Materials Engineering, Esentepe Campus, Sakarya, Turkey EFFECT OF NANO Al_2O_3 REINFORCED NI COMPOSITE COATINGS ON TRIBOLOGICAL AND CORROSION BEHAVIORS OF 6060 ALUMINIUM ALLOYS	KD
YR19	Małgorzata Kaźmierczak[1,2], Andrzej Łapiński[1], Katarzyna Pogorzelec-Glaser[1], Stefan Jurga[2], Filip Matelski[3] and Bartłomiej Andrzejewski[1] [1]Institute of Molecular Physics Polish Academy of Sciences, M. Smoluchowskiego 17, 60-179 Poznań, Poland, [2]NanoBioMedical Centre, Adam Mickiewicz University, Umultowska 85, 61-614 Poznań, Poland, [3]Poznan University of Technology, Nieszawska 13A, 60-965 Poznań, Poland SPECTROSCOPIC AND MICROSCOPIC STUDY OF Fe_3O_4-ALGINIC ACID NANOCOMPOSITES	NN

YR20	Lubomir Klimes, Josef Stetina Brno University of Technology, Faculty of Mechanical Engineering, Energy Institute, Technicka 2896/2, 616 69 Brno, Czech Republic UNSTEADY MODEL-BASED PREDICTIVE CONTROL OF CONTINUOUS STEEL CASTING BY MEANS OF VERY FAST DYNAMIC SOLIDIFICATION MODEL ON GPU	MS
YR21	Jiří Klofáč[1,2], Jakub Sedlák[1,2], Pavel Bažant[1,2], Kristýna Jedličková[1,2], Ivo Kuřitka[1,2] [1]Centre of Polymer Systems, University Institute, Tomas Bata University in Zlin, Nad Ovcirnou 3685, 760 01 Zlin, Czech Republic, [2]Polymer Centre, Faculty of Technology, Tomas Bata University in Zlin, namesti T. G. Masaryka 275, 762 72 Zlin, Czech Republic ANTIBACTERIAL POLYMER SYSTEM BASED ON POLYVINYL CHLORIDE AND CRYSTAL VIOLET	NKM
YR22	Rok Kocen[a,b], prof. Christian Bailly[a], Maksim Shivokhin[a] [a]Université catholique de Louvain, Place de l'Université, B-1348 Louvain-la-Neuve, Belgium [b]JoŽef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia CONTROLLING CONSTRAINT RELEASE IN POLYDISPERSE MELTS OF LINEAR POLYMERS	NKM
YR23	Israfil Kucuk, Cevat Sarioglu Marmara University, Dept. of Metallurgical and Materials Engineering, Göztepe kampusu, 34722, kadiköy-istanbul, Turkey THE PITTING CORROSION OF TiN COATED STAINLESS STEEL IN 3 wt.% NaCl SOLUTION	KD
YR24	Zuzana Lašová, Robert Zemčík University of West Bohemia, Univerzitní 8, 306 14 Plzeň, Czech Republic AMPLITUDE–FREQUENCY RESPONSE OF AN ALUMINUM CANTILEVER BEAM DETERMINED BY PIEZOELECTRIC TRANSDUCERS	NKM
YR25	Michal Madaj, Miroslav Greger VSB-Technical University Ostrava, Regional Materials Science and Technology Centre, 17. Listopadu 15, 708 33 Ostrava-Poruba, Czech Republic MAGNESIUM ALLOYS DIE FORGINGS FOR AUTOMOTIVE APPLICATIONS	NKM
YR26	Miroslav Greger, Michal Madaj, David Žáček VSB-Technical University Ostrava, Regional Materials Science and Technology Centre, 17. Listopadu 15, 708 33 Ostrava-Poruba, Czech Republic STRUCTURE AND MECHANICAL PROPERTIES OF EN AW 6082 ALUMINUM ALLOY PRODUCED BY EQUAL CHANNEL ANGULAR PRESSING	NKM
YR27	[1]Peter Majerič, [1,2]Rebeka Rudolf, [3]Srečko Stopić, [4]Miodrag Čolić, [5]Darja Jenko, [3]Bernd Friedrich, [1]Ivan Anžel [1]Faculty of Mechanical Engineering, Maribor, Smetanova 17, 2000 Maribor, Slovenia, [2]Zlatarna Celje *d.d.,* Kersnikova 19, 3000 Celje, Slovenia, [3]IME Process Metallurgy and Metal Recycling, RWTH University Aachen, Intzestrasse 3, 52072 Aachen, Germany, [4]Military Medical Academy, Institute of Medical Research, Dr Subotića 4, Belgrade, Serbia, [5]Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, Slovenia SYNTHESIS OF Ni-Ti NANOPARTICLES VIA ULTRASONIC SPRAY PYROLYSIS	NN
YR28	Tomáš Mandys, Tomáš Kroupa, Vladislav Laš NTIS – New Technologies for Information Society, Faculty of Applied Sciences University of West Bohemia, Univerzitní 22, 306 14 Plzeň, Czech Republic IDENTIFICATION OF MATERIAL PARAMETERS OF SANDWICH COMPOSITE PANEL FOR LOW-VELOCITY IMPACT LOADING	NKM
YR29	Lukáš Münster[1,2], Pavel Bažant[1,2], Ivo Kuřitka[1,2] [1]Polymer Centre, Faculty of Technology, Tomas Bata University in Zlin, Nam. T. G. Masaryka 275, 762 72 Zlin, Czech Republic, [2]Centre of Polymer Systems, University Institute, Tomas Bata University in Zlin, Nad Ovcirnou 3685, 760 01 Zlin, Czech Republic MICROWAVE ASSISTED SYNTHESIS OF Ag-ZnO SUB-MICROPARTICLES AND THEIR PROPERTIES	NN

YR30	Arnas Naujokaitis[1,2], Rokas Kondrotas[1], Kęstutis Arlauskas[2] [1]Department of Solid State Electronics, Vilnius University, Saulėtekio av. 9, LT-10222 Vilnius, Lithuania, 2State research institute Center for Physical Sciences and Technology, Savanoriu av. 231, LT-02300 Vilnius, Lithuania ELECTRICAL AND STRUCTURAL PROPERTIES OF SOLUTION ASSISTED MoS_2 LAYERS	TP
YR31	Ľubomír Orovčík IMMS SAS Bratislava Slovakia COMPRESSION STRENGTH OF THE ALUMINIUM FOAM	TO
YR32	Ivana Petrášová, Monika Losertová Vysoká škola báňska – Technická univerzita Ostrava, 17. listopadu 15/2172, 708 33 Ostrava - Poruba ELECTROCHEMICAL BEHAVIOR OF BIOCOMPATIBLE TITANIUM ALLOYS	KD
YR33	Jakub Sedlák[1,2], Pavel Bažant[1,2], Jiří Klofáč[1,2], Miroslav Pastorek[1,3], Ivo Kuřitka[1,2] [1]Centre of Polymer Systems, University Institute, Tomas Bata University in Zlin, Nad Ovcirnou 3685, 760 01 Zlin, Czech Republic, [2]Polymer Centre, Faculty of Technology, Tomas Bata University in Zlin, namesti T.G. Masaryka 275, 762 72 Zlin, Czech Republic, [3]Department of Polymer Engineering Faculty of Technology, Tomas Bata University in Zlin, namesti T.G. Masaryka 275, 762 72 Zlin, Czech Republic ANTIBACTERIAL COMPOSITE BASED ON HIERARCHICAL MESOSCALE NANOSTRUCTURED ZnO PARTICLES AND POLYVINYL CHLORIDE	NKM
YR34	Makfir Sefa, Janez Setina, Bojan Erjavec Institute of Metals and Technology, Lepi pot 11 Ljubljana, Slovenia COMPARISON OF PERMEATION OF ATMOSPHERIC GASES THROUGH VITON O-RING GASKETS FOR DIFFERENT INITIAL CONDITIONS	VT
YR35	Tina Skalar[1,2], Marjan Marinšek[1,2], Martin Lubej[1], Marjan Lukežič[1,2], Tomaž Skalar[3], Jadran Maček[1,2] [1]University of Ljubljana, Faculty of Chemistry and Chemical Technology, Aškerčeva 5, Ljubljana, Slovenia, [2]Center of Excellence Low-Carbon Technologies (CO NOT), Hajdrihova 19, 1000 Ljubljana, Slovenia, [3]School Centre of Ljubljana, Mechanical and Chemical High School, Aškerčeva 1, 1000 Ljubljana, Slovenia MODELING OF OPERATING PARAMETERS IN SOFC TESTING SYSTEM	MS
YR36	David Skoda[1], Ales Styskalik[1], Zdenek Moravec[1], Craig E. Barnes[2], Jiri Pinkas[1] [1]MasarykUniversity, Department of Chemistry and CEITEC MU, CZ 61137 Brno, Kotlarska 2, Czech republic, [2]University of Tennessee, Department of Chemistry, Knoxville,TN 37996-1600, USA METALLOSILICATES PREPARED BY NON-HYDROLYTIC CONDENSATION REACTIONS	NKM
YR37	Marko Šori, Borivoj Šuštaršič, Srečko Glodež University of Maribor, Faculty of Natural Sciences and Mathematics FATIGUE PROPERTIES OF SINTERED POWDER METAL DIN SINT D-30 BEFORE AND AFTER HEAT TREATMENT	NKM
YR38	Tomáš Kroupa, Hana Srbová, Robert Zemčík, Jan Krystek NTIS – New Technologies for Information Society, Faculty of Applied Sciences University of West Bohemia, Univerzitní 22, 306 14 Plzeň, Czech Republic INVESTIGATION OF BEHAVIOR OF CONSTITUENTS OF UNIDIRECTIONAL FIBER REINFORCED COMPOSITE SUBJECTED TO TENSILE CYCLIC TESTS USING MICROMODEL	NKM
YR39	Aleš Stambolić[1], Marjan Marinšek[2] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, [2]Faculty of chemistry and chemical technology, Aškerčeva cesta 5, 1000 Ljubljana PREPARATION OF MAGNETIC NANOPARTICLES BASED ON COBALT FERRITE OR MAGNETITE	NKM

YR40	Marko Sedlaček[1], Bojan Podgornik[1], Slobodan Milanović[2] [1]Institute of Metals and Technology, Lepi pot 11, Ljubljana, Slovenia, [2]VALJI group d.o.o., Slovenia MODIFIED HEAT TREATMENT FOR IMPROVED PROPERTIES OF DOUBLE-LAYER CAST ROLE	NKM
YR41	Ales Styskalik[1], David Skoda[1], Zdenek Moravec[1], Jiri Pinkas[1], Craig E. Barnes[2] [1]Masaryk University, Department of Chemistry and CEITEC MU, CZ-61137 Brno, Kotlarska 2, Czech republic, [2]University of Tennessee, Department of Chemistry, Knoxville, TN 37996-1600, USA POROUS HYBRID INORGANIC-ORGANIC PHOSPHOSILICATE MATERIALS BY NON-HYDROLYTIC SOL-GEL POLYCONDENSATION	NKM
YR42	Tuba Yener, Sakin Zeytin Sakarya University, Engineering Faculty, Department of Metallurgy and Materials Engineering, Esentepe Campus, 54187, Adapazari, Sakarya, Turkey SYNTHESIS AND CHARACTERIZATION OF Ti-$TiAl_3$, Ti-Nb-$TiAl_3$ METALLIC-INTERMETALLIC COMPOSITE PRODUCED BY POWDER METALLURGY TECHNIQUE	NKM

43	G. Agdaş, Y. Y. Özbek Sakarya University, Engineering Faculty, Department of Metallurgical and Metarials Engineering, 54187, Esentepe Campus, Sakarya, Turkey THE EFFECT OF PROCESS PARAMETERS ON SURFACE BEHAVIORS OF CARBON STEELS (AISI 4140) MODIFIED BY PULSE PLASMA TECHNIQUE	NKM
44	Boštjan Arh, Franc Tehovnik, Jaka Burja Inštitut za kovinske materiale in tehnologije, Lepi pot 11, Ljubljana PROCESS OF ELECTROSLAG REMELTING – ESR	NKM
45	Serdar Aslan[1], Suzeri Hamdi Suzın [1]Sakarya University, Engineering Faculty, Department of Metallurgical and Materials Engineering, Esentepe Campus, Sakarya, Turkey EFFECT OF HEAT-TREATMENT ON FRICTION AND WEAR PROPERTIES OF SiC AND GRAPHITE PARTICULATE REINFORCED ZA 27 HYBRID COMPOSITES	TO
46	David Beckovsky, Frantisek Vajkay Brno University of Technology, Faculty of Civil Engineering, Veveri 95, 602 00 Brno, Czech Republic UTILIZATION OF COMPUTER TOOLS IN THE FIELD OF PHYSICAL PARAMETER MEASUREMENTS IN WOODEN HOUSES	MS
47	Igor Belič, Besnik Poniku, Monika Jenko Inštitut za kovinske materiale in tehnologije, Lepi pot 11, Ljubljana AUTOMATION OF AES ANALYSIS – THE PROBLEM OF NOISE AND BACKGROUND	NKM
48	Igor Belič, Arsim Bytyqi, Monika Jenko, Inštitut za kovinske materiale in tehnologije, Lepi pot 11, Ljubljana A NEW METHOD FOR GRAIN ROUGHNESS DETERMINATION IN STEEL MICROSTRUCTURE	NKM
49	Roman Brzoň[1], Milan Ostrý[1], Radek Přikryl[2] and Pavel Charvát[3] [1]Brno University of Technology, Faculty of Civil Engineering, Institute of Building Structures, Veveri 95, 602 00 Brno, Czech Republic, [2]Brno University of Technology, Faculty of Chemistry, Purkynova 464, 612 00, Brno, Czech Republic, [3]Brno University of Technology, Faculty of Mechanical Engineering, Technicka 2896/2, 616 69, Brno, Czech Republic LATENT HEAT STORAGE UNDER DIFFERENT BOUNDARY CONDITIONS: MODELING AND EXPERIMENTAL EVALUATION	MS

50	Tomáš Čegan, Michal Cagala, Miroslav Kursa, Petr Kawulok, Stanislav Rusz, Jan Juřica Vysoká škola báňská – Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Department of RMSTC, 17. listopadu 15, 708 33 Ostrava - Poruba, Czech EFFECT OF Ti_2AlC PARTICLES ON THE MICROSTRUCTURE AND ELEVATED TEMPERATURE DEFORMATION PROPERTIES OF γ-TiAl ALLOYS	NKM
51	G. Celebi Efe Sakarya University, Vocational School of Karasu, Department of Machinery and Metal Technologies CHARACTERIZATION OF GAS NITRIDED 31 CrMoV9 STEEL	NKM
52	Roman Celin, Danijela Skobir Balantič Institute of metals and technology, Lepi pot 11, 1000 Ljubljana MATERIALS FOR NEW GENERATION STEAM GENERATORS	NKM
53	Pavel Charvat, Josef Stetina, Lubomir Klimes, Milan Ostry, Jiri Hejcik and Ondrej Pech Brno University of Technology, Technicka 2896/2, Brno, Czech Republic STABILIZATION OF WATER TEMPERATURE WITH THE USE OF PHASE CHANGE MATERIALS	NKM
54	Črtomir Donik, Irena Paulin, Monika Jenko Institute of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia AES, SEM AND XPS CHARACTERIZATION OF ALUMINIUM FOAMS	NKM
55	Pavel Suchmann, Dagmar Jandova, Jana Niznanska, Michal Duchek, Tomas Kubina COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republic, VZU PLZEN s.r.o., Tylova 1581/46, 301 00 Plzen, Czech Republic DEEP CRYOGENIC TREATMENT OF H11 HOT WORKING TOOL STEEL	TO
56	Jan Džugan, Zbyšek Nový, Martina Marešová COMTES FHT Inc., Průmyslová 995, Dobřany, Czech Republic FATIGUE LIFE ENHANCEMENT OF METAL SHEETS MADE OF 34CrNiMo6 STEEL	MS
57	Franek Z., Masarik M, Bernatik W. Silesian University in Opava, School of Business Administration in Karvina MODELING PREDICTION OF QUALITY FOR THE PRODUCTION OF CONTINUOUSLY CAST SLABS	MS
58	Karel Gryc[1], Ladislav Socha[1], Markéta Tkadlečková[1], Karel Michalek[1], Ladislav Válek[2] [1]VŠB-Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Department of Metallurgy and Foundry, and Regional Materials Science and Technology Centre, 17. listopadu 15, 708 33 Ostrava-Poruba, Czech Republic, [2]ArcelorMittal Ostrava a.s., Research, Vratimovská 689, 707 02 Ostrava-Kunčice, Czech Republic POSSIBILITIES OF EXPERIMENTAL STUDY OF SOLIDIFICATION PROCESS ON LARGE STEEL SAMPLES	NKM
59	Mediha Ipek Sakarya University, Engineering Faculty, Department of Metallurgy and Materials Engineering, Esentepe Campus, 54187 Sakarya-Turkey A COMPARISION OF COMMERCIAL AND COPRECIPITATED OF Al_2O_3-20 wt.% ZrO_2 PLASMA SPRAYED COATINGS	TP
60	Jan Juřica, Tomáš Čegan, Daniel Petlák, Kateřina Skotnicová, Bedřich Smetana Vysoká škola báňská – Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Department of RMSTC, 17. listopadu 15, 708 33 Ostrava - Poruba, Czech PREPARATION AND PROPERTIES OF MASTER ALLOYS Nb-Al AND Ta-Al FOR MELTING AND CASTING OF γ-TiAl INTERMETALLICS	NKM
61	Süleyman Kahraman[1], Samed Çetinkaya[1], Mateja Podlogar[2,3], Slavko Bernik[2,3], H. Salih Güder[1] [1]Physics Department, Faculty of Art and Science, Mustafa Kemal University 31034 Hatay, Turkey, [2]Jozef Stefan Institute, Jamova cesta 39, 1000 Ljubljana Slovenia, [3]Center of Excellence NAMASTE, Jamova cesta 39, 1000 Ljubljana, Slovenia SOL-GEL GROWN Cu_2ZnSnS_4 THIN FILMS FOR PHOTOVOLTAIC APPLICATIONS	TP

62	Nuray Karakuş Sakarya University, Engineering Faculty, Department of Metallurgy and Materials Engineering, 54187 Sakarya, Turkey SYNTHESIZING α-PHASE Si_3N_4 POWDERS CONTAINING Y_2O_3-MgO	NKM
63	Anastasia Kholodkova[1], Marina Danchevskaya[1], Nellya Popova[2], Liana Pavlyukova[2], Alexandr Fionov[3] [1]Chemistry Department, Moscow State University, 119991, GSP-1, Leninskie Gory 1-3, Moscow, Russia, [2]D. Mendeleev University of Chemical Technology of Russia, 125047, Geroev Panfilovtsev 20, Moscow, Russia, [3]Kotel'nikov Institute of Radio Engineering and Electronics of RAS, 125009, Mokhovaya 11-7, Moscow, Russia PREPARATION AND DIELECTRIC PROPERTIES OF THERMOVAPOROUS BARIUM TITANATE CERAMICS	NKM
64	Aleksandra Kocijan[1], Marjetka Conradi[1], Milena Zorko[2], Ivan Jerman[2] [1]Institute of Metals and Technology, Slovenia, [2]National Institute of Chemistry, Slovenia SILICA/PVC COMPOSITE COATINGS ON STAINLESS STEELS	KD
65	[1]Tadej Kokalj, [2]BlaŽ Kavčič, [2]Drago Kovačič, [1]Matej Hočevar, [1]Monika Jenko [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]LPKF Laser and Electronics, 33 Polica, 4202 Naklo, Slovenia LASER STRUCTURING FOR ANTI-BIOFOULING SURFACES	NKM
66	M. Kralj Novak, B. Kuselj, S. Bedenk Savatech d.o.o., R & D Institute, Skofjeloska 6, 4000 Kranj, Slovenia APPLICATION OF METHOD OF MEASURING THERMAL EXPANSION COEFICIENT FOR DEVELOPING A RUBBER COMPOSITE PRODUCT	NKM
67	Jana Krupicova, Miloslav Novotny, Karel Suhajda, Jan Skramlik, Pavel Schmid, Roman Krupica Brno University of Technology, Faculty of Civil Engineering, Institute of Building Structures, Veveri 331/95, Brno 602 00 ANALYSIS OF APPLICABILITY OF CONCRETE WITH SECONDARY RAW MATERIALS AS AGGREGATE IN COUPLED TIMBER-CONCRETE CEILINGS	NKM
68	Jan Krystek, Lukáš Bek, Tomáš Kroupa, Radek Kottner University of West Bohemia, Univerzitni 8, 306 14 Plzen, Czech Republic INFLUENCE OF GEOMETRIC PARAMETERS OF PIN JOINT OF CARBON/EPOXY COMPOSITE PLATE ON ITS LOAD CAPACITY	NKM
69	Bong-Su Kim, Dong-Hoon Jang, Sung Park, Jae Chun Lee Department of Materials Science and Engineering, Myongji University, Yongin, Korea PROPERTIES OF ALKALI/ALKALINE-EARTH BOROSILICATE GLASS SEALANTS CONTAINING ALUMINA FILLER FOR SOLID OXIDE FUEL CELLS	NKM
70	Miri Lee, Seonghun Na, Sujeong Suh* School of Advanced Materials Science & Engineering Sungkyunkwan University, Sungkyunkwan University Suwon South Korea SURFACE MORPHOLOGY AND CRYSTAL ORIENTATION OF PYRAMIDAL SHAPED TIN BY ELECTROPLATING	NKM
71	Maja Leitgeb, Gordana Hojnik Podrepšek, Željko Knez University of Maribor, Faculty of Chemistry and Chemical Engineering, Laboratory for Separation Processes and Product Design, Smetanova ul. 17, 2000 Maribor, Slovenia. SYNTHESIS COMPARISON AND CHARACTERIZATION OF CHITOSAN COATED MAGNETIC NANOPARTICLES PREPARED BY DIFFERENT METHODS	NN
72	Anastasia O. Levina, Anthon S. Ivanov, Serguei V. Savilov, Andrey V. Desyatov and Valery V. Lunin M.V. Lomonosov Moscow State University, Chemistry Department, 119991, Russia, Moscow, Leninskie Gory, 1-3 NOVEL MORPHOLINIUM- AND PIPERIDINIUM- IONIC LIQUIDS BASED HIGH VOLTAGE ELECTROLYTE FOR SUPERCAPACITORS AND Li-ION BATTERIES	TO

73	Jitka Malcharcziková[1], Martin Pohludka[1], Vít Michenka[2], Tomáš Čegan[1], Jan Juřica[1], Miroslav Kursa[1] [1]VŠB-TU Ostrava, Faculty of Metallurgy and Materials Engineering, Department of Non-ferrous Metals, Refining Processes and Materials Recycling, Regional Materials Science and Technology Centre, 17. listopadu 15/2172, 708 33 Ostrava - Poruba, Czech Republic, [2]VÚHŽ a.s., Dobrá 240, 739 51 Dobrá, Czech Republic INFLUENCE OF THE HIP PROCESS ON PROPERTIES OF AS-CAST Ni-BASED ALLOYS	NKM
74	Tomas Mauder, Josef Stetina Brno University of Technology, Faculty Mechanical Engineering, Technicka 2, Brno, Czech Republic OPTIMIZATION OF SECONDARY COOLING IN CONTINUOUS CASTING PROCESS WITH DIFFERENT SLAB CROSS-SECTION	NKM
75	Marek Opiela Institute of Engineering Materials and Biomaterials, Silesian University of Technology, Konarskiego 18a, 44-100 Gliwice, Poland THERMO-MECHANICAL TREATMENT OF Ti-Nb-V-B MICROALLOYED STEEL FORGINGS	TO
76	Milan Ostrý[1], Darina Dostálová[1], Tomáš Klubal[1], Radek Přikryl[2] and Pavel Charvát[3] [1]Brno University of Technology, Faculty of Civil Engineering, Institute of Building Structures, Veveri 95, 602 00 Brno, Czech Republic, [2]Brno University of Technology, Faculty of Chemistry, Purkynova 464, 612 00, Brno, Czech Republic, [3]Brno University of Technology, Faculty of Mechanical Engineering, Technicka 2896/2, 616 69, Brno, Czech Republic MICROENCAPSULATED PHASE CHANGE MATERIALS FOR LATENT HEAT STORAGE: THERMAL CHARACTERISTICS AND BUILDING APPLICATION	TO
77	Irena Paulin[1], Črtomir Donik[1], Peter Cvahte[2], Matjaž Godec[1] [1]Institut of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia, [2]IMPOL, d.o.o., Partizanska 38, SI-2310 Slovenska Bistrica, Slovenia MACHINABILITY AND MICROSTRUCTURE INVESTIGATION OF ALUMINUM ALLOYS AA 6062	NKM
78	Joanna Przondziono[1], Eugeniusz Hadasik[1], Witold Walke[2], Janusz Szala[1], Jakub Wieczorek[1] [1]Silesian University of Technology, 40-019 Katowice, Krasińskiego 8, Poland, [2]Silesian University of Technology, 41-800 Zabrze, Gen. de Gaulle'a 66, Poland RESISTANCE TO ELECTROCHEMICAL CORROSION OF EXTRUDED MAGNESIUM ALLOY AZ80 IN NaCl SOLUTIONS	KD
79	N. Revathi, S. Bereznev, J. Iljina, M. Kauk-Kuusik, T. Varema, K. Timmo, E. Mellikov, O. Volobujeva Tallinn University of Technology, Department of Materials Science, Ehitajate tee 5, Tallinn 19086, Estonia PVD OF SnS THIN FILMS FOR SOLAR CELL APPLICATIONS	TP
80	Jan Skramlik, Karel Suhajda and Miloslav Novotny University of Technology, Faculty of Civil Engineering Brno Department of structural engineering, Czech Republic, Brno (Europe), Veveri 95 DETECTION OF MOISTURE FLOW IN THE BUILDING MATERIAL	MS
81	A. Sobolev, N. Cherkasov, S. Savilov, I. Presniakov, A. Ivanov Lomonosov Moscow State University, 119992, Leninskie gory, b.1-3, Moscow, Russia IRON-CONTAINING NANOPARTICLES ON THE SURFACE OF MULTIWALLED CARBON NANOTUBES	NN

82	Ladislav Socha1, Jiří Bažan1, Jan Morávka2, Petr Styrnal3, Pavel Machovčák4, Aleš Opler4, Antonín Trefil4 1VŠB – Technical University of Ostrava, FMME, Department of Metallurgy and Foundry, 17. listopadu 15/2172, 708 33 Ostrava – Poruba, Czech Republic, 2Materiálový a metalurgický výzkum, s.r.o., Pohraniční 693/31,706 02 Ostrava, Czech Republic, 3JAP trading, s.r.o., Karpentná 146, 739 94 Třinec, Czech Republic, 4Vítkovice heavy machinery a.s., Ruská 2887/101, 703 00 Ostrava – Vítkovice, Czech Republic EVALUATION OF SLAG REGIME AND DESULPHURIZATION OF STEEL WITH SYNTHETIC SLAG CONTAINING Cr2O3	NKM
83	Darja Steiner Petrovič[1], Jožef Medved[2], Grega Klančnik[2,3] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]University of Ljubljana, Faculty of Natural Sciences and Engineering, Aškerčeva 12, 1000 Ljubljana, Slovenia, [3]Institute for Foundry and Heat Treatment, Litostrojska 60, 1000 Ljubljana, Slovenia DISSOLUTION OF THE COPPER WIRE DURING THE HOT-DIPPING PROCESS WHEN USING A SnCu1 LEAD-FREE SOLDER	NKM
84	Josef Stetina, Tomáš Mauder, Lubomír Klimes, František Kavicka Brno University of Technology, Technicka 2, Brno, Czech Republic IMPROVING QUALITY AND PRODUCTIVITY CONTINUOUSLY CAST STEEL SLABS BY INCREASING THE NUMBER OF COOLING ZONES OF THE SECONDARY COOLING	MS
85	Karel Suhajda, Miloslav Novotny, Jan Skramlik, Jana Krupicova, Pavel Schmid, Roman Vavra Brno University of Technology, Faculty of Civil Engineering, Department of Building Structures, zVeveri 331/95, Brno 602 00 OPTIMISATION OF UTILIZATION OF MICROWAVE RADIATION FOR THE EXTERMINATION OF WOOD-DESTROYING INSECTS	KD
86	Evgeniya Suslova, Sergey Chernyak, Sergey Savilov Chemistry Department, Lomonosov Moscow State University, 119991, Moscow, Russia APPLICATION OF COBALT NANOPARTICLES IN HETEROGENEOUS CATALYSIS	NN
87	B. Šuštaršič[1], J. Medved[2], S. Glodež[3], M. Šori[3], A. Korošec[4] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]OMM, NTF, University Ljubljana, Aškerčeva 12, 1000 Ljubljana, Slovenia, [3]University of Maribor, FNM, Koroška cesta 160, 2000 Maribor, Slovenia, [4]Talum, Tovarna aluminija d. d., Tovarniška cesta 10, 2325 Kidričevo, Slovenia DSC/TG OF Al-BASED ALLOYED POWDERS FOR P/M APPLICATIONS	NKM
88	F. Tehovnik[1], J. Burja[1], B. Pirnar[2] [1]IMT, Ljubljana, [2]ACRONI, Jesenice LABORATORY HOT WORKING OF SUPERAUSTENITIC STAINLESS STEEL	NKM
89	Primož Ternik[1], Rebeka Rudolf[2,3], Zoran Žunič[4] [1]Private Researcher, Bresterniška ulica 163, 2354 Bresternica, Slovenia, [2]University of Maribor, Faculty of Mechanical Engineering, Smetanova 17, 2000 Maribor, Slovenia, [3]Zlatarna Celje d.d., Kersnikova ul.19, 3000 Celje, [4]AVL-AST, Trg Leona Štuklja 5, 2000 Maribor, Slovenia CONDUCTION AND CONVECTION HEAT TRANSFER CHARACTERISTICS OF NON-NEWTONIAN Au NANOFLUID IN CUBICAL ENCLOSURE WITH DIFFERENTIALLY HEATED SIDE WALLS	NN
90	MatjaŽ Torkar*, Irena Paulin*, Žarko Rajić**, Brane Kaisersberger*** *Inštitut za kovinske materiale in tehnologije, Lepi pot 11, 1000 Ljubljana, **CIMOS d.d., ***RC SIMIT, d.o.o., Perhavčeva ulica 21, 2000 Maribor SUBSTITUTION OF PRIMARY AlSi5Cu1Mg ALLOY WITH ALLOY MADE OF RECYCLED ALUMINIUM	NKM

91	Frantisek Vajkay, David Beckovsky Brno University of Technology, Faculty of Civil Engineering, Veveri 95, 602 00 Brno, Czech Republic COMPREHENSIVE MONITORING OF LIGHT GUIDES WITH RESPECT TO BUILDING PHYSICS	
92	Jiří Hampl[1], Tomáš Válek[2], Tomáš Elbel[3] [1,3]VŠB-TU Ostrava, 17. listopadu 15, Ostrava-Poruba, Czech Republic, [2]Vítkovické slévárny, spol. s.r.o., Halasova 2904/1, Ostrava-Vítkovice, Czech Republic THE CONTROL OF THE METALLURGICAL PROCESSING OF THE ICDP CAST IRONS	NKM
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21. MEDNARODNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH

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21st INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY

13–15 November 2013, Congress Centre GH Bernardin, Portorož, Slovenia

KNJIGA POVZETKOV

BOOK OF ABSTRACTS

WATER SOLUBLE CORES – VERIFYING OF DEVELOPMENT TRENDS

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Application of salts based on pure inorganic salt has been known since the end of the 20th century, mainly for gravity and low-pressure casting technology for casting production. Their utilization for high – pressure casting technology of non – ferrous alloys is present trend of technology. One of the main methods of salt core manufacture is high-pressure squeezing or injection (WARM – BOX). According to continuous investigation it was found, that application of pure salt is not more suitable for high – pressure casting technology, thus the composite salt matrix with defined properties has been used. This contribution is aimed to assessment of properties of pure and composite salt cores prepared by above mentioned methods for foundry technology applications.

THE EFFECT OF PROCESS PARAMETERS ON SURFACE BEHAVIORS OF CARBON STEELS (AISI 4140) MODIFIED BY PULSE PLASMA TECHNIQUE

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In this study, microstructure and surface properties of carbon steel treated by pulse plasma (AISI 4140) were investigated. Four different plasma gun nozzle distances as 50 mm, 60 mm, 70 mm and 80 mm and one battery capacity were chosen for surface modification. The modified surface was analyzed by XRD. The cross-section microstructures of samples were investigated by optical microscope and SEM. The samples were immersed into liquid nitrogen and then breaked in a Charpy machine. The fractured surfaces were exposed to SEM and EDS analyses. At the end of the study, thin grains and small grains coming from consumable electrode were detected. After pulse plasma treatment, new structures and new phases and high hardness values were obtained.

Key Words: Pulse plasma, fracture, low carbon, consumable electrod

Introduction

The pulse plasma process is used to improve surface properties of workpieces of tool steels [1-3]. When irradiated by pulse treatment the near surface layer of targets undergoes a rapid melt and solidification with heating and cooling rates typically 10^7–10^{10} K/s. These rates can promote mixing, rapid diffusion, formation of amorphous or microcrystalline surface layers, hence can improve mechanical performance of material surfaces. [3]. AISI 4140 was used in this study.The different pre-treatments were applied to surfaces such as, annealing, tempering in some samples. The different parameters of pulse plasma were tried in samples.

Results and Discussion

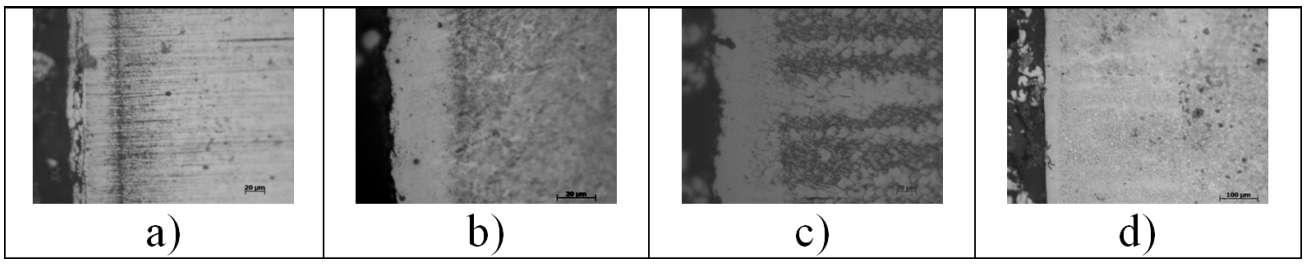

Fig. 1. The optic micrograph of samples, a) annealing, b) tempering, c) W electrode, d) Mo electrode

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INFLUENCE OF THE ORIGINAL MICROSTRUCTURE OF LOW ALLOYED STEEL ON THE PROPERTIES AFTER MINI-THIXOFORMING

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Thixoforming is an unconventional forming method, which is based on material processing in a semi-solid state. It means that a semi product is in a partially liquid and partially solid state after heating at a processing temperature. Even conventional materials can achieve quite remarkable microstructures due to the processes of partial melting and quick solidification. Recent research has been aimed at high alloyed steels with wide semi-solid state interval, which is conveniently placed at relatively low temperatures. On the other hand, low alloyed steels with solidification temperatures over 1400°C have not been frequently tested.

The main aim of this research was to establish whether the original structure of the semi product can in any way influence the final structure of low alloyed 30MnVS6 steel after semi-solid state processing. This steel was therefore first thixoformed in an annealed state ordinarily offered by suppliers. To evaluate the influence of the original microstructure, a second semi product with artificially coarsened structure was prepared by annealing. Severe plastic deformation was applied by HPT (High Pressure Torsion) method to produce three more semi products with ultra fine microstructures. As the final microstructure after HPT depends on the processing parameters, three representative processing schedules were chosen to obtain various degrees of structure refinement.

The microstructure of both the initial and the final states were analyzed using light and scanning electron microscopy and the evaluation of grain size was carried out with the help of image analysis and EBSD.

X-ray diffraction phase analysis was used to determine phase fractions. The development of mechanical properties was verified by compression tests and hardness measurement. Local information about mechanical properties of individual structural components was obtained by micro hardness measurement.

Key words: mini-thixoforming, 30MnVS6, SPD, HPT

FATIGUE BEHAVIOUR OF A MILD STEEL COATED WITH A WC-Co DEPOSITED BY HVOF SPRAYING

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The present investigation has been conducted to study the fatigue behavior of a st37 steel both uncoated and coated with a WC-Co of approximately 400 ěm thick, deposited by HVOF thermal spraying. Previously to deposition the samples were grit-blasted with alumina particles of approximately 1 mm in equivalent diameter. Tensile and fatigue tests were carried out with the uncoated and coated specimens. Fatigue tests were conducted under rotating bending conditions (R = – 1) at a frequency of 50 Hz. The samples tested were in three different surface conditions, including polished, grit-blasted and coated. The fatigue limit was determined by means of the staircase method employing a stress step of 5 MPa. The results indicate that the presence of the coating gives rise to a increase in the fatigue life of the coated samples tested in comparison with the uncoated specimens. At elevated alternating stresses, the coating was observed to delaminate from the substrate, leading to an impairment of the deformation-fatigue behavior of the coated samples.
Keywords: HVOF, WC-Co, Fatigue

PROCESS OF ELECTROSLAG REMELTING – ESR

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The electroslag remelting (ESR) process is used to remelt and refine steels and various super-alloys, resulting in production of high-quality ingots. This is important for the application of the finished product in critical applications such as aircraft, thermal power stations, nuclear power plants, medicine, military technology, ect.. The ESR technology is of interest not only for the production of smaller ingots of tool steels and superalloys, but also of heavy forging ingots. The ESR process gives offers very high, consistent, and predictable product quality. The molten steel in form of both liquid film on the electrode tip and descending droplets is in contact with the slag and gets refined due to desulfurization and removal of non-metalic inclusions. The droplets enter the water-cooled copper mould where the molten steel is progressively solidifing. The refining of liquid steel and finely controlled solidification improves soundness and structural integrity. Today ESR process variations have been developed under controllable atmosphere as a remelting under increased pressure (PESR), remelting under inert gas atmosphere (IESR) and remelting under reduced pressure (VAC-ESR). A general of the description of the ESR process is presented in this work.

PRETALJEVANJE POD ŽLINDRO – EPŽ

Elektro pretaljevanje pod žlindro (EPŽ) je postopek, ki se uporablja za pretaljevanje in prečiščevanje jekla in specialnih zlitin, katere se namensko uporabljajo v letalstvu, termo in jederskih elektrarnah, medicini, v strojni vojaški opremi itd. Tehnologija ni samo zanimiva za proizvodnjo manjših kvalitetnih ingotov orodnega jekla in superzlitin, ampak tudi za potrebe težkih kovaških ingotov. Glavni atribut EPŽ postopka, naproti ostalim postopkom sekundarne obdelave legiranih jekel, je poleg rafinacije tudi sposobnost nadzora strukture strjevanja in kemijske homogenosti jekla hkrati. Pri postopku z električnim tokom pretalimo elektrodo potopljeno v tekočo žlindro v vodno hlajeni kokili. Zaradi pregrete tekoče žlindre, ki je nenehno v stiku z elektrodno konico, se ob konici elektrode tvori tekoči film kovine. Ko razvita kapljica jeklene litine prehaja skozi žlindro, se kovina razžvepla in očisti nekovinskih primesi s kemično reakcijo z žlindro ali fizično s flotacijo na vrh pretaljenega novega ingota. Tekoča jeklena talina se po prehodu skozi žlindro na dno vodno hlajene kokile postopoma strdi v nov nastajajoč ingot. Vodno hlajena kokila zagotavlja relativno visok gradient odvoda temperature in s tem visoko stopnjo homogenega strjevanja. Zaradi zahtev panog inženirstva po novih visokih čistostih legiranih jekel in super zlitin so se razvile variacije EPŽ s kontrolirano atmosfero, in sicer: elektro pretaljevanje pod žlindro z zvišanim tlakom (PESR), elektro pretaljevanje pod žlindro v inertni atmosferi plina (IESR) in elektro pretaljevanje pod žlindro v vakumu oz. zmanjšanim tlakom (VAC-ESR). V tem delu oz. »postru« bo predstavljen splošen opis EPŽ-postopka.

DIFFERENT ENERGY CONTRIBUTIONS ON MAGNETIC DOMAIN CONFIGURATIONS IN ELECTRODEPOSITED CoPt NANOWIRES

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One-dimensional ferromagnetic nanostructures have potential applications in future high density storage devices and magnetic sensors. The magnetization reversal process of electrodeposited ferromagnetic $Co_{65\pm4}Pt_{35\pm4}$ nanowires with different lengths 600-6000 nm and the diameters 80-200 nm were investigated by magnetic force microscopy (MFM). The magnetic domains in nanostructures are determined with relative contributions of micromagnetic energies to total free energy, namely, exchange energy, magnetostatic energy, magnetocrystalline energy. Different ground state domain structures and their growth on the variation of the external magnetic field perpendicular to the wire axis were investigated. Magnetic properties and magnetization reversal process was experimentally visualized by constructing the whole hysteresis loop for single wires. At zero applied field, for wire with diameter 200 nm and the length 5.5 μm a multi-domain structure was obtained represented by quasiperiodic dark and bright contrast along the length of the wire in the MFM image. Such domain modulation is attributed due to the competition between magnetocrystalline and shape anisotropy. With applying 30 mT field, MFM contrast becomes more uniform due to the alignment of the magnetic domains in the wire, mostly in the direction parallel to applied field. With increasing the field a progressive reorientation of the moments (domains) starting from the lower middle part of the wire towards the two edges of the wire, which ends with all the moments parallel to the field direction in the saturation state. A single domain state (SD) was observed for wire with length 1 ěm and diameter 200 nm. On applying 15 mT external field all magnetic moments abruptly reorient with external field without domain movement. The SD configuration arises from the dominant contribution of demagnetization field energy because of shape of wires. With reduced length (600nm) and diameter (85nm) of the wire a single vortex state has been evidenced. Such state could result because of dominant contribution of exchange energy. Transmission electron microscopy (TEM) study revealed different local crystal structure in CoPt nanowires for respective lengths and diameters, which was found to influence the domain configuration.

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EFFECT OF HEAT-TREATMENT ON FRICTION AND WEAR PROPERTIES OF SiC AND GRAPHITE PARTICULATE REINFORCED ZA 27 HYBRID COMPOSITES

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Zinc–base alloys are characteristic materials with their low initial cost, excellent foundry castability, good mechanical properties, good machining properties, compared to many nonferrous casting alloys [1]. Therefore the zinc-based foundry alloys have been used increasingly during the last few years. Particle-reinforced metal-matrix composites (MMCs) have attracted significant attention in recent years in both the academic and in the industrial sector [2]. Heat treatment of the conventional zinc–aluminum alloys improves dimensional stability and ductility. The duration and temperature of solutionizing and ageing play dominant role in controlling the structural, mechanical and tribological properties of zinc–aluminum alloys. Accordingly, it is very important to optimize the heat treatment parameters in order to attain good properties [3].

The aim of study is to enhance the wear behavior of ZA-27 alloy, reinforced with 2.5-5-7.5-10 wt. % graphite composites (GRC), 10 vol % SiC reinforced composites (SRC); 10 vol. % SiC and 2.5-5-7.5-10 wt. % graphite reinforced hybrid composite materials (HCM). The heat treatment was carried out to the produced alloy and the composites to determine the response of the different composites against sliding wear. The microstructural changes after casting and heat treatment processes were investigated via optical microscopy and scanning electron microscopy (SEM) techniques. Microstructural investigation showed modified microstructure of the matrix materials by applied heat treatment. Heat treatment caused refining of α phase. Brinell (HB) and Wickers (HV) hardness test methods were used for the samples produced by casting and heat treatment processes. It was found that the hardness values of the composites were increased with increasing graphite reinforcement till to 5 wt. Further increase in the graphite content with 7.5 and 10 wt. % resulted in decreasing the hardness. Wear tests were performed under 5 N load, within a distance of 500 m and by using 0.5, 1 and 2 m/s sliding speed by using pin on disc methods. The changes in the friction coefficient and mass losses were measured for the samples produced by casting and heat treatment processes. The worn surfaces of the composites were also investigated via scanning electron microscopy techniques. It was found that mass losses were decreased after reinforcing the zinc-aluminum alloy with graphite, SiC and SiC + graphite. The minimum mass losses were obtained with 10% SiC + 7.5 % and 10 % SiC + 10 % graphite reinforced composites. The complete wear analysis revealed that applying heat treatment both to casted and heat treated composites resulted in a remarkable increase in the wear resistance.

Key Words: ZA-27, Hybrid Metal Matrix Composites, Heat Treatment, Wear, Friction

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EFFECT OF DIFFERENT SURFACE HEAT TREATMENT METHODS ON THE HARDNESS OF AISI 4140 STEEL

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In recent years, there are many different surface treatment techniques to improve the mechanical properties on the material surface [1,2], such as plasma spraying [2-4], thermo-chemical treatments [5,6], laser treatment [7–8] and novel technology electrolytic plasma hardening (EPH) [9].
In this study, the effect of different heat treatments on the hardness of AISI 4140 steel was investigated. Sample surfaces of AISI 4140 steel were modified by traditional induction heat treatment and new treatment electrolytic plasma hardening. The microstructural characteristics of surface treated steel samples were examined by optical microscopy and scanning electron microscopy (SEM). The mechanical properties of the samples including the surface microhardness and modified layer thickness were also evaluated. The microhardness of modified AISI 4140 steel by electrolytic plasma treatment was found similar with the induction heat treatment. The obtained results indicate that the electrolytic plasma hardening is a suitable technique for improving the mechanical properties of AISI 4140 steel like traditional hardening method.

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DESIGN OF WIDEBAND PLANAR ANTENNA ON EPOXY RESIN REINFORCED WOVEN GLASS MATERIAL

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In wireless communication technology the necessity of wide and multi-band antennas is increasing rapidly due to the need to support more users and to provide information with higher data transmitting rates. Compared to conventional three dimensional types of antennas, planar antenna printed on a piece of printed circuit board becomes very popular in modern wireless communication because it can be easily embedded into wireless devices or integrated with other RF circuitry. Usually, a planar design can be used to reduce the volumetric size of a wideband antenna by replacing three dimensional radiating elements with their planar version [1, 2].

In this paper a planar monopole antenna is proposed for wideband applications. The antenna consists of rectangular radiating patch and a partial ground plane. The microstrip line-fed radiating patch is printed on one side of an inexpensive dielectric material of thickness 1.6 and permittivity 4.6 while the partial ground plane of side length 5.5 mm is printed on the other side of the substrate. The dielectric material consists of an epoxy matrix reinforced woven glass. The fiber glass in the composition is 60% while epoxy resin contributes 40% of the composition. This composition of epoxy resin and fiber glass varies in thickness and is direction dependent. One of the attractive properties of polymer resin composite is that they can be shaped and reshaped repeatedly without losing their material properties [3]. Due to ease of fabrication, design flexibility, low manufacturing cost and market availability, the epoxy matrix reinforced woven glass material has become popular in the designing of microstrip patch antenna. It is observed that the radiating patch has a strong coupling with ground plane and the antenna designed on polymer resin composite material is capable of supporting multiple resonance modes. The overlapping of these multiple resonances modes leads to the characterization of wideband ranging from 2.9GHz to 18.3GHz.The simple structure, ease of fabrication, low cost, wide operating band and omni-directional radiation patterns makes the proposed antenna suitable for being used in WiMAX, WLAN, C-band, UWB and X-band applications.

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METALLIC COMPOSITES FOAMS WITH PARTICLES MADE BY GAS INSUFFLATIONS

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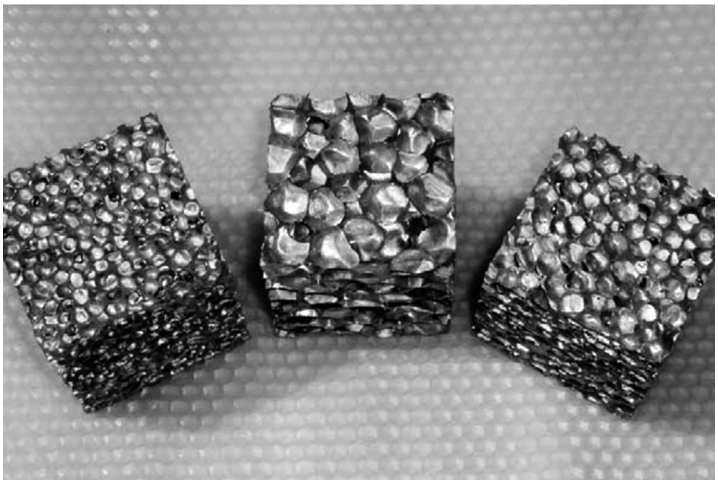
To obtain metal foams we have focused research on Al-Mg alloys with different concentrations of silicon carbide (SiC) particles. To obtain these materials has been chosen different gas blowing method (N_2, SO_2 and C_4H_{10}). It was observed that the best results in terms of pore volume gave blowing with C_4H_{10}. The samples obtained were analyzed by optical and electron microscopy.
The paper also presents some manufacturing processes of metal foams, (such as sheet casting, low pressure casting, precursor technology) and some characteristic properties. Finally, the various application fields for cellular metals are discussed. They are divided into structural and functional applications and are treated according to their relevance for the different industrial sectors.
Aluminum foams are a new class of materials with low densities, large specific surface and novel physical and mechanical properties. Their applications are extremely varied: for light weight structural components, for filters and electrodes and for shock or sound absorbing products. They are recyclable and nontoxic. They hold particular promise for market penetration in applications in which several of these features are exploited simultaneously. [1]



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NUMERICAL MODEL OF COMPOSITE AIRFOIL SEGMENT WITH PIEZOELECTRIC SENSORS

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Numerical model of airfoil segment with piezoelectric sensors was created in commercial finite element software Abaqus and its response to impact loading was compared with experimental results. The wing segment is made of woven glass epoxy composite with varying number of plies and type of weave. The material properties were experimentally determined form tensile tests and used in finite element model of rectangle plate. Results from experimental modal analysis of composite rectangle plate made of the same material as the segment were compared to results from numerical analysis and parameters of numerical model were adjusted. Finally numerical model of whole segment was created and validated on experimental results from experimental modal analysis of whole model. Moreover piezoelectric sensors ware glued to the segment and their response to dynamic loading was compared to results from numerical simulation.

Comparison of Finite Element Models for Piezoelectric Materials; Zuzana Lašová, Robert Zemčík, *Procedia Engineering*, **2012**, *vol* 48, 375-380.

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ANTIBACTERIAL, MECHANICAL AND MICROSTRUCTURAL PROPERTIES OF PLASMA SPRAYED, SILVER DOPED HYDROXYAPATITE COATINGS

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Plasma sprayed hydroxyapatite coatings are commercially used for fixation of dental and orthopedic implants. Although, the perfect bioactivity of hydroxyapatite, reproduction of bacteria, causing infection and implant failure [1]. It is known that silver has antibacterial activity and it is used as antibacterial agents. 1 mol % silver was doped into hydroxyapatite structure by ion exchange method. In this study, Chemically precipitated hydroxyapatite powders were prepared by spray drying method to increase rate of powder flow and limit the particle size distribution. XRD (X-Ray diffraction), SEM (scanning electron microscope), Vickers hardness test and antibacterial activity test were used to characterization of coatings.

Keywords: Hydroxyapatite, antibacterial, spray drying, plasma spraying

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UTILIZATION OF COMPUTER TOOLS FOR MOISTURE AND THERMAL DESIGN OF FLAT ROOFS

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Nowadays, due to the increasing requirements put onto buildings in conjunction to energy efficiency and because of the increasing prices which are to be paid for various types of energy, owners of existing buildings tend to often choose the possibility to save money by reconstructing their own estates. Howbeit, they want to meet the conditions of local codes and regulations. Throughout these renovations they do increase the thermal resistance of the buildings envelope, but they tend to forget that some details are to be solved too, to prevent the creation of issues, especially in case of roof structures, the reconstruction of which can be done by one of the available two possible ways. The first of the available options to decrease the thermal conductivity of the roof is to exchange the original composition of the whole roof for a new one, including all of the layers the roof is made up from, except for the load bearing elements. The second, by the investors more frequently chosen way is to add another set of layers on top of the existing ones, since it is cheaper and therefore financially more attractive. That is why it is necessary to seek for other ways how the theoretical base of thermo-technical calculations could be fully utilized.

The paper deals with a feasible methodology for roof composition design, which ensures that the expansion of water stuck within the roof in the form of water vapour will not endanger the damp proof course, whereas it can leave the structure and at the end it may let the structure to retake its former thermal insulating properties.

UTILIZATION OF COMPUTER TOOLS IN THE FIELD OF PHYSICAL PARAMETER MEASUREMENTS IN WOODEN HOUSES

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Nowadays a huge emphasis is put onto wooden buildings especially when looking at aspects like energy saving and energy efficiency in family housing, which is the theme of a related research project. The topic of the paper hence, is focused on the comparison and streamlining of methods available for the engineering discipline in the fields of energy consumption and air-tightness measurements of buildings. The newly developed methods and practical outputs of the solved project are to be delivered directly to the industry related to wooden housing.

The project is focused on humidity and temperature control of family housing as well. These are to investigate the quality of other applicable tools and methodologies, since the main targets of wooden family housing are the timber structural elements. Particularly it handles about issues connected to moisture and humidity which may cause problems related to liability later on. But who is responsible for such an error. Did the moisture reach the structural elements in the factory throughout manufacturing, while transportation or during storage on the construction site.

The aim of the project is to find out the efficiency of various moisture measuring methods, because it would be essential to find a solution that would allow a permanent installation of humidity measurement sensors into the structural elements in the processes of manufacturing.

The project equips dwellings with high-end measuring devices to continuously gather data regarding the quality of living environment in the dwellings. These observations do include the monitoring of following parameters:

- Parameters of building physics in structures and buildings likewise;
- Humidity and moisture content profile of structural elements;
- Temperature profile of structural elements;
- Comparison of indoor and outdoor atmospheric pressure levels (air pressure levels);
- Energy consumption and its allocation;
- Circulation and exchange of air;
- Local weather parameters (temperature, wind, atmospheric pressure, humidity, etc.);
- Temperature and humidity of indoor air.

CAST POROUS METALS WITH REGULAR STRUCTURE AND SOLID SKIN

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The subject of the performed research was testing infiltration techniques to manufacture porous metals with different cellular structure. Regular cellular structure can be achieved using different types of preforms which fill the mold cavity. Using preform like a core not filling the whole mould cavity can enable to manufacture a casting with solid surface layer and internal porous structure. The preform must satisfy a certain number of criteria. In particular it must not contain disconnected islands of material so that could be completely eliminated from solidified metal. It must be made of a material that retains its shape during liquid metal infiltration (sufficient strength, low abrasion) and could be destroyed after casting to leave the porosities.

The experiments have demonstrated the possibility of using one foundry operation and conventional foundry process for production of a casting with internal regular cavities and solid skin. This method is based on the infiltration of metal into the mould cavity with a filling material with a solid rugged construction, which is used as a foundry core and which makes it possible to create in this way a solid surface skin of the casting. Mixture for the core must meet the requirements for sufficient strength, low abrasion and good shelf life. Good disintegration of preforms should be guaranteed after casting and solidification of the casting. The biggest advantage of this method is the ability to control not only the size of pores and of porosity, but mainly the regular structure of internal cavities and the related possibility of achieving the optimal and predictable mechanical and thermal properties of the material throughout the whole volume of the casting.

AUTOMATION OF AES ANALYSIS – THE PROBLEM OF NOISE AND BACKGROUND

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Our research work aims to automate the AES (Auger Electron Spectroscopy) analysis. The task has not been accomplished yet since the AES produces a very complex signal consisting of at least three elements, the spectrum itself, the spectral background and the noise. In order to be able to perform the automated analysis, the spectral signal should be as free as possible of the background as well as the noise component. In order to perform the Fourier analysis of the signal aiming to supress the noise or to perform the post-processing such as convolution or correlation, the AES spectrum must be background free. Background and noise phenomena are bound together so much that in order to detect the background, the noise must be studied first. Our work was initially focused on the high energy part of the AES spectrum being free of spectral peaks thus enabling us to study only the noise and the background. The most straightforward approach to compress the noise is the averaging technique. It provides the first information on the background since the noise is substantially reduced. Taking a closer look at the background curve, obtained by the averaging, one notices that it is still distorted by the noise. The next step is the definition of the pseudo envelope of the noise. The upper and lower (noise and background together) envelopes are much smoother than the noise and by obtaining the average value between the upper and the lower envelope the next approximation of the background is obtained. The derived background is much smoother than the one obtained by the process of averaging. By subtracting the obtained background from the spectrum only the noise remains. The noise is free of background and thus prepared for further analysis which must provide information useful to suppress the noise on the peak populated part of the AES as well.

A NEW METHOD FOR GRAIN ROUGHNESS DETERMINATION IN STEEL MICROSTRUCTURE

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Shape roughness is an important parameter that describes the morphological characteristics of the grain in microstructure. Considerable progress is achieved in different models for grain roughness determination, but there is no single analysis method that can provide full description of surface topography. In present research wide variety of two dimensional grains are generated using a unique combination of geometry and neural network, and new method for grain roughness assessment is developed. Grain roughness of each shape was calculated by measuring the grain boundary departure from the ideally round object (circle). The equations governing the problem as well as histograms of grain boundary roughness are illustrated for a number of complex grain shapes. The descriptive model used is stable and representative regardless of size, rotation, and mirror image of grains in coordinate system. Moreover, the method is expected to be particularly convenient for modeling heterogeneous materials regardless of roughness level in grain boundaries.

CAPITALIZED DEVELOPMENT OF COMPOSITE SALT CORES FOR FOUNDRY APPLICATIONS

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Instead of cores based on inorganic salts, generally used for pre-casting of casting cavities and holes from non-ferrous alloys, composite salt matrix are preferred in order to improving of physical-mechanical properties of cores. Basic salt is enhanced by materials with defined properties (granulometry, refractoriness, cooling effect, heat conductivity). The goal of this contribution is determination of influences of individual additives on cores behavior, which were prepared by different methods (High-pressure squeezing or Injection) for casting production with high surface quality of pre-casted cavities and holes.

PREPARATION OF MESOPOROUS FULLERENES WITH ORDERED POROUS STRUCTURE FOR ENERGY STORAGE APPLICATION

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Fullerene is a new allotrope of carbon which exhibits interesting physical and chemical properties including high resistivity and superconductivity that make them available for various applications.[1] Although the structure of the fullerene molecules is highly attractive, the poor textural parameters and the conductivity limit their applications in fuel cells, Li-ion battery and supercapacitors. Creating mesoporosity in the fullerene could allow us to make materials with an extremely high surface area, uniform pore diameter and large pore volume, and a high electronic conductivity, which would increase the active electrochemical surface area. In this work, nano-hard templating approach is used to synthesize mesoporous fullerene using fullerene as the carbon source and highly ordered mesoporous silicas such as SBA-15 and FDU-12 as nanotemplates (Figure 1). However, the main challenge involved in this fabrication was to obtain perfect pore filling of the templates with the fullerene solution to obtain a defect free well-ordered mesostructure. Therefore, the fullerene solutions are prepared by using solvents such as 1,2,4-trimethyl benzene and 1-chloronaphthalene wherein the fullerene is highly soluble, which also further facilitates the efficient diffusion of fullerene inside the channel of the template accessing all the adsorption sites. The cross linkage between the template and the carbon source along with the carbonisation process finally resulted in a well-ordered mesoporous fullerene with a large surface area in the range of 700 to 1500 m^2/g, large pore diameter and uniform pore size. The structure and pore diameter of the final product can be easily controlled by choosing the template with different structures and pore diameters, respectively. The highly ordered material was examined for its conductivity and due to its crystalline nature, the conductivity reached to the range of 26-247Scm^{-1}. The conductivity of the materials can also be finely tuned by choosing the appropriate mesoporous silica templates. Finally, the prepared materials which exhibit high surface area, conductivity, and crystallinity have been employed as electrodes for the supercapacitor applications. It was found that the mesoporous fullerene shows much higher specific capacitance than the mesoporous carbon based materials and the detailed results will be discussed during the presentation.

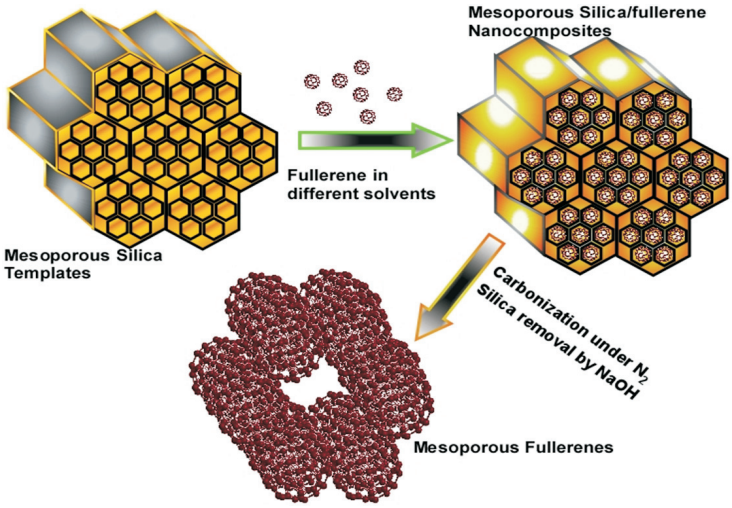

Figure 1: Schematic representation of the fabrication of mesoporous fullerenes.

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TRIBOLOGY OF CrAg7N – COATINGS DEPOSITED ON VANADIS 6 LEDEBURITIC TOOL STEEL

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Samples made from Vanadis 6 PM ledeburitic tool steel were surface machined, ground and mirror polished. Prior the deposition, they were heat treated to a hardness of 60 HRC. CrAg7N-coating was deposited by magnetron sputtering technique, using pure Cr and Ag targets, in a composite low pressure nitrogen/argon atmosphere and at a temperature of 500°C at the Hauzer Flexicoat 850 device. Tribological testing using a pin-on-disc apparatus has been realized at ambient and elevated temperatures: 300, 400 and 500 °C, respectively. Al_2O_3, 100Cr6 and CuZn balls were used as counterparts. Wear tracks after pin-on-disc testing were analyzed by scanning electron microscopy and microanalysis. The experiments have shown strong dependency of tribological parameters on the temperature. The friction coefficient of CrN-Ag against 100Cr6 ball at ambient temperature was $\mu = 0.56 \pm 0.11$. Tribological sliding tests of this coating system against alumina balls indicate decrease of friction coefficient with increasing temperature. At ambient temperature was $\mu = 0.68 \pm 0.02$ and minimum occurred at temperature 400°C, $\mu = 0.24 \pm 0.04$. This is attributed to the diffusion of Ag particles to the sliding top surface at elevated temperature. Testing against CuZn brass ball gave generally lower friction coefficient at ambient temperature, $\mu = 0.39 \pm 0.12$. In contrast, friction coefficient slightly increase with increasing temperature and was practically constant at elevated temperatures, ranging between $\mu = 0.43 – 0.48$.

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HIGH TEMPERATURE ENGINEERING OF METALLURGICAL SLAGS IN A FRAMEWORK OF SUSTAINABLE INORGANIC MATERIALS MANAGEMENT

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In this presentation I will give an overview of my research group's work of the last years in the area of slag engineering and valorization. Our background is in high temperature metallurgical processing where we were looking at refractory lining life-time as well as metal quality issues in close cooperation with ferrous and non-ferrous producers. In these project the role of the slag is essential and it has become apparent that without good slag control the soundness metallurgical process is seriously jeopardized. More recently we also started to investigate how the slag, after fulfilling its metallurgical role, can be valorized in high added value applications by controlling its microstructure by targeted additions and controlled cooling trajectories and how the remaining metal value can be extracted fully.

In the meantime, we as a society are slowly awakening to the grand challenge of resource scarcity. My group's research on high temperature process engineering has teamed up with a number of other research groups at the KU Leuven to form a resource efficiency consortium which has been named SIM^2 for 'Sustainable Inorganic Materials Management'. The platform brings together research expertise from a wide range of technological and non-technological domains and its mission is to target a zero-waste, environmental-friendly, cost-effective recovery/recycling approaches, covering the full value chain. I will start my presentation to explain shortly the SIM^2 programme and how it is helping to preparing the impending call for proposals for an EIT-KIC on raw materials.

[1]http://www.mtm.kuleuven.be/Onderzoek/Semper/Hitemp
[2]http://set.kuleuven.be/mrc/sim2

CHARACTERIZATION OF GEOMETRICAL AND MECHANICAL PROPERTIES OF ADVANCED PORE MORPHOLOGY (APM) FOAM ELEMENTS

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Advanced pore morphology (APM) foam is a novel porous material consisting of sphere-like metallic foam elements with solid skin and a complex internal closed-cell structure. It has some advantageous mechanical properties and unique application adjustability. The APM foam elements can be used either individually, e.g. as fillers of hollow engineering parts, as core layers of sandwich structures etc., or bonded with a resin matrix as composite materials. This paper reports on the results of conducted topological and mechanical characterization of APM foam elements.

A micro computed tomography scanning was used to record the internal structure of the APM foam elements. The resulting images were used to reconstruct a 3D computer model of APM foam samples. Then a new procedure for topological and morphological analysis of APM foam samples was used, which is based on the scalar distance transform field of the micro computed tomography data. Two different APM foam element sample sizes were used with outside diameters of 5 and 10 mm.

Mechanical properties of APM foam elements have been determined with quasi-static and dynamic compressive experimental testing program. The materials showed a characteristic cellular material behavior and it has also been observed that larger foam elements experience lower densification strain and higher energy-absorption capabilities.

Acknowledgment

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PROGRESSIVE METHOD OF POROSITY PREDICTION FOR ALUMINIUM CASTINGS

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The final integrity of a casting is greatly influenced by the presence of porosity. Progressive way to predict presence of porosity is the use of modern computer simulation programs. Main disadvantage is, that most of today simulation programs does not take into account gas and interdendritic shrinkage porosity, and yet, these types of porosity are the main factors affecting mechanical properties of cast aluminium alloys. The main aim of executed experiments is to verify possibilities of this promising method of porosity prediction. Various factors will be discussed: melt temperature, mold temperature, mold material and also used alloy. A calculation of advanced porosity prediction was performed for an aluminium alloys by advanced porosity module included in ProCAST software. This calculation takes into account all basic phenomena, which are at the origin of micro and macro porosity. For experiment purposes was used mold with specific shape – Sanduhrprobe. Shape of mold is designed in unique way, so in solidification phase is induced three types of voids, at a free surface, the level of liquid decreases as solidification proceeds (piping), within closed liquid pockets (hot spots), a macropore surrounded also by microporosity will be present. Materials used in experiments were not loaded from software database, because results could be distorted by deviations from particular material we used. To achieve precise results, we used thermal analysis to get accurate data about used alloys. Important solidification events, which affects porosity formation, such as recalescence and nucleation undercooling temperature, coherence point and rigidity point have been determined from cooling curves and its first derivate. These data were then included to the database of simulation software and used in simulation process.

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MICROSTRUCTURE AND PROPERTIES OF HYPOEUTECTIC Al – Si ALLOY DURING REPEATED UTILIZATION

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The aim of the research is to study the effect of recycling (repeated re-melting) of alloy based on Al-Si on its utility properties and to ability to use recycled material as a charge for further use. AlSi7Mg alloy was employed for the experiments, four repeated re-melting were carried out finally. The input material was not modified (without alloying, vaccination and modification) during the individual melts. The input material (casting pig) with the exact chemical composition according to the supplier list was used for the first melt. For further melting returnable material from previous melting (gating system, feeder) was used. Twenty samples were obtained from the each melt. Hardness (HB), microhardness (HV), metallographic analysis, EDX and spectral analysis were carried out for the average sample from the each melt, which were prepared by gravity casting technology into a metal mold with a protective coating, Furthermore, the thermo-physical properties of selected samples were determined using of dilatometric analysis.

LATENT HEAT STORAGE UNDER DIFFERENT BOUNDARY CONDITIONS: MODELING AND EXPERIMENTAL EVALUATION

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Latent heat storage by Phase Change Materials (PCMs) represents promising technology when the high heat storage density is required. While the sensible heat storage is familiar for builders the practical use of latent heat storage is still under development. From this point of view each demonstration and examples of the behavior of latent heat storage media contributes to the better knowledge of building designers and building owners. Heat storage by building structures reduces room indoor air temperature swings. For this purpose the kinetics of the heat storage plays the key role. Advanced approach uses additional latent heat storage capacity in PCMs that could be microencapsulated and integrated in final layer of building structures. The PCMs microencapsulation represents relatively novel technology that allows use common building materials as a matrix (Tyagi *et al.,* 2011). The final building layers are in direct contact with indoor environment therefore the best heat transfer can be achieved. Heat from external gains, e.g. direct solar radiation, and internal gains, e.g. electric equipment, are stored in latent heat storage layer during day. The problem can occur when the stored heat must release from medium during night. The performance of latent heat storage media was modeled by specialized software ANSYS with the use of different boundary conditions and compared with measured temperatures and heat flows. The heat transfer process in structures with PCMs is rather complex compared to heat transfer in sensible heat storage media, especially during the melting and solidification. For modeling the method of effective heat capacity was chosen (Heim *et* Clarke, 2004). As an material characteristics input for modeling the results from differential scanning calorimeter were used.

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CHROMITE SPINEL FORMATION IN STEELMAKING SALGS

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The aim of this work was to study the oxidation of chromium and the behavior of chromium oxides during melting under different conditions. A special stainless steel grade PT929 was chosen for the experiments. Three sets of experiments were set up in order to study chromites in slag, oxidation and formation of chromites, prevention of further oxidation of chromium, and silicothermic reduction of chromium. Slag microstructure was observed in each experiment and connected to the chemical reaction that took place on the slag – steel melt phase border. Ferrosilicon additions and previously and pre-prepared slags were used to establish different thermodynamic conditions. Influence of silicon on chromium oxidation was observed.
Keywords: Chromite spinel, Chromium oxides, Chromium alloyed steel, Steelmaking slag

NASTAJANJE KROMITNIH SPINELOV V JEKLARSKIH ŽLINDRAH

Raziskava je usmerjena v proučevanje oksidacije kroma in lastnosti kromovih oksidov pri taljenju pri različnih pogojih. Narejene so bile tri serije eksperimenti, s katerimi smo preučevali oksidacijo in nastanek kromitov, preprečevanje oksidacije kroma in silikotermična redukcija kroma. Pri vseh eksperimentih smo vzeli vzorce žlindre, ki smo jo opazovali pod mikroskopom. Mikrostrukturo žlindre smo povezali s kemijskimi reakcijami, ki potekajo na fazni meji žlindra – jeklena talina. Pred pripravljenim žlindram smo dodajali ferosilicij ter s tem ustvarjali različne termodinamske pogoje in opazovali vpliv silicija na oksidacijo kroma.
Ključne besede: kromitni spinel, kromovi oksidi, jekla legirana s kromom, jeklarske žlindre

VERIFICATION OF INFLUENCE OF INOCULATION ON COOLING CURVES AND ON MICROSTRUCTURE OF HYPOEUTECTIC ALLOY Al-Si

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Alongside numerous physical principles influencing the primary crystallization we use nowadays also the processes called inoculation. Inoculation has a positive effect on enlarging of crystallization nuclei and it refines primary structure of the cast material. Refining of primary phase influences positively mechanical and utility properties of material. The work was aimed at assessment of the influence of inoculation on the overcooling temperature on the cooling curve below the equilibrium liquidus temperature, and on the size of primary phase grains of hypoeutectic phase of the AlSi alloy. For verification of the above mentioned properties we chose the inoculant of the AlTi5B1 type in various proportions in respect to the mass of the melt. This influence was investigated also by thermal analysis. Thermal analysis is based on precise measurement and evaluation of the cooling curve of investigated material. Charge of the investigated material consisted of aluminum ingot bars with standard chemical composition. Melting was performed in an electric resistance furnace in Al_2O_3 crucible. Temperature of pouring was for all the samples 780°C, with addition of various quantity of inoculant ranging from 1% to 5% AlTi5B1. Samples of material were cast into metallic moulds and temperature of the cooling metal was measured by thin thermocouple of the NiCr - Ni type. Each sample was after solidification cut and afterwards the following characteristics were evaluated: structure, size of the primary grains and Brinell hardness. In the case of thermal analysis we monitored the value of overcooling below the equilibrium liquidus temperature, which confirmed that state of crystallization nuclei influences the value of overcooling. All the evaluations confirm favorable effect of inoculation on micro-structure and on utility properties of the inoculated material.

EFFECT OF Ti_2AlC PARTICLES ON THE MICROSTRUCTURE AND ELEVATED TEMPERATURE DEFORMATION PROPERTIES OF γ-TiAl ALLOYS

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The γ-TiAl intermetallics with and without 0.3 at. % of yttrium and with different carbon contents ranged from 0.9 to 1.6 at. %, were prepared by vacuum induction melting in graphite crucible. Different contents of carbon were obtained by varying time of melting. The resulting samples had from 0.6 to 3.7 vol. % Ti_2AlC large rod-like carbides in the lamellar matrix consisting of alternating lamellas of γ-TiAl and α_2-Ti_3Al phases. In has been found that the grain size of the matrix decreases with increasing volume fraction of Ti_2AlC carbides from 430 to 35 μm. In addition finer carbides with similar composition were observed even. Their size reached below 1 μm and they were occurred mainly at the grain boundaries, but also inside the lamellar grains. Compression testing revealed that all samples had relatively high yield strength at elevated temperature from 917 to 623 MPa at 600 °C and from 608 to 547 MPa at 800 °C, but the best strength and the best yield strength had sample with the lowest contents of Ti2AlC large rod-like carbides. From these results it is concluded that the elevated temperature strengthening is the result of C in solid solution and small carbide precipitates rather than large rod-like Ti_2AlC carbides.

CHARACTERIZATION OF GAS NITRIDED 31 CrMoV9 STEEL

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Nitriding is a widely employed thermochemical surface treatment to improve the chemical and mechanical properties of ferritic steel components [1]. The nitriding process has been successfully applied to carbon steels, alloy steels, tool steels, and stainless steels [2,3]. Gas nitriding of 31CrMoV9 has been carried out at three different temperatures i.e., at 500°C, 520°C and 540°C for 10h, 20h and 30h duration. Nitrogen activity on surface was controlled by the nitriding potential-K_N which is known as thermodynamical control parameter for controlled gas nitriding process. Optical microscope studies revealed that there are three distinct regions on the cross-section of nitride sample (Fig.1). The microstructure of the base material and the nitrided layer was examined by optical and scanning electron microscope. The thickness of the compound layer on the steel surface changed in the range from 8,7 to 22,7 μm (Table 1). By selecting the proper nitriding potentials according to Lehrer diagram, ε-Fe_3N and γ'-Fe_4N nitrides which determined by X-ray diffraction technique were obtained. The hardness of diffusion layer changed from 620HV to 750HV. Maximum surface hardness reached 920HV. Kinetic studies showed that diffusion coefficient increased with increase in process temperature, and the activation energy is around 151 kJ/mol.

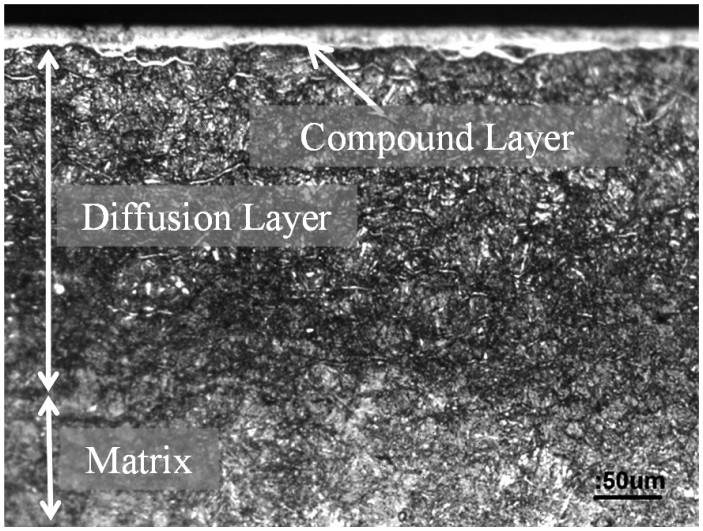

Fig. 1. Optical microstructure of 31CrMoV9steel nitrided at 520°C for 30h

Table 1. The change of the compound layer thickness, the case depth and surface hardness with the nitriding temperature and time.

Nitriding temperature (°C)	Time (h)	Compound layer thickness (mm)	Case depth (mm)	Surface hardness (HV)
500	10	8,70	210	920
	20	14,8	250	908
	30	17,1	350	870
520	10	12,8	230	914
	20	17,4	320	895
	30	20,4	370	860
540	10	17,0	250	910
	20	20,6	350	891
	30	22,7	450	821

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MATERIALS FOR NEW GENERATION STEAM GENERATORS

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One of the means to reduce the emissions from coal fired steam boilers is increasing the live steam parameters (temperature and pressure) over the critical point of water. To allow increases (temperature of a 720 °C and pressure of a 350 bar), advanced materials for use in ultra-supercritical steam generators were developed. These materials are ferritic/martensitic steel alloys with 9-12% chrome, austenitic stainless steel alloys and nickel-base alloys. High-strength ferritic 9-12 Cr steels for use in steam generators are available up to 650 °C. Such steels are P91 to P92, austenitic steels grades 18-8 to 18-25 like Super 304H, as well as the high nickel content alloys like Inconel 617 and 740. Furnace walls (water wall) need high-temperature creep-resistant feritic steel with grade T23 as probable candidate. Thermal fatigue strength requirement is much higher for high pressure steam headers, which are exposed to higher temperature fluctuations, than for steam pipes. Additionally steam headers have many welded attachments to inlet tubes from re-heaters and super-heaters. P92 and P122 grade which allow steam temperatures up to 620°C and pressure up to 340 bar are good for header applications. Most severe conditions in the steam generator undergo super-heater tubes. With respect to creep-rupture strength, application of high-creep-strength alloys, like Inconel 740 and Inconel 617 for use up to 650-720°C is under consideration.

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MEASUREMENT TECHNIQUES OF SPRAY COOLING HOMOGENEITY

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The cooling homogeneity is one of the most important factors which must be considered when designing the cooling sections for hot rolling of thin sheets. The inhomogeneous cooling may origin an undesirable thermal distortion. The cooling homogeneity is mainly influenced by the water distribution of the cooling section. And so, one way how to measure the cooling homogeneity is to measure the impact pressure distribution of the cooling section. Another way is to measure the surface temperature distribution of a steel sample during the cooling process. There are two ways how to measure surface temperature and temperature field: contact and non-contact. Contact measurements are conducted with the help of thermocouples and noncontact measurements use an optical measurement, i.e. using an infrared-scanner. Each of these methods has their advantages and disadvantages. The comparison was demonstrated by the experimental cooling measurement of a stainless steel sheet done by full cone water nozzles.

STABILIZATION OF WATER TEMPERATURE WITH THE USE OF PHASE CHANGE MATERIALS

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Stability of water temperature plays an important role in many applications and there are various ways to stabilize the water flow temperature. Beside the active thermal management, additional thermal mass can be used to provide short-term thermal storage and thus improve the thermal stability. Both sensible and latent heat storage materials can be employed for this purpose. The Phase Change Materials (PCMs),[1] which have already found their use in many thermal storage applications,[2,3] can also be used for stabilization of flowing water temperature.[4]

Experiments have been carried out in order to investigate the stabilization of water flow temperature with a water-PCM heat exchanger. The investigated heat exchanger was a round tube, through which the water flowed, embedded in an annular layer of a PCM. The heat exchanger was divided into one-meter-long segments (modules) and the water temperature was monitored at the outlet of each of the segments. A paraffin-based PCM with the melting temperature of 42 °C was used in the experiments. The experimental set-up consisted of two water reservoirs maintained at different temperatures, the water-PCM heat exchanger, PC controlled valves and a data acquisition system. As the first step a response to a step change in the water flow temperature at the inlet of the heat exchanger was investigated. Subsequently, a series of experiments with a square wave change of temperature at the inlet of the exchanger were carried out. The square wave temperature profile was achieved by periodic switching between the two water reservoirs. Several amplitudes and periods of temperature square wave were used. The results of experiments show that a water-PCM heat exchanger can effectively be used to stabilize the flowing water temperature when the inlet temperature changes are around the melting range of the PCM.

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MECHANICAL PROPERTIES OF NANOSILICA REINFORCED EPOXY COMPOSITES

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We focus on the preparation and mechanical properties of the nanosilica-reinforced, epoxy resin Epikote 828LVEL [1]. Epoxy composites containing two sizes of spherical silica nanoparticles, 130 nm and 30 nm, were prepared at a fixed volume fraction (V_P = 0.5%). To prevent agglomeration, the silica fillers were initially pre-treated with diglycidyl ether of bisphenol A (BADGE). Due to the low content of silica fillers, their inclusion in the matrix was confirmed by the increased roughness of a fracture surface compared to the smooth surface of the neat epoxy. Raman spectroscopy was employed to obtain additional information about the crack-propagation path. The mechanical properties, characterized by a three-point bending test, revealed a 10-20% increase in the composite's modulus of elasticity with 30-nm and 130-nm silica-filler inclusions. Elongation at break, on the other hand, decreased for 5-10 % in both composites compared to neat epoxy, suggesting brittle fracture behaviour in silica/epoxy composites. The fracture toughness results showed a 25-30% improved toughening for both composites compared to the pure epoxy. The composite's resistance to failure in terms of the impact energy was, however, strongly dependent on the size of the silica: we observed a 30% increase for the 130-nm, and a 60% increase for the 30-nm, silica/epoxy composites, compared to the pure epoxy.

Table 1: Mechanical characteristics of silica/epoxy composites compared to pure epoxy.

Sample	E (GPa)	UTS (MPa)	elongation at break (%)	K_{IC} (MPa.m$^{1/2}$)	Impact energy (J)
Epoxy	2.6	127	10.0	0.66	0.19
Epoxy + 0,5 vol% 130nm SiO_2	3.0	141	9.6	0.91	0.26
Epoxy + 0,5 vol% 30nm SiO_2	2.8	138	9.0	0.93	0.33

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MECHANICAL PROPERTIES OF AUSTENITIC STAINLESS STEEL X15CrNiSi20-12 PRODUCED RECYCLING

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Steel X15CrNiSi20-12 are heat resisting steel that provide excellent corrosion resistance and heat resistance plus good strength at room and elevated temperatures. According to EN 10095 the steel forged conditions commonly used for products which is the main condition for resistance to the action of hot gases and combustion products at temperatures above 550 ° C. They are essentially non-magnetic as annealed and become slightly magnetic when cold worked. Typical uses include furnace parts, heating elements, aircraft and jet engine parts, heat exchangers, carburizingannealing boxes, sulfite liquor handling equipment, kiln liners, boiler baffles, refinery and chemical processing equipment, and auto exhaust parts.
The influence of remelted back (waste) materials on the quality of steel X15CrNiSi20-12 was analyzed by flow (RM), remelted (MM) and realloying (AM) material. For the analysis of the material was carried out testing of the tensile strength. Performance testing of tensile strength of raw (RM), remelted (MM) and realloying material (AM) was performed on two standard test specimen at room temperature, and two for testing at temperature 740 °C. The results of tensile properties were used for the analysis and comparison of features in order to obtain suitable material for recycling.
Keywords: austenitic stainless steel, mechanical properties, remelt, realloying, recycling.

CARBIDE MORPHOLOGY AND FERRITIC GRAIN SIZE AFTER ACCELERATED CARBIDE SPHEROIDISATION AND REFINEMENT (ASR) OF C45 STEEL

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Pearlite spheroidisation and grain refinement of C45 steel was investigated. ASR (Accelerated Carbide Spheroidisation and Refinement) process allows achieving microstructure of fine ferritic grain and globular carbides in seconds or minutes. This paper deals with ASR process realization via thermomechanical processing by controlled rolling.

Hot rolling is common part of structural steel processing. Conventional structure after hot rolling of C45 steel consists of lamellar pearlite and ferrite. It is able to achieve microstructure of fine ferritic matrix and globular carbides by controlled rolling with deformation at temperatures around critical temperature A1. Deformation causes recrystallization of ferritic matrix – grain refinement. Furthermore, high dislocation density during deformation enhances diffusion and promotes carbide spheroidisation.

The aim of the experimental program was to achieve microstructure of C45 steel consisting of fine ferritic grain and homogeneously dispersed cementitic globular particles by processing of bars at laboratory rolling mill. Morphological changes of cementite after thermomechanical treatment in comparison with conventional hot rolling were investigated as well as ferritic grain refinement. Image analysis was performed to determine spheroidisation level of cementite (aspect ratio of cementite particles) and ferritic grain size.

Proper examination of cementite morphology can be carried out only by observation of whole cementitic particles [1]. A common metallography analysis relies on 2D section observation. Thus, deep etching and cementite extraction was performed to study cementite particles shape formed during ASR process.

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DETERMINATION OF ELASTIC-PLASTIC PROPERTIES OF ALPORAS FOAM AT CELL-WALL LEVEL USING MICROSCALE CANTILEVER BENDING TESTS

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Presented paper is focused on determination of mechanical properties of closed-cell aluminium foam Alporas. To utilise the favourable properties of cellular metals (e.g. high strength-weight ratio, energy absorption or insulation capabilities) a detailed description of mechanical properties is required. The cellular metals exhibit heterogeneity at several scale levels. Contribution of the internal structure to the overall mechanical properties may not be in detail evaluated by utilizing the macroscopic testing only. On the other hand, the compact material of the cell-walls is influenced by its composition (titanium- and calcium-rich regions are present in the aluminium). Therefore too localised testing (e.g. indentation methods) may neglect inhomogeneities along the cell-walls. Hence testing of the isolated cell-wall was performed.

A custom developed modular loading device[1] (based on precise linear bearing stages) was assembled to enable cantilever bending tests. The load was applied by a stepper motor and the loading force was measured by a micro-scale load cell with loading capacity 2.25 N. Displacements of the samples were measured optically. Several points along the longitudinal axis of the sample were tracked by Lucas-Kanade tracking algorithm[2], and the obtained displacements were compared with analytically prescribed deflection curve. Based on obtained deflections and measured forces stress-strain diagram was constructed and constants of the elastic-plastic material model were evaluated.

Acknowledgements
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AES, SEM AND XPS CHARACTERIZATION OF ALUMINIUM FOAMS

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In presented study just aluminium alloy AlSi12 was used. Aluminium foams with closed cell structure were produced with foaming agent (TiH2, CaCO3, CaMg(CO3)2,..), a gas releasing substance. Closed cell structure has high impact energy absorption. Advanced metal materials with a high porosity and many appealing combinations of physico-mechanical properties, such as high stiffness in conjunction with very low specific weight, high impact energy absorption, flame and heat resistance, sound absorption are metal foams. Pure aluminium and aluminium alloys based metal foams are usually used for aerospace and aeronautics industry, armoured vehicles, car industry and related areas.
Investigations of aluminium foams' alloy AlSi12 by SEM showed us interesting results of pore size distribution and of decreasement of material density with spacial distribution of chemical elements. Surface sensitive techniques Auger electron spectroscopy and X-ray photoelectron spectroscopy (AES and XPS) was used for characterization for detailed surface analysis inside of pores and for chemical species that occur.
Key words: AlSi12 alloy, aluminium foam, AES, XPS, SEM/EDS

DO WE NEED TO SEE ATOMS?

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In the lecture the need for imaging and chemical composition determination at atomic level in the research and development of advanced materials will be explained and discussed. The basics, evolution and techniques of Cs corrected transmission electron microscopy will be reviewed. The new state-of-the-art atomic resolution scanning transmission electron microscope (AR-STEM) which is conjointly run by the Centre of Excellence for Low Carbon Technologies (CONOT) and the National Institute of Chemistry (NIC) will be presented.

The microscope enables atom-by-atom imaging resolution and spatial resolution for atom-to-atom chemical mapping of materials. The system is equipped with the new energy-dispersive X-ray spectrometer for fast elemental mapping and with the energy filter for electron energy-loss spectroscopy with dual-EELS capability, energy-filtered TEM (EFTEM) mapping and ultrafast spectrum imaging (SI).

The range of the materials that could be analysed is very wide, from material science where nanopartciles, crystal defects, interfaces and surface phenomena will be studied to life science with cryo-electron microscopy, single particle analysis and EM reconstruction.

In the talk the first results from the AR-STEM will be displayed and discussed.

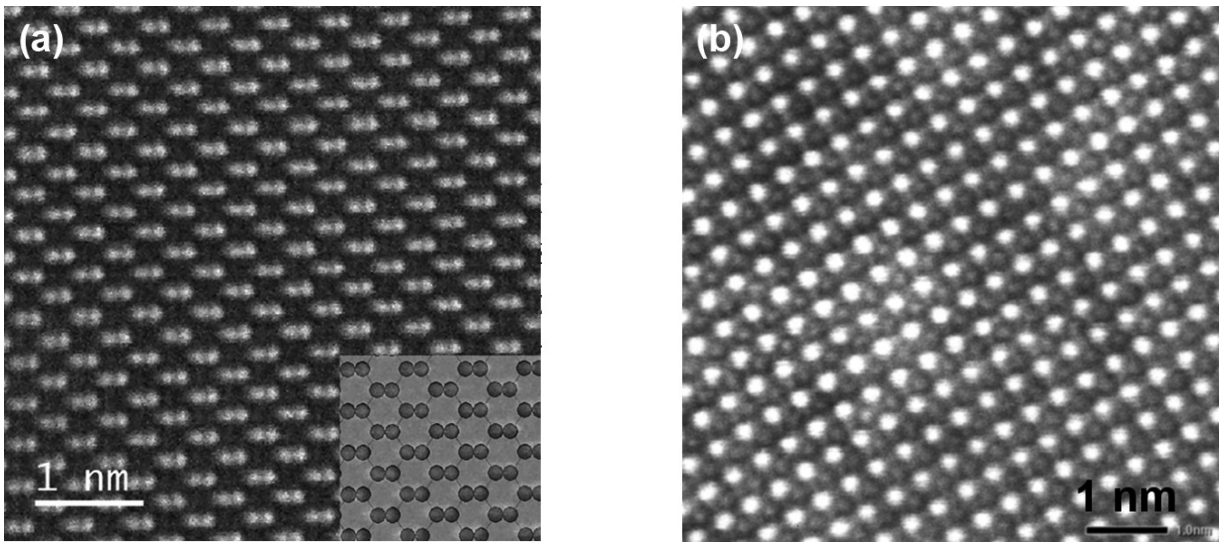

Figure 2: Testing the resolution, a - dumbbells of silicon atoms in monocrystalline Si in [110] zone axis. The inset is the position of the atoms inside the model structure of Fd-3m silicon, b – HAADF (Z-contrast) micrograph of KTaO3 in [100] zone. Spots with higher contrasts are mixed Ta/O (1:1) atom columns and spots with darker contrast are K columns.

DEEP CRYOGENIC TREATMENT OF H11 HOT WORKING TOOL STEEL

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Unlike conventional cold treatment, which is commonly used for elimination of retained austenite, deep cryogenic treatment (DCT) primarily improves the wear resistance of tools. This effect is supposed to result from preferential precipitation of fine ç-carbides whose formation mechanism is the subject of several recent investigations performed mainly on high speed steels. The article describes the influence of DCT on the microstructure and properties of X37CrMoV5-1 (H11) hot working tool steel. Specimens were treated using both DCT and conventional hardening procedure. In order to investigate the process parameters of DCT more in detail several holding times were applied on the cryogenic temperature of –160 °C. The specimens' properties were analysed using pin-on-disc hot wear test and transmission electron microscopy. The conditions of the hot wear test (temperature, specific surface pressure) were set according to the work loading of forging dies which are standardly made from the investigated steel. Furthermore, tempering diagrams for DCT of the investigated steel were compiled.

The test results have shown that deep cryogenic treatment of the X37CrMoV5-1 (H11) steel dramatically improves its resistance to wear at high temperatures (as determined by the pin-on-disc test). However, the length of the holding time at the temperature of deep cryogenic treatment is crucial. The optimum time appears to be approx. 6 hours. Microstructure observation in an optical microscope did not reveal any substantial differences between specimens hardened in the conventional manner and the specimens upon deep cryogenic treatment. On the other hand, the analysis of specimens upon deep cryogenic treatment by means of transmission electron microscopy found two types of substructure which are likely to facilitate the precipitation of fine carbides during final tempering of the steel. To this date, the impact of longer holding times at the deep cryogenic temperature on this substructure has not been analysed. The cause of the decline in the wear resistance with extending holding time thus cannot be determined.

FATIGUE LIFE ENHANCEMENT OF METAL SHEETS MADE OF 34CrNiMo6 STEEL

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Currently available and well known materials treated by special procedures can provide superior properties in the comparison to presently obtained ones. Special treatment procedures are efficiently developed with the use of physical simulators nowadays. Physical simulators allow treatment optimization on small scale laboratory samples which can be subsequently transferred to real production processes later on. Nevertheless, there is always need of successful transfer from small scale laboratory experiments to real production of for example metal sheets.

In the current paper previously developed thermo-mechanical procedures[1,2] for 34CrNiMo6 steel under laboratory conditions are applied to metal sheets production. There were obtained very promising properties on the bulk material samples processed in the physical simulator, the challenge was to obtain similar properties on a real metal sheets by transfer of laboratory procedure to metal sheet production process.

There were applied several previously developed thermomechanical procedures to metal sheets production. Sheets exhibit very good combination of the tensile strength exceeding 1500 MPa and elongation reaching 10%. The fatigue strength was investigated for all considered states and comparison of the materials treated by various thermomechanical procedures is carried out.

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PRESSURE – INDUCED PHASE TRANSFORMATION OF InN: AN AB INITIO CONSTANT PRESSURE STUDY

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InN and related group-III nitride alloys are currently being the object of intense investigation because of their potential applications in optoelectronics, photovoltaics, and highfrequency electronics[1]. The application of high pressures is a powerful tool for the study of the structural properties of these alloys. The structural behaviors of InN are sensitive to external conditions and this material undergoes a number of phase changes as a function of pressure. Theoretical and experimental studies have shown that InN undergoes a phase transition to the rocksalt structure at high pressure[2-4]. However, in spite of much research on the fundamental properties and device applications of InN, relatively little is known about the pressure behavior of this compound and there is some uncertainty about the transition pressure.

We study the pressure induced phase transition of InN using a constant pressure ab initio technique and predict the structural phase transformation from the wurtzite structure to a rocksalt type structure with the application of hydrostatic pressure. We also propose two intermediate phases for the wurtzite to rocksalt type phase transformation of InN. The transition pressure is predicted and we find a new transition pressure, which is different from the previously proposed transition-pressures.

Furthermore, we study this phase transition using the total energy calculations, and the lattice constants, the bulk modulus, the pressure derivative of the bulk modulus, and equilibrium energies are obtained for both low and high pressure phases. Our predicted transition parameters and bulk properties are in good agreement with the previous first principle calculations.

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JOINING AND INTEGRATION OF ADVANCED MATERIALS

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Ceramic Matrix Composites (CMC), i.e. SiC/SiC, C/SiC and C/C, are being considered the primary candidates for components and subsystems in the field of satellite (sun-near) missions, defence aerospace and aircraft missions (e.g. nose cones, wings, leading edges, turbine components) and for terrestrial/industrial applications under extreme environmental conditions (e.g. valves, shaft sleeves for pump sliding bearings, etc.). Furthermore, search for new materials for hot structure elements in nuclear reactor technology has triggered development programs for SiC-fibre reinforced SiC materials. The use of glass-ceramics as joining materials in a neutron environment will be briefly discussed.
A critical issue for a wider use of CMC is the development of easy, user-friendly joining methods to assemble large SiC/SiC components into more complex structures, and also to repair damaged parts after missions.
Some pressure-less joining techniques and joining materials for CMC will be described: results obtained by using glass ceramics, modification of a commercial adhesive and W/SiC based joining materials will be discussed.
The mechanical characterization of the joints will be also discussed.

ASSESSMENT OF POST IMPACT DAMAGE PROPAGATION IN CARBON-FIBRE COMPOSITE UNDER CYCLIC LOADING

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Carbon fibre in polyphenylene sulfide composites (C/PPS) became popular material in aircraft industry but its fragility and low impact resistance limits application of these composites in aircraft primary structures[1,2]. This study is focused on damage propagation in laminated composites reinforced by carbon fibres. The damage may be inflicted during the ground maintenance, by inflight bird strike or during flight severe meteorological conditions (hail storm). Initial damage (stitching and unstitching of the laminates) was prescibed by drop-weight out-of-plane impact damage[3]. Damage response was analysed from the impacted zones propagation history. Influenced zones area and specimen thickness in the centers of influenced zones were chosen as degradation parameters. Post impact damage propagation induced by cyclic loading was assessed using custom-made computer controlled laser profilometery device. Both upper and lower profile of the specimen were scanned during interruptions of fatigue test. Global specimen deformation was described by analytically determined centroidal axis curve. Local topography changes ware obtained by subtraction of this curve. Surface deformation maps ware created and used for demonstration of damage propagation in the specimen.
The research has been supported by Grant Agency of the Czech Technical University in Prague (grant No. SGS12/205/OHK2/3T/16), research plan of the Ministry of Education, Youth and Sports MSM6840770043 and by RVO: 68378297.

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GROWTH OF AlN BY REACTIVE GAS INJECTION OF NITROGEN IN AN AlMg MATRIX

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The primary objective of the present research was to provide a fundamental understanding of the processing science necessary to fabricate the Aluminum Nitride (AIN) reinforced Aluminum-Magnesium (AIMg) composites via Reactive Gas (N_2) Injection in the AIMg alloy melt. Aluminum nitride (AlN) matrix composites were prepared by a novel approach. It was possible to produce a considerable amount of AIN particles in the AI alloy matrix at a reaction temperature as low as 900 °C utilizing the "in-situ" nitration reaction process developed in the present study. The temperature of nitridation was found to play an important role in the formation of AlN particles. The volume fraction of AIN increases almost linearly with increasing the magnesium (Mg) content in the alloy and the reaction time. The shapes of AIN particles were found to have different forms, whose sizes were in the range from submicron to a few microns. From the present study, it is concluded that the new innovative "in-situ" nitridation process developed in the present study can be successfully applied for processing of high strength AIMg/AIN composites. For particles and composite structure characterization some methods were used, including: light microscopy, scanning microscopy, quantitative analysis of selected composite regions, dilatometry and pin on disc friction. Composite structure and reinforcement distribution was compared with use of quantitative analysis. Morphology and diffraction pattern of aluminum nitride particles was shown. Typical structure of studied composites with microanalysis results was indicated. Aluminum nitride dispersion change was represented. In previous investigations[1,2], AlN synthesis and its growth mechanism through the reactive gas injection of nitrogen (RGI) gas have been studied and it was found that increasing the magnesium content an enhancement of the conversion level has been obtained.

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MODELING PREDICTION OF QUALITY FOR THE PRODUCTION OF CONTINUOUSLY CAST SLABS

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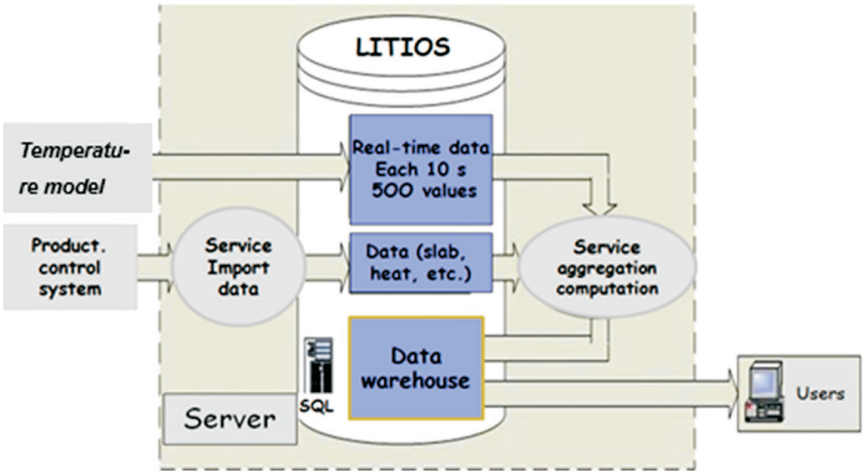
The paper summarizes the basic analytical and empirical findings from analysis of dependences of the influence of thermal processes continuous casting machine for steel (hereinafter CCM) on quality of slabs, and thus also the influence of thermal processes on the quality of final products rolled from slabs, mainly steel sheets. The course of thermal processes at continuous steel casting has a principal influence on the quality of slabs and thus also on the entire economics of production in the steel works, as well as in the whole metallurgical plant.

The article describes the proposal of the concept of efficient storage of data of temperature model into data warehouse and of their use both for operational control of production and for statistic evaluation of long-dated data, quality optimization and prediction. Such approach requires creation of super-structural software for standard information system of the steel shop. The original software system LITIOS (see Fig.), which was developed and implemented on CCM, can serve as an example of such software. This proprietary software gives to technologists on the slab CCM a possibility not only to analyze the history of casting, but also to perform long-term monitoring of production and modeling prediction of quality.



Practical part of the paper presents analysis of mathematical or statistical methods for the assessment of slab casting process, which enable also prediction of slab quality. This analysis is substantiated by statistical data analysis of concrete data.

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Ta_2O_5-RICH THIN FILMS FOR TRANSPARENT ELECTRONIC DEVICES

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Transparent electronics aims towards the realization of fully transparent devices, and thus it requires the low cost deposition of semiconducting or dielectric thin films with suitable properties onto substrates requiring low temperature processing, as glass or even plastic.

Ta_2O_5 is a high-*K* dielectric known to exhibit high relative permittivity, good thermal and chemical stability, yet high leakage currents. To improve its electrical properties, amorphous multicomponent dielectrics, resulting from mixing Ta_2O_5 and low *K* oxides may be considered.

The present study aims at the preparation of solution-derived Ta_2O_5-based high-*K* dielectric thin films suitable for transparent electronic devices. Amorphous thin films of the ternary composition Ta_2O_5 – Al_2O_3 – SiO_2 with the Ta:Al:Si = 8:1:1 atomic ratio were prepared by sol-gel synthesis and processed at temperatures not exceeding 400 °C. As reference, also pure Ta_2O_5 samples were prepared.

Samples deposited on platinized silicon substrates were characterized from the structural and electrical point of view. The Ta_2O_5 film heated at 400 °C exhibited the highest permittivity of about 27. The films of mixed ternary composition showed lower dielectric permittivity values, yet considerably improved leakage characteristics. Also similar samples deposited onto Corning Eagle XG glass substrates exhibited high optical transparency in the visible range.

The Ta_2O_5-based thin films exhibited promising properties both for transparent capacitors and thin-film transistors. Thin films deposited on ITO covered glass exhibited very smooth surfaces. The samples showed optical transmittance larger than 65% in the visible range. For the Ta_2O_5 capacitor a permittivity value of about 22 was measured.

Acknowledgement
We acknowledge the financial support of the Slovenian Research Agency (Young researcher programme, contract number: 1000-10-310134; and projects: J2-4173, P2-0105), and of the EU7FP Project “ORAMA”, Grant Agreement NMP3-LA-2010-246334.

BIOACTIVE GLASS REINFORCEMENT OF 3D GELLAN GUM SCAFFOLDING MATERIAL

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Ostochondral damage in the knee joints, which can results from trauma or disease, presents one of the great problems in modern medicine as the cartilage tissue lacks the ability for complete self-repair through native healing mechanism. Currently, most common treatment of advance osteoarthritis is joint replacement, using metal, ceramic and/or plastic prosthesis, which in increasing number of cases shows the need for revision surgery. One of the promising ways to overcome the metal-ion leaching into the body or prosthesis fail is the rapidly evolving field of the tissue engineering. It holds a great promise to provide new generation of functional and biodegradable materials with appropriate architecture to promote self-regeneration of cartilage-subchondral bone tissue. To mimic the structure of ostochondral tissue layer-by-layer 3D biopolymer (gellan gum) scaffold reinforced with bioinorganics (bioactive glass) is proposed. Both of the selected materials are biodegradable and non-toxic. Gellan gum (GG) presents a novelty in the field of regenerative medicine, however its lack of tissue mineralization ability and low mechanical properties, narrow the range of GG applications. To extend the application field to suchondral or any other bone, nano-sized bioactive glass (BAG) particles were used to increase osteogenic potential and vascularization of the 3D construct.

The nano-sized BAG particles were synthetized by sol-gel procedure. Two different BAG compositions were prepared and studied as reinforcement in the GG in different percentage. Taking advantage of ionic cross-linking mechanisms 3D stable structures of GG were obtained and analyzed. The morphology of the composite material was observed by scanning electron microscopy (SEM) and micro-CT. Also the mechanical properties, degradation rate and the bioactivity were examined. To understand the chemistry behind the composite material EDS and FT-IR analyses were performed. SEM observations of the GG-BAG composite material revealed BAG particles embedded into the polymer matrix, resulting in high porosity and pore size ~200μm, which was also confirmed with micro-CT. The 3D scan also showed the uniform porosity with interconnected pores. The observed microstructure reflected in improved mechanical properties, where composite materials exhibited the Young's modulus ~2 MPa. After the SBF immersion the composite was completely covered with hydroxyapatite, suggesting improved bioactivity of the composite material. In vitro cell test resulted in improved cell attachment and good cell proliferation, which can be a result of smaller and interconnected pores when comparing to the GG.

With addition of BAG to the biopolymer matrix, crucial characteristics for scaffold's success were achieved and the possibility of GG application was expanded, not only to ostochondral but also bone defect regeneration.

IMPACT OF A THIN CHROMIUM FILM EVOLUTION ON THE DAMPING OF A SILICA RESONATOR

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The main interest of this work is to identify what are the leading structural and compositional factors of a thin chromium film implying the variation of the damping of a low mechanical loss material after annealing.

A test bench has been developed in order to measure low-mechanical loss material. The bench uses a Laser Doppler Vibrometer (LDV), allowing a damping measurement without mass-loading the samples, which could have modified the intrinsic damping of the material. In the same time, samples synthetic a-silica made have been realized, due to the extremely low mechanical loss factor of this material [1]. The geometry of the samples avoids any prehension mechanical loss.

Thin chromium films were deposited on the a-silica surface by pulsed DC magnetron sputtering with a thickness of about 50 nm. The coated samples are vacuum (10^{-3} Pa)-annealed at 210°C for 96 hours.

In normalized damping unity, the damping falls down from 1 to 0.4 with the annealing. In the same normalization, the resonator before coating had a damping of 0.12. This shows the important impact of an only 50 nm chromium film and its structural and/or composition evolution on the damping behavior of a low mechanical loss material. It has to be kept in mind that the interface Cr/SiO_2 could also have a role in these damping evolutions. Annealing and damping measurements on non-coated samples are realized in order to isolate the coating effects.

Using X-ray photoelectron Spectroscopy (XPS) and low-angle X-Ray Diffraction (low-angle XRD), the structure and composition of the thin chromium film is analyzed with the annealing time. The evolutions detected will allow us to better understand the influence of the chromium thin film evolution on the damping of low mechanical loss material.

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POLYPYRROLE AND POLY(3,4-ETHILENEDIOXYTHIOPHENE) COMPOSITES WITH CARBON NANOTUBES FOR IONIC LIQUID BASED SUPERCAPACITORS

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Over the long time different batteries were the main energy storage devices. However in the last 15-20 years double layer supercapacitors began to attract great attention due to their greater power dencity, greater service life, high coefficient of efficiency, less charge-discharge time and a large number of charge-discharge cycles. But such devices are losing batteries in energy storage density and output voltage. For these reasons, new matherials for supercapacitors electrodes are currently being developed to make such devices more efficient. For this purpose various composites based on carbon materials (carbon nanotubes, graphene, activated carbons, carbon black) with various electroactive conducting polymers are very promising due to their high electrical conductivity and presence of pseudocapacity.

The purposes of this work were synthesys and investigation of CNT\polypyrrole and CNT\PEDOT composite matherials. Matherials were obtained from the following method: TBAP (Tetrabutylammonium perchlorate) or TBAT (Tetrabutylammonium tetrafluoroborate) were used as supporting electrolite dissolved in acetonitrile containing 2% of water. Then various weights of oxidized carbon nanotubes were dispersed in this solution by ultrasonication. After that the monomer (0.1 M) was added to solution and stirred for 15 minutes. Polymerisation was performed by galvanostatic method with a current density 3mA/cm^2 on tantalum (for polypyrrole composites) or “graphlex” electrodes (for PEDOT composites).

Obtained composites were characterised by SEM, TEM and elemental CHNS/O analysis. Then these composites and their mixtures with nanographite were used to prepare the supercapacitor electordes and investigated by cyclic potential sweep method with acetonitrile solution of ionic liquid EmimBF$_4$ (1-ethyl-3-methylimidazolium tetrafluoroborate) as electrolite.

According the results of CV the capacitance values of used matherials were calculated. The best characteristics were obtained from electrodes made of the mixture of CNT\Polypyrrole composite with nanographite containing 50% of nanographite, 6.5% of CNTs and 43.5% of polypyrrole. The capacity of that matherial in acetonitrile-EmimBF$_4$ solution as electrolite was about 70 F/g for the weight of 2 electrodes in symmetric capacitor. Also, the capacity dependence of the polymer/CNT composites from CNT content was investigated.

MICROSTRUCTURAL COMPARISON OF THERMOMECHANICALLY TREATED AND COLD DEFORMED Nb-MICROALLOYED TRIP STEEL

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Advanced high strength steel (AHSS) grades for the automotive industry offer the beneficial combination of high strength, ductility and technological formability which enables production of responsible automobile components of lower weight. Their development in the last decade focuses mainly on multiphase steels consisting of ferrite, bainite, martensite and retained austenite. A special interest is devoted to DP (Dual Phase) and TRIP (Transformation Induced Plasticity) steels [1-3]. TRIP phenomenon is related to the increase of steel plasticity due to strain-induced martensitic transformation of retained austenite during cold working.

The present work concerns the microstructural comparison of the Nb-microalloyed Si-Al-type TRIP steel under conditions of thermomechanical treatment and subsequent cold working. The steel sheet specimens were produced by laboratory thermomechanical rolling and controlled cooling under conditions allowing to obtain a very fine-grained ferritic-bainitic microstructure with a large fraction of retained austenite (Fig. 1a). The test samples were subsequently subjected to 10% uniaxial tension. The identification of morphological details of structural constituents including strain-induced martensite (Fig. 1b) was carried out using light microscopy, electron microscopy and scanning microscopy equipped with EBSD.

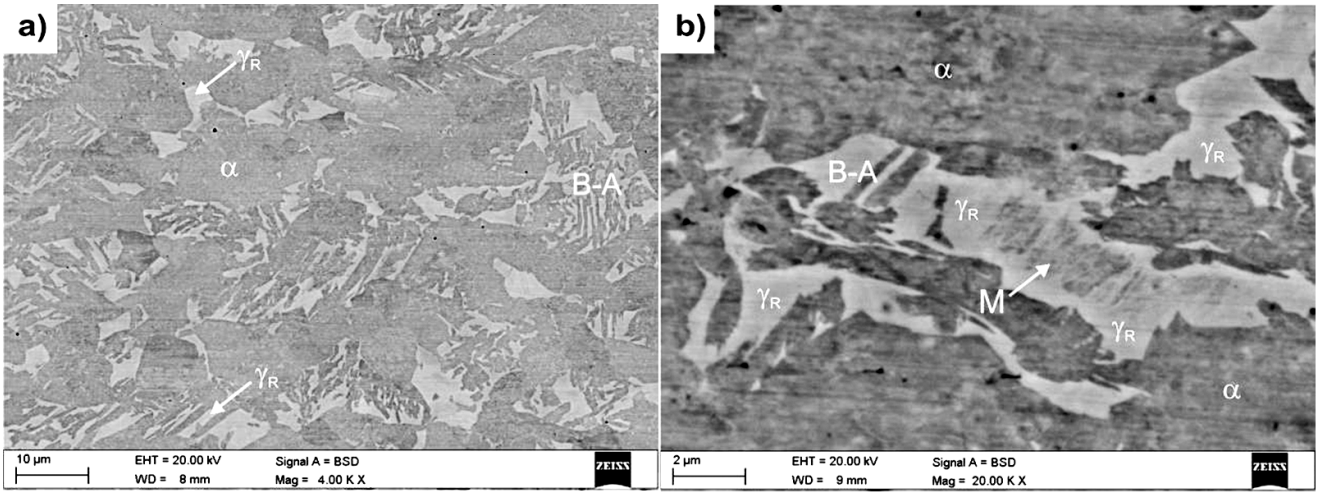

Fig. 1. Microstructure of the thermomechanically treated (a) and cold deformed (b) Nb-microalloyed Si-Al steel

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OPTICAL AND ELECTRICAL PROPERTIES OF DOPED VARIABLE BAND GAP SiN_x:H

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The aim of this work was to deposit various band gap silicon nitride (SiN_x:H) samples and investigate the influence of doping impurities on the optical and electrical properties. Silicon nitride thin films were grown on CaF_2 and c-Si substrates by the remote plasma-enhanced chemical vapour deposition (PECVD) method at various silane (5% SiH_4 + 95% Ar) and nitrogen (N_2) partial pressure ratios in order to shift optical band gap. The chemical composition of the layers have been investigated using FTIR measurements and the photoluminescence spectra have been measured. An electric features of layers before and after doping have been examined using time-of-flight (TOF) and charge extraction by linearly increasing voltage (photo-CELIV) current transient techniques.

POSSIBILITIES OF EXPERIMENTAL STUDY OF SOLIDIFICATION PROCESS ON LARGE STEEL SAMPLES

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Correct setting of parameters for steel making control during its refining [1,2] and finally casting [3,4] and solidification is the most important for production of steel with high quality. It is very important to verify the thermo-dynamical steel properties like high temperature phase transformations (especially temperatures of liquidus and solidus) and thermal capacity [5,6].

The Laboratory for Modelling of Processes in the Liquid and Solid Phases built during solving the project RMSTC starts applied research within new project TACR TA03011277 devoted to the optimization of round billets continuous casting. It is necessary to quantify high temperature thermo-dynamical properties of real plant steel grades for correct setting of numerical simulations and control of casting process itself.

Apart from standard tools like thermo-dynamical databases (CompuTherm, Thermo-Calc, Dictra) and three modern devices for thermal analysis (SETARAM SETSYS 18^{TM}, SETARAM MHTC 96, NETYSCH STA F3 JUPITER), the Laboratory received new unique high temperature resistance furnace specially constructed for physical modelling of solidification processes of steel. The experimental works are focused on segregation processes, structures and also direct thermal analysis of large real steel samples (more than 5 kg mass). The aim is to get as close as possible to real plant conditions from the viewpoint of heterogeneity structure and other parameters setting for real steel during its solidification. The process and the results of initial experiments focused on the tubular steel grades continuously cast into a round format in conditions of ArcelorMittal Ostrava company are then included in this paper.

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HYBRID SOL-GEL COATINGS DOPED WITH CERIUM FOR CORROSION PROTECTION OF MAGNESIUM ALLOYS

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With a density equivalent to 2/3 of that of aluminium, magnesium and its alloys are interesting weight-saving materials for the automotive and aeronautics industries. However, compared to steel and aluminium alloys, magnesium alloys have a very low corrosion resistance. In order to prevent this, many surface treatments and coatings have been developed by different techniques . However, most of these processes make use of chromium (Cr VI) compounds, nowadays forbidden by the international regulations since these are classified as carcinogen, mutagenic and reprotoxic compounds. The sol-gel route is an efficient method to produce "green" coatings, and their anticorrosion performances have been proved on steel and aluminium alloys . The aim of this work is the evaluation of the anticorrosive properties of a hybrid coating obtained by sol-gel route and deposited on a cast Elektron21 magnesium alloy (El21) and the identification of its mechanisms. The sol consists of tetraethyl-orthosilicate (TEOS) and 3-(trimethoxysilyl)propylmethacrylate (MAP) in which corrosion inhibitors were added. The influence of the cerium nitrate on the corrosion properties of the hybrid coating is presented. The morphology of the organic/inorganic coatings deposited on the magnesium alloy was determined by scanning electron microscopy (SEM). In parallel, the electrochemical behavior during immersion in a 0.05M NaCl corrosive solution was studied by electrochemical impedance spectroscopy (EIS). It is shown that the hybrid films exhibit a high impedance modulus during the first hours of immersion and the addition of cerium into the sol at a concentration of 0.01M considerably increases the durability of the film delaying the degradation of the resistance during the immersion. A key point is the determination of a critical concentration in cerium salt at which the impedance modulus of the hybrid coating strongly decreases during the immersion.

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ACCELERATED CARBIDE SPHEROIDISATION AND REFINEMENT (ASR) OF C45 STEEL DURING CONTROLLED ROLLING

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Current industry trends include the search for cost and energy-saving procedures and technologies. A new phenomenon has been discovered recently, which allows ferrite grain to be refined significantly and carbides to be spheroidised over many times shorter period when compared to conventional heat treatment techniques. This newly-developed ASR-based (Accelerated Spheroidisation and Refinement) process utilises plastic deformation introduced in the course of heat treatment in the vicinity of A_1 temperature.

Controlled rolling enables production materials with fine microstructure and better mechanical properties than conventional production process. Accelerated Carbide Spheroidisation and Refinement (ASR) aim is to produce steel workpiece with microstructure consisting of fine-grained ferritic matrix and globular carbides. Considering carbon steels, this microstructure has higher yield strength and toughness than conventional ferritic-pearlitic microstructure.

Presented paper describes effect of ASR process applied to structural C45 steel. Pearlite morphology can be influenced by forming at temperatures around critical temperature A_1. Carbide spheroidisation is accelerated by plastic deformation. The deformation leads to high dislocation density and thus enhances diffusion. Cementitic globules form rapidly in seconds or maximally minutes.

Semi products were heated up to common forming temperature and then formed at common temperature. The rolling ended at temperature around transformation temperature A_1. Thermomechanical treatment was carried out on the rolling mill. The processing time is very short when compared to conventional heat treatment techniques taking several hours. This offers potential for achieving desired mechanical properties with time and energy savings.

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INFLUENCE OF IMPACT ANGLE AND PRESSURE ON SPRAY COOLING OF VERTICALLY MOVING HOT STEEL SURFACES

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Cooling of vertically moving strips is used very often during the heat treatment. Water spray cooling has to be used when the high cooling intensity is needed. The water impacting on the strip surface is reflected and falls down between water nozzles and strip surface. This falling water has a significant influence on cooling intensity and also on cooling homogeneity. It causes undesirable problems with strip deformation and controllability of cooling. A water knife is used to reflect falling water out from the area between strip surface and water nozzles.

Heat Transfer and Fluid Flow Laboratory is equipped with testing device which allows vertical movement of a heated experimental plate (sheet). Three different size of flat jet nozzles were tested with different water pressure (water flow rate) and angle of water impact (inclination angle of spraying bar). Water pressure range was between 2 and 8 bar and angle of water impact was changing from 20 to 40°.

Dependence of heat transfer coefficient on surface temperature was evaluated for each experiment. Interesting results were obtained from comparison of these experiments results and showed that water pressure (flow rate) and also water impact angle has significant influence on the cooling intensity.

THE INFLUENCE OF SURFACE PROPERTIES ON THE ADHESION OF BACTERIA TO UNCOATED AND SILVER COATED STAINLESS STEEL

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Microbial adhesion on stainless steel causes healthcare problems in food and medical industries due to the contamination of food products and medical equipment. It is well known that substrate surface properties play important role in adhesion process and thus it is very important to determine their influence. Silver (Ag) has long been known to have strong inhibitory and antimicrobial properties. The influence of austenitic stainless steel (AISI 316 L) on the adhesion of *Escherichia coli* from suspension was investigated and compared to stainless steel coated with thin Ag films.

Atomic force microscopy (AFM), scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS) and contact angle goniometer were used to analyse and describe the surface properties (roughness, topography, chemistry and energy). Six stainless steel (SS) samples with different surface finishes (mechanical wet polishing) were prepared and coated with Ag thin films. SS and Ag coated SS samples correspond to different topography and roughness values (R_a) ranging from 0.4 μm to 0.002 μm, with significant differences in surface chemistry and energy.

Bacterial attachment assay showed that the minimum adhesion on SS samples occurs at R_a 0.08 μm, attachment to both smoother and rougher surfaces was higher. Similar results with minimum adhesion at R_a 0.04 μm was also observed for Ag coated SS samples. In general the adhesion to Ag SS is slightly lower compared to bare SS. On rougher surfaces (SS and Ag SS) bacteria attach to surface irregularities especially when they correspond to bacterial size, whereas on smoother surfaces without any observable topography they are more evenly distributed across the surfaces and often aggregates of cells are found. The results are suggesting that adhesion of *E. coli* is not related only to roughness but also depends on the surface topographical features. The addition of Ag thin film reduced adhesion to stainless steel.

NANOPORES: FABRICTION AND CHARACTERIZATION

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Nanopore devices constitute a powerful and versatile answer to the rising and urgent demand for innovative solutions. A precise control of size and functionality of such devices allows reaching single molecule manipulation [1]. Nanopores fabricated on solid-state membranes, thanks to their extremely reduced size, have been effectively used as high sensitivity sensors for the detection of small molecules of biomedical interest, such as DNA, mi-RNA. Recently solid state nanopores devices have been used in order to generate gas flows in the molecular regime from the high vacuum to atmospheric pressure [2]. Solid-state nanopores are generally made in silicon compound membranes, one of the most commonly used is the silicon nitride. Solid-state nanopores can be manufactured with several techniques including ion-beam sculpting and electron beams. Here we present the fabrication and the characterization of solid state nanopores. The nanopores have been manufactured by milling a silicon nitride membrane by means of the Focus Ion Beam (FIB), and their shape has been characterized by Scanning Transmission Electron Microscopy (STEM), Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM). Because of the capability of the AFM to acquire surface three-dimensional images with very high resolution, it is a very useful tool to perform a precise topographic characterization of the nanopores.

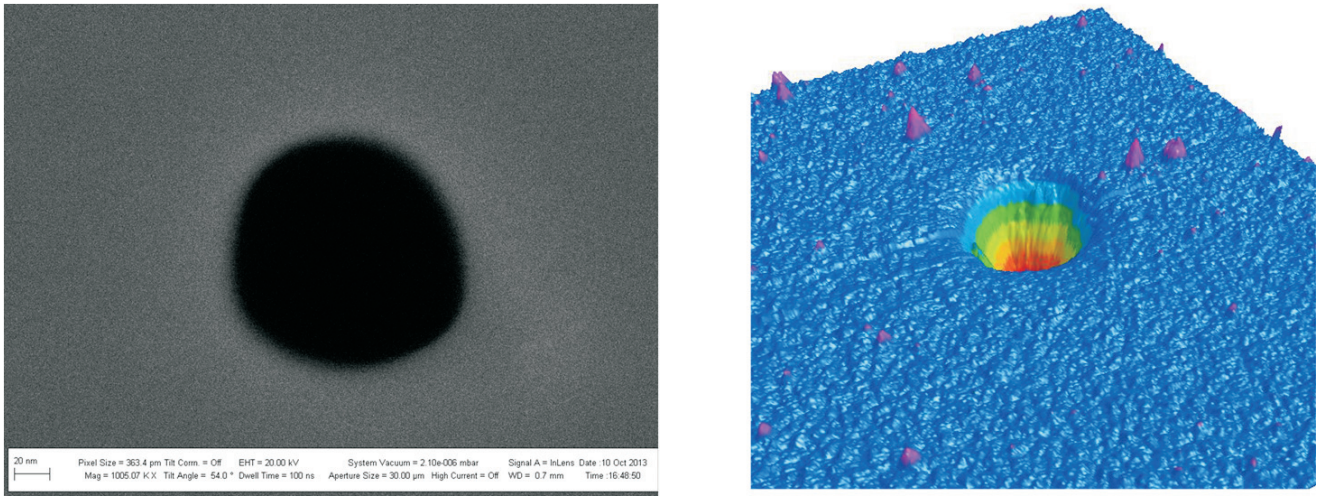

Figure 1: SEM and 3D-AFM nanopore images.

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A COMPARISION OF COMMERCIAL AND COPRECIPITATED OF Al_2O_3-20 wt.% ZrO_2 PLASMA SPRAYED COATINGS

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The aim of this study is to characterize plasma sprayed coating using coprecipitated Al_2O_3-20wt.% ZrO_2 powders with commercial Al_2O_3-20wt.% ZrO_2 (8 mol% Y_2O_3) powders. Alumina-20wt.%zirconia powders were synthesized by the coprecipitation method from $Al_2(SO_4)_3$ and $Zr(SO_4)_2$ salts and were not included stabilized component. In powder mixture, aluminum sulfate salt was first dissolved in hot distilled water and it was cooled down to room temperature. Then aqueous zirconium sulfate salt was added into cooled aluminum salt solution with continuous stirring. For precipitation, the pH of solution was adjusted to 10 with addition of NH4OH. Precipitate was calcinated at 1300°C for 1 h after drying at 80°C for 72 h. Then, calcinated powders were ball milled for 24 h. Furthermore, for a comparison commercial alumina and 8wt.% Y_2O_3 stabilized ZrO_2 powders are mixed by conventionally ball milling for 2 h. The morphology of powders and coatings were examined by means of SEM and phase analyses were performed by XRD instrument. Alumina and zirconia regions are not clear (Figure 1a) and the distribution of zirconia was more homogeneous in the plasma sprayed coating obtained from coprecipitated powders according to the other coating obtained from commercial powders and as mentioned in the open literature [1-3].

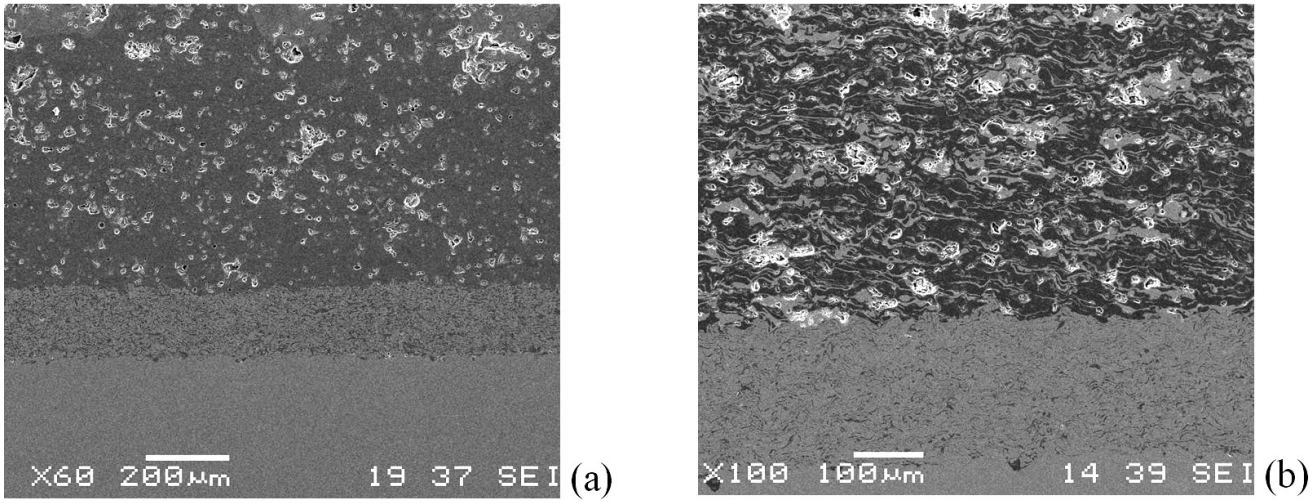

Figure 1. SEM micrograph of alumina-wt%30 zirconia coating with a) coprecipitated and b) commercial powders

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PROPERTIES OF ALUMINIUM-CLADED STEELS FOR HOT FORMING

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High-strength steel sheets are used more and more for automotive parts in recent years to reduce the weight of an automobile to improve environmental problems and collision reliability. Many automotive body sheets can be made significantly lighter by using high-strength steel sheets and reducing their thicknesses. When the strength of a steel sheet increases, its formability decreases, and to solve this problem, various types of high-strength steel sheet products with controlled microstructures and metallic overlays have been developed. This paper reports the results of the properties and characteristics that are required of both of coated and uncoated DP600 steel sheet products for cladding and hot forming properties.
Keywords: High-strength steel sheets, Cladding, Hot forming

CHARACTERIZATION OF METAL NANOPARTICLES SYNTHESIZED BY ULTRASONIC SPRAY PYROLYSIS BY MEANS OF TRANSMISSION ELECTRON MICROSCOPY

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Metal nanoparticles (NPs) of typical dimensions ranging from 1 nm to 100 nm are similar to cellular objects and because of their high stability, biological compatibility, controllable morphology and size dispersion, and easy surface functionalization, they are of high interest. Ultrasonic Spray Pyrolysis (USP), which is a simple aerosol synthetic technique, enables synthesis of metal NPs of various sizes and shapes, including nanoparticles contaminated with metals from alloys[1-3].

Chemically dissolved metal (Ag as $AgNO_3$, Au as $HAuCl_4$ or Ni as $NiCl_2$) and ortotitanate ($Ti(OC_4H_9)_4$) were used as a precursor for the synthesis of metal-TiO_2 NPs by means of USP, using an ultrasonic atomizer. A water solution of $AgNO_3$, $HAuCl_4$ or $NiCl_2$ and $Ti(OC_4H_9)_4$ was used for the aerosol production. The solution was then passed over to the ultrasonic atomizer at 2.5 MHz. The aerosol produced was transported by nitrogen (or nitrogen/hydrogen) gas into a wall heated reactor, where the aerosol droplets underwent evaporation, droplet shrinkage, solution precipitation, thermolysis, and sintering to form nanoparticles. Thermal decomposition of the resulting solution was performed at 800 °C. NPs were collected in two washing bottles.

The study focused on the Transmission Electron Microscopy (TEM) analysis of Ag-TiO_2, Au-TiO_2 and Ni-TiO_2 nanoparticles synthesized by means of USP: their size, shape, and morphology, which are associated with the key parameters of growth.

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OXIDATION OF Ni 50.74 at% Ti ALLOY

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A group of nearly equiatomic NiTi alloys are often used in medical applications due to their special functional and mechanical properties (shape memory effect and super elasticity). Because of high Ni content the possibility of Ni being released into the human body, needs to be considered as Ni can cause severe problems. The results of our previous studies showed that bare NiTi alloy is covered by thin oxide film so cold natural oxide film, approximately 5 nm thick, the mixture of TiO_2 and NiOx traces with some nanocrystaline grains of elemental N inhomogeneously distributed in the subsurface region. The oxidation of Ti to TiO_2 on the surface of NiTi is a promising method to decrease the Ni release significantly. This can be achieved by controlled oxidation process.

We have studied the oxidation of Ni 50.74 at% Ti alloy in different oxidation environment, in vacuum 10^{-6} mbar at the temperatures 400 °C, 450 °C and 500 °C, in air and in wet hydrogen. The kinetics of oxidation at constant temperature of 500 °C from 10 to 90 minutes in air was studied also.

The oxide layers were analysed by Auger electron spectroscopy (AES), x-ray photoelectron spectroscopy (XPS) and time of flight secondary ion mass spectroscopy (TOF-SIMS).

The effect of natural oxide film on the further oxidation was studied in situ in AES spectrometer in UHV in the temperature range from 200 to 800 °C by Linear Heating Method (LHM).

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MOLTEN SALT SYNTHESIS OF Nb doped $Sr_3Ti_2O_7$ PLATELET SEEDS

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Nb-doped $SrTiO_3$ and other members of the $SrO\text{-}TiO_2$ phase system, eg. Sr_2TiO_4, $Sr_3Ti_2O_7$ (also known as the Ruddelsden Popper phases[1]) are promising candidates for n-type thermoelectric high-temperature thermoelectric materials. Although their figure of merit (ZT) of 0,37 is one of the highest among high-temperature oxides[2], it still needs to be improved for practical use. The main drawback of these materials is their high thermal conductivity. However, thermal conductivity could be lowered by processing textured microstructure containing more or less ordered planar faults with a rock salt type structure. It is expected that the presence of such faults in textured microstructure will increase phonon scattering and consequently lower the thermal conductivity of these materials.

In view of this, our present work is focused on producing textured Nb-doped strontium titanates by addition of pure and Nb doped $Sr_3Ti_2O_7$ platelet seeds, obtained by the molten salt synthesis (MSS). There are several reports on MSS of pure and $Sr_3Ti_2O_7$[2,4,5] platelets, but none on the MSS of doped $Sr_3Ti_2O_7$ platelets. Our results show that Nb influenced the growth of the $Sr_3Ti_2O_7$ particles. In comparison with pure $Sr_3Ti_2O_7$, the Nb-doped $Sr_3Ti_2O_7$ samples required higher temperatures and slower cooling rate to form platelets. The resulting samples consisted of anisotropic platelets with well-developed facets and agglomerated matrix. The XRD, SEM and EDXS analysis revealed that the platelets were in fact composed of $Sr_3Ti_2O_7$ or $SrTiO_3$ with Nb on Ti site, while the agglomerates were composed of either Sr-rich phases or strontium niobates. The obtained Nb-doped $Sr_3Ti_2O_7$ platelets were added to the starting Nb-doped titanate powders as seeds in order to obtain textured microstructures of sintered strontium titanates.

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PREPARATION AND PROPERTIES OF MASTER ALLOYS Nb-Al AND Ta-Al FOR MELTING AND CASTING OF γ-TiAl INTERMETALLICS

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The advantage of gamma TiAl-based alloys in specific modulus, specific high temperature strength and oxidation resistance makes them attractive candidate for use as high temperature structural materials in automotive, aerospace and power industry. Currently most attention is paid to the alloys of the third and fourth generation. However, this type of alloys contains relatively high amounts of refractory metals such as Nb and Ta. High melting point of these metals (2477 and 3017 °C) deteriorates the preparation of these products by conventional casting, because it is necessary to use higher temperatures and thus generally a longer total time of melting. This may result in increased oxygen content in the products and in decreased of mechanical properties. The use of Nb-Al and Ta-Al master alloys for the preparation of the resulting Ti-Al-Nb and Ti-Al-Ta alloys is highly suitable because of reduction of temperature during melting.

This article describes the preparation of selected master alloys Nb-60Al a Ta-80Al (at. %) with melting point about 1600 – 1650 °C by plasma melting. Optimal conditions for the preparation of these master alloys (current density, feed speed, distribution and size of charge) are be characterised in order to maximise purity and homogeneity. The prepared alloys were studied by optical microscopy (OM), backscattered scanning electron microscopy (BSE), energy-dispersive spectrometry (EDS) and melting temperature was evaluated by differential thermal analysis (DTA).

PRIMARY CREEP ANALYSIS OF SIMULATED HAZ FOR TWO 9-12% Cr STEELS

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The primary creep analysis of the parent metal (α), and the simulated inter-critical (α+γ) and coarse-grained (γ) microstructures of HAZ of the X20CrMoV121 and P91 steels, additionally tempered for 6 months at 750°C and 2 years at 650°C was performed. Tempering at 750°C for 6 months showed greater effect on the microstructure evolution and properties deterioration, compared to the 2 years of tempering at 650°C. The inter-critical (α+γ) showed the lowest creep resistance, especially after tempering at 750°C. A simple power function provided an excellent fit with experimental data, and could be compared with the Garofalo Equation if the latter uses adjustable parameters for the primary creep.

SOL-GEL GROWn Cu_2ZnSnS_4 THIN FILMS FOR PHOTOVOLTAIC APPLICATIONS

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As a promising and alternative solar absorber material, the copper-zinc-tin-sulfide (Cu_2ZnSnS_4) has been drawing attention in recent years for the production of cheap thin-film solar cells owing to the high natural abundance and non-toxicity of all the constituents, a tunable direct-band-gap energy and a large optical absorption coefficieny[1-4]. In addition, to overcome the problem of expensive methods, solution-based approaches are being developed[5,6]. In this study, we have produced Cu_2ZnSnS_4 thin films via the sol-gel technique. The effects of the sulfur pressure on the structure, morphology and photo-conversion efficiency of the films were investigated. X-ray diffraction and Raman spectroscopy analyses confirmed the formation of phase-pure CZTS films. The crystallinity of the films changed with sulfur pressure. From the surface images and the results of the composition analysis, it was found that the film annealed under 0.5 atm sulfur pressure is uniform, composed of large grain. Incident photo-current efficiency (IPCE) measurements showed an efficiency of 4.5% maximum efficiency.

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SYNTHESIZING α-PHASE Si_3N_4 POWDERS CONTAINING Y_2O_3-MgO

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Developing of silicon nitride ceramics started in 1950s when it was considered a very promising material for high-tech applications. These materials are used heavily in cutting tools, ball bearings, motor valves and the other wear resistant tools [1]. The microstructural growth of Si_3N_4 ceramic is controlled by three different parameters; properties of initial Si_3N_4 powders, compositions of sintering reagents and sintering conditions. Generally, metal oxides, such as MgO, Al_2O_3, Y_2O_3, Yb_2O_3, La_2O_3, and Lu_2O_3, were used as sintering additives, which can react with Si_3N_4 and SiO_2 on the surface of Si_3N_4 powder at a high temperature to form M–Si–O–N liquid phase [2,3].

In this study, α-phase Si_3N_4 powders were synthesized containing sintering additive by carbothermal reduction and nitridation (CRN). The starting agent for silicon source was high-purity synthetic silica. MgO and Y_2O_3 powders were premixed (wt. %4 Y_2O_3 - %6 MgO, %5 Y_2O_3 - %5 MgO and %6 Y_2O_3 - %4 MgO) in the starting reactants depending on the final powder composition and the type and amount of the secondary phases desired for sintering. Carbon was added to the high purity SiO_2 above the stoichiometric amount of oxygen (C/SiO_2 ratio of 3). The synthesis was carried out in a tube furnace at different temperature (1400°C, 1450°C and 1475°C-3h) ranges under nitrogen gas atmosphere. After the CRN process, the products were heated in air for 1 hour at 900C for residual carbon burning. In this way, the sintering additives dispersed in the structure more homogeneously and sinterable the starting material is produced. Having completed synthesis process, α-Si_3N_4 powder properties were examined by using XRD, SEM, etc.

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SPECTROSCOPIC AND MICROSCOPIC STUDY OF Fe_3O_4-ALGINIC ACID NANOCOMPOSITES

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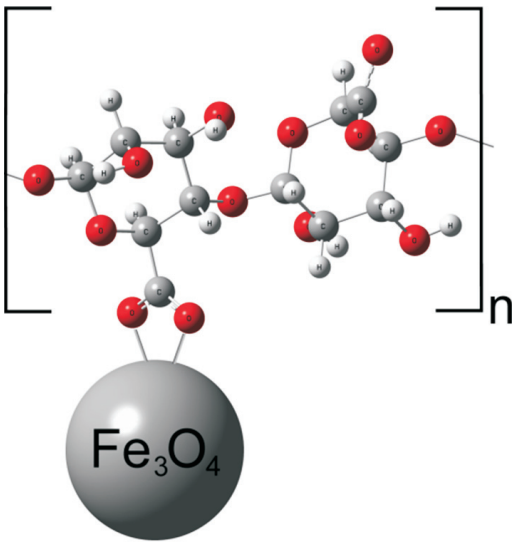
The interest in magnetic nanoparticles is still increasing due to their unique physico-chemical properties, potential medical applications, such as MRI contrast agents, carriers for targeted drug delivery and biochemical sensing. Before the magnetic nanoparticles can be used practically they should be functionalized for instance by forming nanocomposites with biopolymers. The magnetite (Fe_3O_4) nanoparticles were synthesized by Pechini method using microwave activation. The nanocomposite was prepared from aqueous dispersion of magnetite nanopowder and alginic acid (AA) and dried in the air at room temperature.



Morphology of magnetite (Fe_3O_4) nanoparticles was studied by Transmission Electron Microscopy (TEM). To study the interaction of Fe_3O_4 nanoparticles with AA we used infrared spectroscopy. We have investigated AA-Fe_3O_4 nanocomposites with three different weight concentrations of magnetite: 74, 80 and 88%. AA and Fe_3O_4 have been measured as reference materials as well. The experimental data are supported by quantum chemical calculations.

Acknowledgements

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PREPARATION AND DIELECTRIC PROPERTIES OF THERMOVAPOROUS BARIUM TITANATE CERAMICS

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Barium titanate ($BaTiO_3$) based ceramics is widely used in electronic industry as material with extremely high dielectric permittivity up to thousands at room temperature[1]. In present work $BaTiO_3$ powder was synthesized by thermovaporous method, which was industrially approved for other complex oxides obtaining[2]. The synthesis was carried out in water vapour at 350°C, 16 MPa for 0-24 hours using BaO and TiO_2 (29% anatase and 71% rutile) as reagents. From XRD data the process lead to crystalline single-phase $BaTiO_3$ regardless to its duration. The morphology of product studied by SEM depends on processing time and shows different shape of particles and grade of aggregation. Taking into account the requirements for $BaTiO_3$ powder as raw material for ceramics (nano-sized, well-dispersed, sphere-shaped, uniform particles[3,4]), sample synthesized for 3 hours was chosen for ceramics preparation as it consists of 80-90 nm weekly aggregated sphere-shaped crystals. Two series of pellets were uniaxially pressed at 100, 150 and 200 MPa with 1% PVA. In appliance with literature the first series was sintered at 1300°C for 1 hour[1]. Density of obtained ceramics is 84-86% of theoretical value (6,01 g/cm^3)[5]. Average grain size from SEM study is 170 nm. Microstructure includes micrometer-sized plates, formed due to recrystallization, and pores. Porosity causes low values of dielectric permittivity: at 20 Hz – 2 MHz it varies in ranges 84-68, 93-83, 120-82 for pellets pressed at 100, 150 and 200 MPa, respectively. For the second series of pellets sintering temperature lowered to 1200°C and sintering time increased to 5 hours in order to prevent recrystallization process and decrease the porosity. The density of as-prepared ceramics is about 94% of theoretical value and corresponds to improved dielectric properties.

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USE OF ACTIVE MATERIALS FOR CONTROL OF PROPELLER BLADE TWIST AND ITS INFLUENCE ON PROPELLER EFFICIENCY

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Progress in the field of adaptive materials and structures brings the possibility to build propeller blades with variable twist so that blade twist and lift distribution can be optimal under any flight condition and so propeller efficiency can be increased. Variable-twist rotor blades for helicopters were developed and tested by DLR ([1]) and NASA ([2]). Variable-twist propeller blades have not been built yet. Current paper analyses the possible increase of propeller efficiency by using the variable-twist blades and also tries to explain related phenomena.

Possible increase of efficiency is analyzed by comparison of the variable-twist propeller with conventional constant-speed propeller (fig. 1 - 2). Both propellers have identical blade chord distribution and use the same airfoils. Optimal lift distribution according to Goldstein theory ([3]) is achieved by the variable-twist for every flight condition. Blade element method was used for the computations. Benefits of using variable-twist blades are discussed.

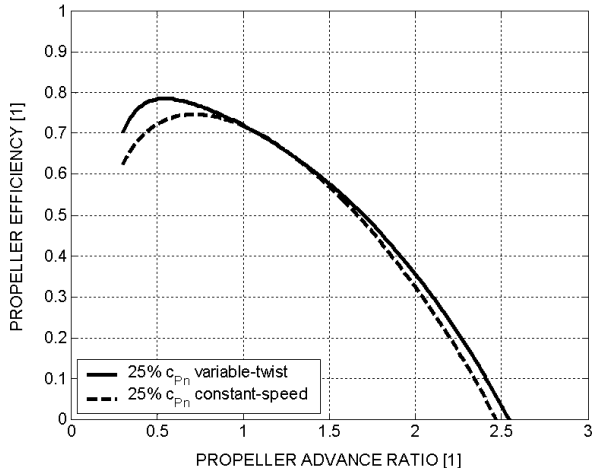

Fig. 1 – Comparison for 25% engine power

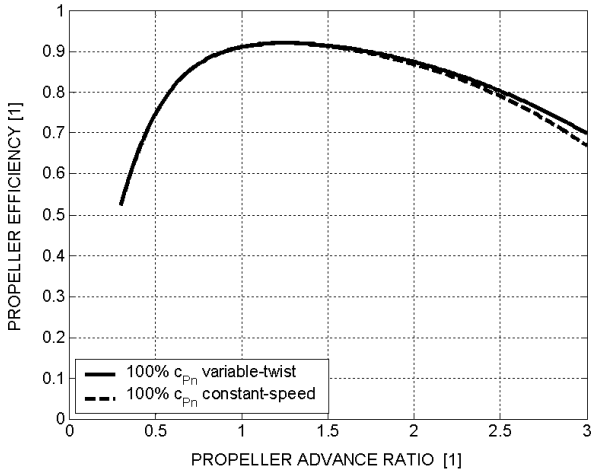

Fig. 2 – Comparison for 100% engine power

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UNSTEADY MODEL-BASED PREDICTIVE CONTROL OF CONTINUOUS STEEL CASTING BY MEANS OF VERY FAST DYNAMIC SOLIDIFICATION MODEL ON GPU

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In continuous steel casting, the quality and productivity of cast steel are among the most important and inspected parameters for steelmakers over the world. An improper control strategy of the casting machine, e.g., a spray cooling intensity in the secondary zone or a wrong casting speed, can lead to a poor surface quality of cast blanks or even to surface and corner cracks or internal defects. A special attention is required due to unsteady casting states, e.g., hot exchanges of tundishes. Nowadays, the optimal control and optimization of continuous steel casting are frequently accomplished with the use of dynamic solidification models, which solve the unsteady transient temperature field of cast blank and its solidification. However, recently used commercial dynamic solidification models are usually computationally very demanding, and therefore their use for advanced on-line control and optimization of casting in real time is often limited.

The aim of the paper is the development and testing of the model-based predictive control[1] of continuous steel casting with an emphasis to unsteady casting situations, often accompanied by abrupt changes of the casting speed. For that purpose, a very fast dynamic solidification model was developed. This fully 3D model runs on graphics processing units, GPUs, and is significantly faster (in order of tens) than recently used commercial models[2]. Therefore, a scenario approach can be utilized, which means that the control system in real time predicts and evaluates the thermal behavior of cast blank for various scenarios of the control strategy. Moreover, the concept of the effective casting speed[3] is also utilized in order to improve the control process. The results show that the proposed model-based predictive control with the use of the developed GPU dynamic solidification model can offer an effective control method of the casting process and brings new control possibilities of continuous steel casting.

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ANTIBACTERIAL POLYMER SYSTEM BASED ON POLYVINYL CHLORIDE AND CRYSTAL VIOLET

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The searching for novel antibacterial materials for biomedical application in indwelling devices such as catheters is very important as the resistance of the microbes responsible for nosocomial infections towards recent systems emerges with increasing rate. The work presented here is focused on the preparation and the characterization of antibacterial polymeric system composed of polyvinyl chloride (PVC) in combination with crystal violet (CV). The antibacterial activity of system against gram-negative bacteria (Escherichia coli), gram-positive bacteria (Staphylococcus aureus) and yeasts (Candida albicans) were measured by disk diffusion test. The release profile of the active substance was observed by UV-VIS spectrometry. Mechanical properties of prepared material were evaluated to verify that they were not deteriorated.

CONTROLLING CONSTRAINT RELEASE IN POLYDISPERSE MELTS OF LINEAR POLYMERS

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The demand in polymer materials is growing worldwide. With that, a need in fundamental understanding the link between structure and properties is essential for processing and application of the final product. Even when focusing on a particular chemistry of a polymer, there can still be difference in topology, molecular mass, polydispesity, etc. This results in different rheological properties and measuring all of them for all possible polymers takes a lot of time and is expensive. For this purpose certain quantitative models have been developed in order to predict rheological properties of polymer melts.

Main topic of this work is linear rheological characteristics of polymer melts. Understanding these is crucial for predicting non-linear rheological behaviour of polymer melts, which is responsible for defects occurring in processing of polymer materials like extrusion, injection molding, blow molding etc. Experimental data is studied in order to observe specific effects in bidisperse blends with different amounts of certain components. Using small angle oscillatory shear measurements (SAOS) of specifically designed bidisperse polymer mixtures, stochastic model is validated, which naturally includes all tube-related relaxation mechanisms. This stochastic model is then used for probing chain dynamics in more general cases of polydisperse polymer mixtures and improving already existing tube models.

SILICA/PVC COMPOSITE COATINGS ON STAINLESS STEELS

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In this study we presented successful preparation of micrometer thick corrosion protection polymer coatings synthetized from 30 nm and 600 nm silica particles dispersed in polyvinyl chloride (PVC) and sprayed on duplex DSS 2205 and austenitic AISI 316L steel substrates. We showed that silica surface modification with silane $IO_7T_7(OH)_3$ (trisilanol isooctyl polyhedral oligomeric silsesquioxane, POSS) significantly improved silica's dispersion properties when mixed with PVC and further on assured a high quality coating with favourable surface protection properties. The surface morphology of silanated silica/PVC coatings on both steel substrates indicated agglomerate free silica dispersion consisting of randomly dispersed linear chains or small 2D units all over the surface. On the contrary, coatings prepared from non-silanated silica spheres were characterized with several agglomerates.

The beneficial role of silanated compared to non-silanated silica fillers in improving the corrosion resistance of coated stainless steel is reflected in contact angle/surface energy and potentiodynamic measurements. Contact angle and surface energy measurements of silanated silica/PVC coatings indicate improved surface wettability through induced surface hidrophilicity which is attributed to the addition of POSS low surface energy additives into the PVC matrix. This observation is additionally supported with average surface roughness parameter, Ra, which is lower for silanated silica/PVC coating. In addition, electrochemical study in 3.5 wt% NaCl solution confirmed the improved corrosion stability of DSS 2205 and AISI 316L stainless steels coated with investigated polymer coatings compared to the uncoated specimens.

LASER STRUCTURING FOR ANTI-BIOFOULING SURFACES

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Biofouling on surfaces exposed to marine environment as hulls of ships and power plant heat exchangers cause a huge cost (only for shipping industry estimate $60 billion per year). Recently, the use of toxic anti-biofouling paints is facing increasing restrictions due to their environmental impacts. The investigation of novel surface treatment technologies is therefore crucial for development of non-biocidal anti-biofouling surfaces. The surface chemistry is proven to be the most important property for efficient anti-biofouling surface, however, most of the biological anti-biofouling surfaces also exhibit periodical micro/nano structures. Usually it is a nano pattern superimposed on a micro pattern.

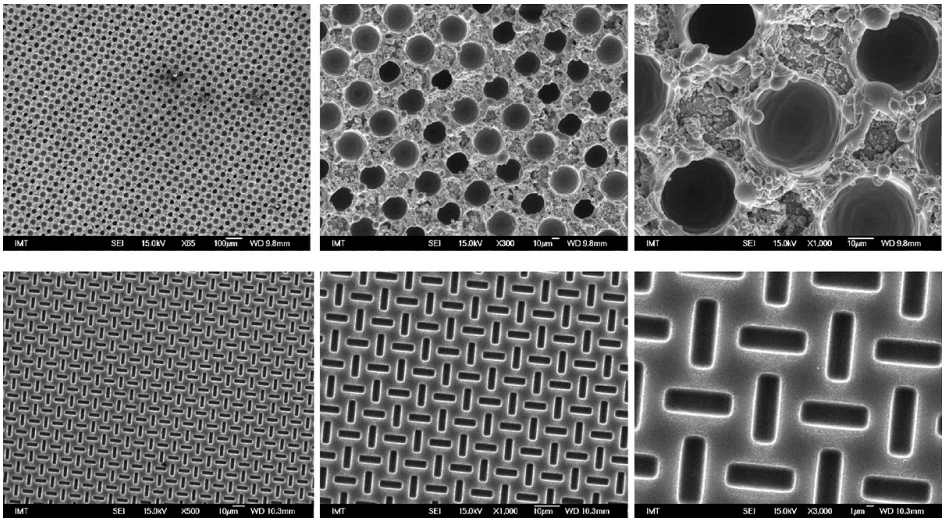

Figure: Example of laser direct structuring on steel surface (upper three images) and laser direct imaging (LDI) in photoresist

We use laser surface structuring to enhance the anti-biofouling properties of the surfaces. Two different laser structuring methods are being used: First method is direct laser structuring on the various metal surfaces. Laser power in this case is sufficient to change the metals surface morphology directly and the smallest feature size is around 15um. This method is more convenient for scale up and allows for large surface structuring. The second method is novel photolithographic method called laser direct imaging (LDI) with minimum feature size bellow 1um and laser beam positioning accuracy bellow 1nm. The patterns in this case are created in photoresist and molded to PDMS. This method allows for more detailed structuring and is more convenient for study of adhesion mechanisms of various fouling organisms.

EFFECTS OF TEMPERING TREATMENT ON MECHANICAL PROPERTIES IN MARTENSITIC STEELS WITH HIGH CHROMIUM CONTENT

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There are many potential applications for the 9-12% Cr steels, but the single largest use is in the thermal power plants (superheaters and reheaters, boilers, steam pipes, bolting, turbine blades and rotors). This type of steels offers the best combination of high creep strength, high resistance against thermal fatigue, high steam oxidation resistance, low cost and good manufacturability.[1]

The key to an understanding of mechanical properties of materials is to relate these properties to the microstructure. Microstructure depends from chemical composition, processing route and heat treatment. Therefore an effective steel development should be based on a knowledge of the influence of different alloying elements and heat treatment procedures on microstructural parameters.[2]

Precipitation hardening is one of the most effective strengthening mechanisms in 9-12% Cr steels. During tempering of martensite, carbides, nitrides and carbonitrides precipitate along grain boundaries, martensite laths and inside the grains. The dispersion of fine precipitates stabilizes free dislocations and the sub-grain structure against recovery, which further enhances dislocation hardening and sub-boundary hardening.[3]

In our research we want to optimize tempering process of 9-12%Cr steels. Base for that is knowledge of precipitation mechanism. We calculated the phase equilibrium with ThermoCalc, determined typical transformation temperatures (Ar_1, Ar_3, M_s, M_f) with dilatometry and differential scanning calorimetry. We investigated effects of tempering temperature on mechanical properties. Next step is identification of precipitations that appears at different tempering temperatures (precipitation mechanism) and connect mechanical properties with microstructure. On base of these results we will investigate microstructure and mechanical properties of different combinations of heat treatment.

Our goal is demonstrate that with right combination of two-step tempering treatment (first tempering at lower temperature than second tempering at higher temperature) it is possible to enhance mechanical properties and get microstructure with finer subgrains, martensitic laths and higher dislocation density.

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DETERMINATION OF LOCAL MECHANICAL PROPERTIES FOR FEM SIMULATIONS

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The crucial role in the case of any FEM simulation play input data. There is significantly increasing demand on material data measurement for FEM simulation and on their accuracy. In the case of many simulations, the material cannot be considered as continuum with uniform properties over whole volume and in all directions. Therefore local measurements are necessary. Standard samples are in many cases too big to allow such a detailed local studies and thus miniature samples based techniques have to be applied. The paper deals with the determination of local mechanical properties with the use of micro tensile samples. Newly developed Micro-Tensile test technique (M-TT) is employed here. M-TT specimen dimensions are based on Small Punch Test sample volume 8mm diameter and thickness 0.5mm. In the case of M-TT following samples dimensions are used: thickness of 0.5 mm, width of 1.5 mm and parallel length of 3 mm. ARAMIS system using Digital Image Correlation method (DIC) enables precise strain measurement in the course of M-TT.

There is presented M-TT performance in comparison to the standard size samples in order to prove its reliability. Subsequently is the method applied to evaluation of local properties for the anisotropy assessment. The method is also applied to determination of mechanical properties variation across a weld. Finally, is the M-TT technique used for dynamic properties determination, as not only quasi-static conditions are being present in real cases. Results of powerful testing method enabling description of local mechanical properties using miniature samples are presented here with high application potential.

POSSIBILITIES OF INCREASING STEEL PURITY DURING PRODUCTION USING SECONDARY METALLURGY EQUIPMENT

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Possibilities of increasing steel purity during production of the liquid phase using secondary metallurgy are especially in affecting the emerging quantity of occlusions, their size, type morphology and chemical composition. Metallographical steel purity during production in the electric arc furnace (EAF), in the following ladle furnace (LF) and when processed in VD caisson technology was assessed. Steels samples were processed by means of an electron microscope and they were simultaneously tested using the Single Spark Evaluation (SSE) method.
The aim was looking for a possibility of operative steel quality control and affecting the desired mechanical properties already while processing the liquid phase.
Key words: steel purity, secondary metalurgy, occlusions, electron microscope, single spark evaluation

HYBRID FePt/Au NANOPARTICLES WITH A COMBINED MAGNETO-PHOTOTHERMAL EFFECT

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Magnetic nanoparticles based on the Fe-Pt alloy can be used in biomedical applications, as contrast agents in magnetic resonance imaging (MRI) and in hyperthermia tretments. On the other hand, Au nanoparticles are widely used in biomedical applications because of their biocompatibility, stability, and ease to further functionalize their surface. These particles can be used in biomedical imaging applications and, more important, are potential candidates for localized photo-thermal therapy because they mediate strong plasmon induced surface heat flux upon absorption of near IR light. Combining both materials in a multifunctional FePt-Au core/shell structures represents a novel approach to combine and upgrade magnetic and optical properties of each single component and permit potential applications as optical agents and magnetic carriers for bio assay. Superparamagnetic 5nm-FePt nanoparticles were synthesized by using modified polyol method[1]. Au nanoshells absorb significantly in near IR region where hemoglobin and water, the major absorbers in visible and infrared light, have their lowest absorption coefficient[2]. Therefore, near IR region is the most suitable for photothermal therapy and imaging of deeper tissues. Au nanoshells were irradiated with laser with wavelength in the region where Au shells exhibit strong absorption (810nm) and showed high photo-thermal effect. To preserve desired optical properties of Au shells, a dielectric spacer between FePt core and Au shell has to be used. For this purpose, FePt nanoparticles were covered with SiO_2 shells via water-in-oil microemulsion method[3].

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MODELING OF OCCURRENCE OF SURFACE DEFECTS OF C45 STEEL WITH GENETIC PROGRAMMING

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Carbon steel C45, used for tempering, with a higher content of carbon is used in automotive industry for highly stressed parts (axles, shafts), machine parts, screws, drills for wood, axes, knifes, hammers and similar. In the present work the attempt of different steelmaking parameters influences analysis is presented. According to monitored data on casting temperature changes, total oxygen, number of added aluminum rods, chemical analysis before and after steelmaking, added lime, aluminum cored wire, calcium-silicon cored wire, sulphur cored wire, rolling dimensions, casting speed, opening of ladle nozzle with oxygen and surface defects (efficiency) on rolled bars the mathematical model was obtained with the help of genetic programming method. The results show that the most influential parameters on surface defects occurrence at C45 steel are opening of ladle nozzle with oxygen and aluminum. According to the results the steelmaking technology could be easily adjusted. C45 steel could be made without aluminum according to so called ACF (Al+Ca Free) technology. So the C45 steel could be, instead of Al-killed steel, Si-killed steel. The amount of opening of ladle nozzle with oxygen should also be reduced.

COMPUTATIONAL CHARACTERIZATION OF LOTUS-TYPE POROUS IRON

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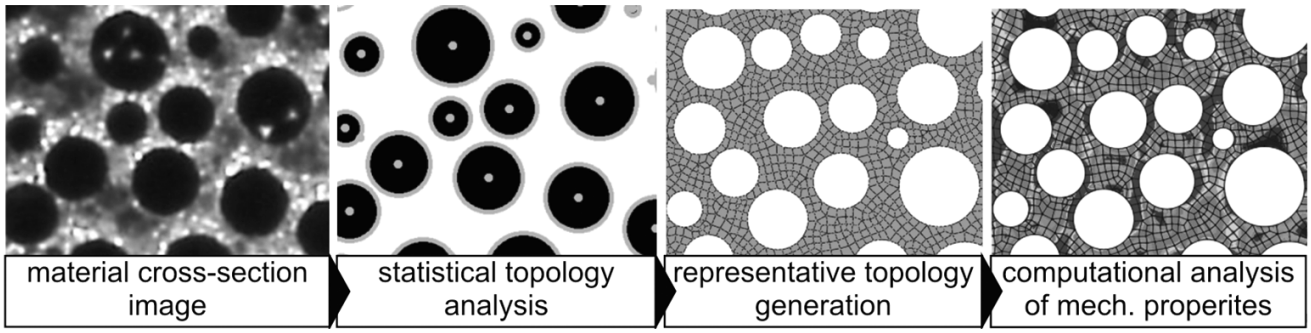

Lotus-type porous materials are recognized for their unique porous structure of unidirectional elongated pores, which define their orthotropic properties . This paper presents a methodology for characterization of mechanical properties of lotus-type porous iron, where a small number of experimentally obtained results were complemented by an extensive analysis based on parametric computer simulations, with the global porosity as a varying parameter. The pore topology parameter dependence on global material porosity was investigated through statistical analysis of a small number of material's cross-section images, using purposely-developed image recognition code. Topological parameters for arbitrary analyzed porosity were determined with linear interpolation and extrapolation of acquired parameter values, and were then used to define new representative topologies in generated computational models used in computer simulations. Parametric computer simulations of material representative volume were then used to estimate the engineering elastic modulus for a chosen material porosity. The computational models were validated through comparison of computational results with some experimental measurements with a very good agreement of results. The proposed method presents a simple and effective way to complement a small number of experimentally obtained results with computational characterization of mechanical properties of lotus-type porous material, using appropriate computational models of generated porous material structure, where the topological parameters are easily varied inside the statistically representative window for a chosen porous structure.

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APPLICATION OF METHOD OF MEASURING THERMAL EXPANSION COEFICIENT FOR DEVELOPING A RUBBER COMPOSITE PRODUCT

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Solid state material expands with increasing temperature. Measurement of one-dimensional expansion comprises the so called linear thermal expansion coefficient. During developing a layered rubber product composed of different materials, for each of them, equivalent materials were tested in order to design an optimal final product in terms of properties and price.

Relevant mechanical as well as thermal properties were also investigated by measuring the thermal expansion coefficients of rubber compounds and other components as a function of temperature by a distinctive method of dynamic mechanical analysis (DMA).

Rubber compound is elastomeric material. Elastomers in general consist of macromolecular systems with long, linear and flexible molecules, appearing as random coils in amorphous state. Such systems are characterized by low temperature glass transition and by transition from amorphous to crystalline state. With respect to thermal expansion, elastomers in a glassy state behave as other solid materials, they expand with increasing temperature. Upon transition from glassy to amorphous state at glass transition temperature, however, elastomeric bodies of constant length exhibit increase in elastic force with temperature increase, which corresponds to contraction at constant force with a negative linear thermal expansion coefficient. This coefficient temperature pattern depends on type of elastomer and additives, especially the active fillers, such as carbon black or silica.

The paper presents the optimization of corresponding materials for the rubber compound used regarding the properties in the main range of service temperatures that is from –20°C to about 60°C.

CHARACTERIZATION OF SUBSTRATES FROM TWO CULTURAL HERITAGE OBJECTS AND PREPARATION OF MODELS SUBSTRATES

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Within the scope of the 7th FP HEROMAT project (*"Protection of cultural heritage objects with multifunctional advanced materials"* ENV-NMP.2011.3.2.1-1 NMP) the main goals have been to develop consolidants and multifunctional photocatalytic coatings for cultural heritage objects in order to conserve degraded materials and to prevent their further degradation. To meet the set goals and derive a basis for further applications, the following steps were needed: (i) analysis of the microstructure of the substrates from the two studied objects (Dornava Manor, Slovenia, and Bač Fortress, Serbia), (ii) preparation of a model substrate which mimics substrates from such objects for the preliminary testing of newly developed products, (iii) analysis of the microstructure of the model substrate before and after the ageing procedure, and a comparison of this substrate with the substrates from the two selected objects. The samples were characterized by means of mercury intrusion porosimetry (MIP) and total specific area analysis (BET). Good agreement between the samples from the object and the model samples were obtained in the case of the brick and mortars from Bač Fortress, as well as in the case of the stone and render from Dornava Manor (Table 1).

Table 1: Comparison of the porosity and specific surface of samples from Dornava Manor and samples from Bač Fortress with the corresponding values of the model substrate before and after ageing (F-exposure to freezing/thawing).

	Brick Bač	Model brick	Model brick F	Mortar Bač	Model mortar	Model mortar F
Porosity (%)	45.7	45.3	44.1	39.7	35.1	30.0
BET (m2/g)	5.98	1.5	5.9	3.0	2.2	1.9
	Stone Dornava	Model stone	Model stone F	Render Dornava	Model render	Model render F
Porosity (%)	9.9	14.2	15.1	25.5	39.3	27.9
BET (m2/g)	1.7	2.6	3.4	10.6	4.3	8.9

Based on these results, the selected model substrates will be used for the application of newly developed materials in order to test and otherwise scrutinize them before applying them to valuable substrates belonging to cultural heritage objects.

PARAMETER IDENTIFICATION OF 3D SIMULATION MODEL OF REAL BUILDING CONSTRUCTION USING MKP IN SYSTEM ANSYS AND GENETIC ALGORITHM

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The paper deals with the parameters identification of density and modulus of elasticity (ρ_1, ρ_2, E_1, E_2) of segment of the real construction simulation model. The behavior of real structure has been determined by experimental measurement of frequency response. The experimental measurement has been done on the real-reduced 3D model of building excited external force. The measured frequency characteristics have been used to identify parameters of the simulation model created in the ANSYS APDL environment using the Genetic algorithm. The ANSYS parametric model included geometry of the experimental object, material assignment, a finite element mesh, boundary conditions solution settings and results retrieving. Simulation model parameters have been tuned by GA and then was used to simulate structure behavior more precisely than classical theoretical model[1].
The resulting (tuned) 3D simulation model in the FEM environment will be used to simulate and investigate behavior of buildings using various types of external actuating effects. The model can be also used for exploration of relations, reasons and analogies and help to find the best solution in terms of the desired goal without necessity to build real objects.

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ANALYSIS OF APPLICABILITY OF CONCRETE WITH SECONDARY RAW MATERIALS AS AGGREGATE IN COUPLED TIMBER-CONCRETE CEILINGS

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The beginnings of coupled timber-concrete ceilings are to be found in reconstructions of now historic buildings. Nevertheless, nowadays these types of structures are further developed because of their application in newly erected wooden building objects, especially in those of multi-storey buildings or buildings with higher utilized loads.

From the viewpoint of contemporary requirements put on environmental and sustainable development, wood as a renewable building material is often used for structural purposes. However it is not enough, therefore another emphasis is put onto the application of recycled materials in constructions. The paper discusses one of the ongoing extensive research activities, that of coupling of timber joists with an on site cast concrete slab plate, where secondary raw materials were used as fillers in the concrete mixture. The recipe of this lightweight concrete type has been specially created within the research project for the experimental verification of its strength characteristics and the possibilities of their utilization for coupling with timber ceilings, where they were not used before.

The results of load tests made on models of coupled sections and on models of ceiling structures were compared to data obtained by experiments done on the same elements but with the application of expanded clay granules as an aggregate in concrete LC 20/22 (expanded clay granules are called as Liapor). In both cases, it handled about a type of lightweight concrete, which did however differ significantly in their mechanical and building physical parameters. The concrete based on secondary raw materials did reach only a quarter of the module of elasticity in compression and a fifth of the strength in compression of the concrete with Liapor used as an aggregate.

Throughout the experiments it was found out, that the specially created concrete can be successfully used for coupling with timber ceilings, however only under given circumstances.

INFLUENCE OF GEOMETRIC PARAMETERS OF PIN JOINT OF CARBON/EPOXY COMPOSITE PLATE ON ITS LOAD CAPACITY

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Currently, the number of products that utilize composite materials is rapidly increasing. Usually, a whole structure is not replaced with composite materials, but only a certain part of it is replaced. However, the integration of the composite part into metal structures brings many problems. A pin joint is one possibility of joining of composites with metals.

The influence of geometric parameters of the pin joint on its load capacity was investigated. Numerical simulations of the pin joint were performed using the finite element method in *Abaqus*. A material model with nonlinear function with constant asymptote had to be used for the description of shear stress behaviour. The model of progressive damage was used in these simulations. The numerical model was validated by means of the comparison of experimental and numerical results.

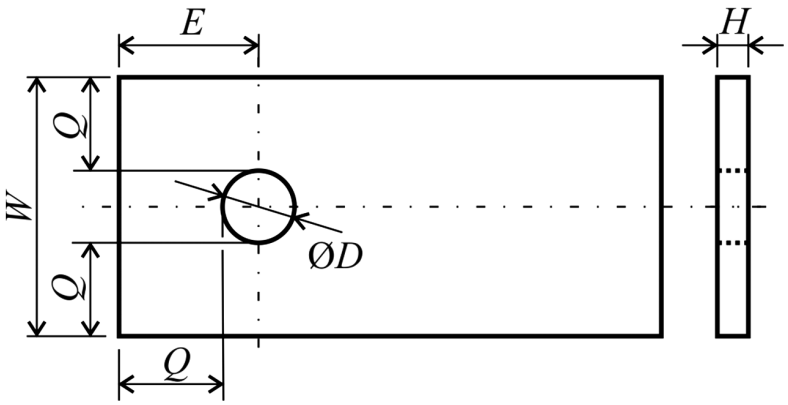

Fig. 1: Investigated geometry parameters.

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PREPARATION OF ULTRA FINE-GRAINED COMMERCIALLY PURE TITANIUM WIRES FROM DIFFERENT GRADES BY CONFORM EQUIPMENT AND THEIR THERMAL STABILITY

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Titanium and its alloys are frequently used in many sectors, including the health care sector, where they outperform other materials. From the biocompatibility viewpoint, the preferred condition of these materials is ultrafine or nanostructured state. Processes based on severe plastic deformation (SPD) that are capable of producing microstructures with sizes of the order of nanometers are gaining importance these days. Their typical limitation is the small volume of material processed. One of available ways to enhancing the productivity is to combine the CONFORM continuous extrusion process with the ECAP method.

This paper describes initial experience with this combined process in the CONFORM 315i machine, which is equipped with a specially-designed forming die chamber. The feedstock was a titanium bar (cp – Ti grade 2, grade 4 and grade 5,) with 10 mm diameter. Influence the number of passes through CONFORM machine on thermal stability was study by horizontal dilatometer and heat-flux calorimeter. The impact of deformation on the shift in recrystallization temperature of pure titanium was confirmed [1, 2]. The microstructure evolution and the grain growth behavior were investigated by electron back scattered diffraction (EBSD) technique. The deformed UFG titanium was annealed at a range of temperature (400-600 °C) for up to 6 h. The grain growth kinetics was characterized by calculating the grain growth activation energy Q and the time exponent n based on the experimental results for deformed material. Data for annealing temperatures of 550 and 600 °C allowed the values of the time exponent n = 0.19 and activation energy Q = 248 kJ/mol to be calculated for cp – Ti grade 2.

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THE PITTING CORROSION OF TiN COATED STAINLESS STEEL IN 3 wt.% NaCl SOLUTION

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Hard ceramic coatings such as TiN have been used mainly for tribological applications such as cutting tools. Tribological properties of single layer and multilayer TiN coatings were extensively studied in the literature and published in the hand book. On the other hands, corrosion of TiN in tribological applications was often overlooked mainly due to shorter life time of cutting tools. TiN possessing golden colors have been used for decorative applications such as watches, architecture materials and ornaments.

In this work, TiN coating was deposited by Arc PVD on EN 1.4034 stainless steel substrate at $1.1 \cdot 10^{-3}$ mbar nitrogen pressure. These martensitic stainless steels generally used for blades in kitchen appliances were coated for both decorative and wear applications. The TiN coatings and stainless steel substrate were characterized by XRD and SEM. In-situ measurement of corrosion of the substrate and TiN coated substrate were made by corrosion potential (Cor.Pot.), Polarization Resistance (PR) method and Electrochemical Impedance Spectroscopy (EIS) in 3 wt.% NaCl solution as a function of immersion time (about 24 hours). Semiconductor scale formed on TiN was identified by Mott-Shottky analysis as n-type semiconductor with flat band potentials, –0.83 V(SCE). TiN coating (0.5 μm thick) consisted of cubic TiN exhibited columnar grains, pin holes, voids and porosities. Pitting corrosion of TiN observed visually between 1 and 2 hours was captured by EIS and PR. Electrical circuit (EC) model used for EIS data supported the degradation of coating through pitting corrosion in agreement with visual observation. Corrosion resistance (polarization resistance) determined by polarization resistance method (R_p) and EIS (R_{total}) decreased suddenly during pitting corrosion and it remained relatively constant value after increasing to steady-state value at longer time. Polarization resistance of substrate (R_p and R_{total}) increased logarithmically as the passive layer grew with time. The corrosion resistance of TiN coated substrate was greater than the corrosion resistance of the substrate. Based on microstructural observation (SEM) before and after corrosion and Cor.Pot., PR and EIS data, the formation and growth of pitting corrosion of TiN coating were evaluated with respect to galvanic coupling of the substrate and TiN coating.

INFLUENCE OF QUALITY SURFACE ON THERMAL CONTACT RESISTANCE AT HIGHER TEMPERATURES

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The thermal contact resistance (TCR) is an important parameter for describing heat transfer losses. When two solids are put in contact and heat transfer occurs, the temperature drop is observed at the interface between solids. It is caused by an imperfect joint which occurs because of real surfaces are not perfectly smooth and flat.

An experimental apparatus for the evaluation of TCR was designed and fabricated in Heat Transfer and Fluid Flow Laboratory. The principal of this investigation is the unsteady measurement of temperatures of two solids which are put into the contact. The surface temperature and heat transfer coefficient (HTC) can be calculated from measured temperatures by inverse heat transfer task. Experimental tests were performed under different conditions such as a change in type of material, initial temperature, pressure in contact and quality of surface.

The paper describes experimental apparatus and the determination of TCR between two solids with different surfaces qualities at higher temperatures. The measured data and computed values of the HTC were presented and compared with theoretical models of thermal contact conductance.

AMPLITUDE–FREQUENCY RESPONSE OF AN ALUMINUM CANTILEVER BEAM DETERMINED BY PIEZOELECTRIC TRANSDUCERS

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This work is focused on creation of appropriate finite element model of aluminum cantilever beam with applied pair of piezoelectric patch transducers.
Thanks to reversible behavior of piezoelectric effect each patch transducer can represent either actuator or sensor. For precise prediction of amplitude values in numerical simulations each transducer is calibrated before attaching to the beam by two ways of measurement: strain gauges and optical microscopy. From these experiments piezoelectric properties of each piezoelectric patch are obtained.
The cantilever beam is actuated by a voltage signal applied to one of the patches. The signal is a linear chirp (sine with swept frequency) with sufficient range to affect selected natural frequencies. The time response of the beam from the piezoelectric sensor and alternatively by a laser position sensor is transformed by STFT algorithm to obtain the characteristics in time–frequency domain (spectrogram).
The finite element model of the cantilever beam with piezoelectric patches was created using 3D solid structural and piezoelectric bricks in Ansys. The time response of the model to the chirp voltage signal was determined by a transient analysis. The amplitude–frequency characteristics is compared with experimental results.

FABRICATION AND APPLICATIONS OF MULTILAYERED LYSOZYME FILMS WITH HIGHLY ORDERED STRUCTURES AND MORPHOLOGIES

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Protein-based nanomaterials have been receiving much attention in the recent years owing to their peculiar characteristics including low toxicity, biocompatibility and biodegradability and serve as superior platform for various applications including sensing, catalysis, and disease diagnosis. By constructing these interesting materials with well-ordered nanoporous structure and excellent morphology, many novel applications could emerge and especially, the efficiency of these materials can be significantly enhanced for applications including sensing and enantio-selective separation. This report focuses on the preparation of protein films with customized properties and well-ordered nanoporous structure through nano-templating techniques using polystyrene spheres (PS) as templates (Fig. 1a). The flexibility of the nano-templating techniques can offer the opportunity to control the porosity, morphology and the composition of the protein based nanomaterials. Protein films with different diameters are prepared using polystyrenes with different diameters as nano-templates. The thickness, composition and the morphology of these protein films are also exploited by varying the concentration of the protein solution and the nature of the PS spheres. The thin films hence obtained by these techniques are subjected thorough physico-chemical characterisation employing sophisticated techniques such as HRSEM, HRTEM, and atomic force microscopy (AFM). From these results, it is found that the sample which is prepared using the lysozyme solution with a concentration of 6g/L exhibits highly ordered porous structure with uniform thickness. It is also observed from the HRSEM image that the size of the pore is almost similar to the size of the polystyrene beads used in the study. Layer-by-layer technique is used to fabricate protein films with different layers and the porosity was generated by washing the templates (PS) with toluene (Fig. 1b). The Fig. 1b reveals freestanding, porous multilayered films of high surface area-volume ratio and homogenous thickness. On the other hand, the AFM image confirms that the pores are highly ordered and the shape of the pores is almost similar to that observed in the HRSEM image (Fig. 1c). Subsequently, these nanoporous protein films are employed for bio-sensing applications using quartz crystal microgravimetry (QCM) and the detailed results will be discussed during the presentation.

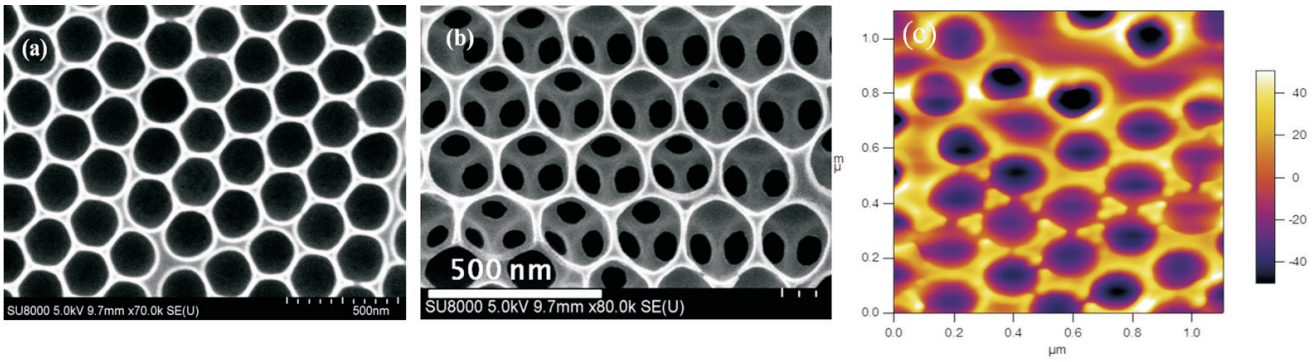

Figure 1: HRSEM images of a) single layer, b) double layer nanoporous lysozyme films prepared by using polystyrene spheres as templates. c) AFM image of the nanoporous lysozyme films.

PROPERTIES OF ALKALI/ALKALINE-EARTH BOROSILICATE GLASS SEALANTS CONTAINING ALUMINA FILLER FOR SOLID OXIDE FUEL CELLS

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Development of a reliable sealant or sealing system remains one of the top priorities in planar solid oxide fuel cell (SOFC) technology.[1] Recently, a compliant glass seal such as an alkali silicate glass was proposed for SOFCs. In contrast to the conventional glass–ceramic sealant which develops a rigid or semi-rigid microstructure after sealing, the compliant glass shows so called "self-healing" behavior and will remain vitreous without substantial crystallization after sealing and during operation at elevated temperatures.[2] From a structural point of view, the compliant glass contains network modifiers, i.e., Ca, Sr, Na, and K, which weaken the rigid glass network. Although addition of network modifiers is effective for lowering the viscosity of a sealing glass, a long-term chemical and mechanical durability may also be diminished. Therefore, optimized glass structure is necessary for a long-term SOFC operation. In alkali aluminosilicate glasses, the trivalent aluminum ions act as network formers and provide the framework and rigidity of the glass through the formation of bonds with bridging O atoms (BO).[3] In this paper, we will present the results of studies on the sealing and electrical properties of alkali/alkaline-earth borosilicate glass containing alumina filler. Alkali borosilicate glass sealants showed better cyclic sealing performance than alkaline-earth borosilicate glass sealants due to their lower viscosity at seal operation temperature. The higher conductivity and viscosity of the glass composites containing alumina filler were attributed to the formation of bonds with bridging oxygen by the partial dissolution of alumina filler in sealing glass.[4]

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SURFACE MORPHOLOGY AND CRYSTAL ORIENTATION OF PYRAMIDAL SHAPED TIN BY ELECTROPLATING

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Tin is well known to high corrosion resistance, nontoxicity and good solderable coatings in electronic packaging processes[1]. Tin and tin based alloy electrodeposition has been regarded as of important subject. Electrodeposition of tin will be interesting as an object of scientific research for many years.

Organic additives are commonly used in electroplating applications to produce a lustrous or bright deposit, enhance the corrosion protection or mechanical properties of the electroplated coating or to provide some other desirable property[2]. The effect of hydroquinone and poly ethylene glycol including potassium salt (PEG-K) on the surface morphology as well as crystal orientation of electrodeposited tin from acid tin sulfate solutions was investigated3. We studied thin film characteristics of electrodeposited tin with the additive according to various electrodeposition conditions.

Pyramid like growth was observed at more than 160 rpm and 52 minute. The distinct difference in the crystal orientation was observed between 80 and 160 rpm. X-ray diffraction spectra confirm that these pyramid structures have (101) and (112) as the preferred orientation instead of the (200) orientation observed for a plane film. Pyramid structure was turned into polyhedron shape as increased PEG-K concentration.

The effect of various stirring speed on surface morphology of the deposits was investigated by scanning electron microscopy (SEM). X-ray diffraction (XRD) was performed to identify the crystal structure of tin. The cross section of deposited tin was observed by focused ion beam (FIB) and electron backscatter diffraction (EBSD).

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SYNTHESIS COMPARISON AND CHARACTERIZATION OF CHITOSAN COATED MAGNETIC NANOPARTICLES PREPARED BY DIFFERENT METHODS

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In this study, magnetic maghemite nanoparticles were prepared by the coprecipitation method[1], due to its simplicity and productivity. Thereafter, chitosan coated magnetic nanoparticles were synthesized by three different methods, by microemulsion process[2], suspension cross-linking technique[3] and covalent binding[4]. Subsequently the comparison of the used methods were done with various analyses such as Fourier transform infrared spectroscopy (FTIR), scanning electron microscope (SEM), thermogravimetric analysis (TGA), differential scanning calorimetry analysis (DSC), vibrating sample magnetometer (VSM) and dynamic light scattering (DLS). Characterization results from Fourier transform infrared (FTIR) spectroscopy and thermogravimetric analysis (TGA) indicated the successful binding of chitosan on magnetic nanoparticles. SEM pictures showed that spherical structured particles with increased particle size were obtained as the chitosan layer around the particles was increased. Considering that the magnetic separation technique possesses the advantages of rapidity, high efficiency, cost-effectiveness, and lack of negative effect on biological activity, these carriers may hold potential applications in enzyme immobilization.

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NOVEL MORPHOLINIUM- AND PIPERIDINIUM- IONIC LIQUIDS BASED HIGH VOLTAGE ELECTROLYTE FOR SUPERCAPACITORS AND Li-ION BATTERIES

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Due to the wide perspectives of the practical use in different fields of chemical industry ionic liquids are of great interest of researchers. Depending on properties, ionic liquids can be used in inorganic synthesis, fuel cells, as well as serve as suitable media for the electrochemical processes in supercapacitors and Li-ionic batteries. Present work deals with synthesis and characterization of N-methyl-N-(2-(2-methoxyethoxy)-ethyl)-morpholinium bis-(trifluoromethylsulfonyl)imide (TFSI) and N-methyl-N-(2-(2-methoxyethoxy)-ethyl)-piperidinium TFSI obtained due to 2 stage procedure from N-methylmorpholine and N-methylpiperidene respectively and investigated by simultaneous thermal analysis, NMR ^{1}H and ^{13}C, low-temperature DSC, cyclic voltammetry and electrochemical impedance spectroscopy for electrical conductivity calculations. The ionic liquids described are unique because of wide electrochemical window and thermal stability that is why they are important as electrolytes for supercapacitors and Li-ion batteries. Moreover, they might be supposed to interact with lithium ions with complex compound formation due to ethers fragment in the structure of their cations. Unfortunately, pure ionic liquids have low electrical conductivity and high viscosity, thus their solutions in acetonitrile have also been investigated. Up to our knowledge these ionic liquids were never described before in the literature.

Investigations of these ionic liquids by thermal analysis demonstrate wide range of thermal stability: decomposition starts from 367.2 °C. It was also found that maximum of electric conductivity in acetonitrile solution corresponds to 5.3 S/m and 5.6 S/m at 0.906 M and 1.1 M for morpholinium and piperidinium salt, respectively. Under these values dissociation constant was calculated as 0.0059 mol/l and 0.0089 mol/l. The electrochemical windows were determined as 4.84V for morpholinium liquid and 4.82V for piperidinium one, moreover under the presence of acetonitrile these values changes. Dependence the conductivity of ionic liquids on temperature allowed to determine the activation energy of conductivity was calculated as 35.9 kJ/mol and 27.1 kJ/mol.

THERMOPHYSICAL PROPERTIES AND MICROSTRUCTURE OF MAGNESIUM ALLOYS OF Mg-Al TYPE

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Generally, magnesium alloys of Mg-Al type are used as constructional materials, but their disadvantage lies in their low heat resistance. Addition of suitable alloying elements can be positive to achieve high thermo-mechanical properties. For application of the specific material for thermally stressed cast parts is necessary to consider the extent of their linear and volumetric changes at elevated and high temperatures. The aim of this contribution is to study the behavior of selected magnesium alloys based on Mg-Al during heat stress conditions to simulate real conditions using dilatometric analysis. Effect of heat stress on the microstructure of the alloy was also simulated during experiments. These properties were evaluated on samples of alloys prepared by gravity casting in metal molds were used for determination of above mentioned properties of studied alloys. The effect of metallurgical processing of the alloys on studied parameters was also investigated.

IMPROVED NON-SINGULAR METHOD OF FUNDAMENTAL SOLUTIONS FOR TWO-DIMENSIONAL ISOTROPIC ELASTICITY PROBLEMS

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The purpose of the present paper is to improve the Non-Singular Method of Fundamental Solutions (NMFS) [1] based on the Method of Fundamental Solutions (MFS) and Boundary Distributed Source (BDS) [2] method for linear elastic problems. In the NMFS, the source points and the collocation points coincide and both are positioned on the boundary of the problem domain. In order to remove the singularities of the FS, are the concentrated point sources replaced by the distributed sources over the disks around the singularity. The values of distributed sources are calculated directly and analytically in case of Dirichlet boundary conditions. In case of Neumann boundary conditions, the respective values of the derivatives of the FS, as required in the calculations, have been previously calculated indirectly from the considerations of the solution of the linearly varying simple displacement fields [3]. The problem with this approach is that not all such fields can be used and a careful selection is needed. Recently, [4] suggested a much simpler way to determine the diagonal elements for the Neumann boundary conditions by invoking that the boundary integration of the normal gradient of the potential should vanish. In the present paper, the approach from [4] is extended from potential to linear elasticity problems. It could be applied also to the external domain problems, which previously can't be tackled by the NMFS. Numerical examples, relevant to micromechanics problems, with mixed boundary conditions are presented. The feasibility and the accuracy of the newly developed approach are demonstrated for problems of deformation of metallic grains with inclusions and/or voids.

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STRUCTURE AND MECHANICAL PROPERTIES OF EN AW 6082 ALUMINUM ALLOY PRODUCED BY EQUAL CHANNEL ANGULAR PRESSING

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An apparatus for verification of Equal Channel Angular Pressing (ECAP) technique was installed at the VŠB-TU and it was used for investigation of influence of deformation on development of structure and mechanical properties. Microstructural development of aluminium alloy 6082 during ECAP pressing was investigated to understand the mechanisms of grain refinement and strain accommodation. The samples were extruded at room temperature. Cross-section of original samples was 20 x 20 mm and their length was 110 mm. Deformation forces were measured during extrusion, resistance to deformation was calculated and deformation speed was determined approximately. Analysis of structure was made with use of light microscopy and SEM. Mechanical properties of samples after extrusion were determined by tensile test and by so called penetration test.

MAGNESIUM ALLOYS DIE FORGINGS FOR AUTOMOTIVE APPLICATIONS

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The paper presents an investigation on the effect of process variables and material condition on forgeability of magnesium wrought alloys of Mg-Al-Zn group, AZ31, AZ61 and AZ91. The experimental work includes studies of forging capabilities of the alloys in closed-die forging at hot and warm-working temperatures. Forging tests are performed for material both in as-cast and as-worked condition, for two variants of workpiece geometry. The different variants of the workpiece indicated fracture-related problems in forging magnesium alloys in the warm-working temperature regime, which involved interaction between material condition and process variables, and state of stress. By means of numerical calculations it was concluded, that in addition to material condition, a favourable stale of stress, provided by a closed-die, can greatly improving the forgeability of magnesium alloys in the warm-working range.

SYNTHESIS OF NiTi/Ni-TiO_2 COMPOSITE NANOPARTICLES VIA ULTRASONIC SPRAY PYROLYSIS

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In this paper we present the production of NiTi/Ni-TiO_2 composite nanoparticles via the synthesis method called Ultrasonic Spray Pyrolysis (USP). The precursor solution for synthesis of spherical NiTi particles was prepared from orthodontic wire with the chemical composition of Ni (51,46 at.%) and Ti (48,54 at.%). TEM microscopy, in combination with EDX analyses, was used for detailed characterization of the obtained NiTi nanoparticles. The results showed nanoparticle sizes ranging from 60 nm up to 600 nm, depending on the parameters of the production procedure. This has shown the versatility of the new USP synthesis procedure, proving its usefulness for different materials and applications.
Keywords: Ultrasonic Spray Pyrolysis, NiTi/Ni-TiO_2 composite nanoparticles, characterization, TEM microscopy

Povzetek
V tem prispevku je predstavljena izdelava NiTi/Ni-TiO_2 kompozitnih nanodelcev s pomočjo izdelovalne metode tako imenovane ultrazvočne razpršilne pirolize (USP). Sferični NiTi nanodelci so bili izdelani iz ortodontske žice s kemijsko sestavo Ni (51,46 at.%) in Ti (48,54 at.%). Za karakterizacijo nanodelcev smo uporabili TEM mikroskopijo v kombinaciji z EDX analizo. Rezultati meritev so pokazali velikostno porazdelitev izdelanih nanodelcev v razponu od 60 do 600 nm, v odvisnosti od parametrov izdelave. To je potrjuje vsestranskost novega USP izdelovalnega procesa in njegovo uporabnost za različne materiale in aplikacije.
Ključne besede: ultrazvočna razpršilna piroliza, NiTi/Ni-TiO_2 kompozitni nanodelci, karakterizacija, TEM mikroskopija

INFLUENCE OF THE HIP PROCESS ON PROPERTIES OF AS-CAST Ni-BASED ALLOYS

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Ni-based alloys, including alloys based on intermetallic compounds (IMC) and superalloys are still in the forefront of interest. These alloys that can be used even at high-temperatures, are continuously investigated thanks to their excellent mechanical and corrosion properties[1,2]. We prepared Ni_3Al based alloys and selected types of modified superalloys as experimental samples. The samples were molten by vacuum induction melting and then cast centrifugally into the shaped graphite mould. Final castings had the shape corresponding approximately to the test specimen. It was established after flaw detection analysis, that the castings contain numerous casting defects. That's why part of the samples was subjected to hot isostatic pressing (HIP). Conditions for HIP were derived from literature sources [3-5]. Hot isostatic pressing can create by sufficient compaction a homogenous structure with reduced number of pores and casting defects (shrinkage cavities and contractions) even in castings. This was confirmed in our case as well. Castings contained after HIP substantially less casting defects. Part of the samples in as-cast state and samples after HIP was ground to precise dimensions of the test specimen and tensile testing was performed. We performed comparison of selected mechanical properties in as-cast state and after HIP. In majority of investigated alloys the HIP process led to an increase of determined strength and ductility.

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IDENTIFICATION OF MATERIAL PARAMETERS OF SANDWICH COMPOSITE PANEL FOR LOW-VELOCITY IMPACT LOADING

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This contribution is focused on finite element simulation of dynamic response of sandwich plate loaded by transverse low-velocity impact. The model is capable to describe non-linear orthotropic elastic behavior and damage of skins and elasto-plastic behavior of the core foam. The identification of material parameters of laminated textile fiber-glass composite skin and polyurethane foam core was performed using combination of gradient optimization method and finite element simulations. Experiments, static tensile and compressive tests, were performed separately for skin and core and averaged force-displacement curves were used as target functions for identification process. User defined material model for composite skin was implemented into Abaqus software using umat subroutine. Strengths of materials in material axes directions were determined directly from the experimental results. Static three-point bending tests of sandwich beam were performed in order to validate obtained data from the static tests.

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PHYSICO-METALLURGICAL ASPECT OF FORMATION OF CORE–SHELL AND HOLLOW NANOSPHERES

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In the present work, we report, on hollow nanospheres produced via PLA in nitrogen ambient gas based on Al-O, Co-Pt and Sm-Fe(Ta)-N system, which could be technologically relevant in biomedical, magnetic and catalytic applications. The structure and composition of core-shell and hollow nanospheres were characterized by scanning/transmission electron microscopy (STEM/TEM), energy-dispersive x-ray spectroscopy (EDXS) and electron energy-loss spectroscopy (EELS). Combined STEM-EELS technique was applied to calculate nitrogen density and pressure inside the voids within individual nanospheres, providing data for reconstructing formation mechanism of core-shell and hollow nanospheres. Obtained results confirm the idea of generalized formation mechanism of core-shell and hollow nanospheres, where the spheres are nucleated at relatively high pressure and temperature in the plasma plume. Hollow spheres are afterwards formed by a combined mechanism of gas intake, gas condensation within the saturated liquid sphere and melt-soldification phenomena. The proposed formation mechanism opens the possibilities for the fabrication of metallic hollow nanospheres in various material systems.

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DECREASING OF CARBONITRIDES SIZE AND CONTENT IN AUSTENITIC STEEL BY MEANS OF HEAT TREATMENT

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Article deals with the heat treatment of AISI 321 steel and its variants used in energy industry. AISI 321 is typical austenitic stainless steel with combination of main alloying elements Cr-Ni in ratio ca 18/10 of weight percents. Experiment was focused on influence of heat treatment a thermomechanical processing on the microstructure and especially on the morphology and distribution of titanium carbo/nitrides and its clusters. Three experimental heats with various amounts of carbon, titanium and boron were prepared and subjected to different heat treatment regimes. Also different solution annealing after forging was applied. Microstructure of the samples was analyzed by means of optical and scanning electron microscopy. Numerical simulation in DEFORM HT software was used for simulation of cooling in different environments after forging.

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OPTIMIZATION OF SECONDARY COOLING IN CONTINUOUS CASTING PROCESS WITH DIFFERENT SLAB CROSS-SECTION

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Although the continuous casting of steel was originated almost 60 years ago, the production still suffers from many serious defects in the final structure. Cracks in solidifying slab are caused by variable thermal conditions and mechanical stresses. The secondary cooling zone has an important impact on the internal and surface quality. Thus, the optimal control of cooling intensity is inevitable in order to get high quality products. Nowadays, the control of the slab temperature via numerical temperature field models is a common practice to control the slab quality[1]. Unfortunately, the actual state in many steel works is still the setting of the cooling intensity as a simple linear function of the casting speed. However, the final temperature field is influenced by many other factors, such as chemical composition of steel, actual value of casting temperature, size of slab cross-section, etc.

This paper describes differences between optimal cooling parameters for different slab cross-sections (width between 800 mm and 1600 mm, thickness between 180 mm and 250 mm) produced by a real caster. The tool for this analysis is based on the original numerical model of temperature field and on the closed-loop fuzzy regulator[2]. The block diagram can be seen in **Fig. 1**.

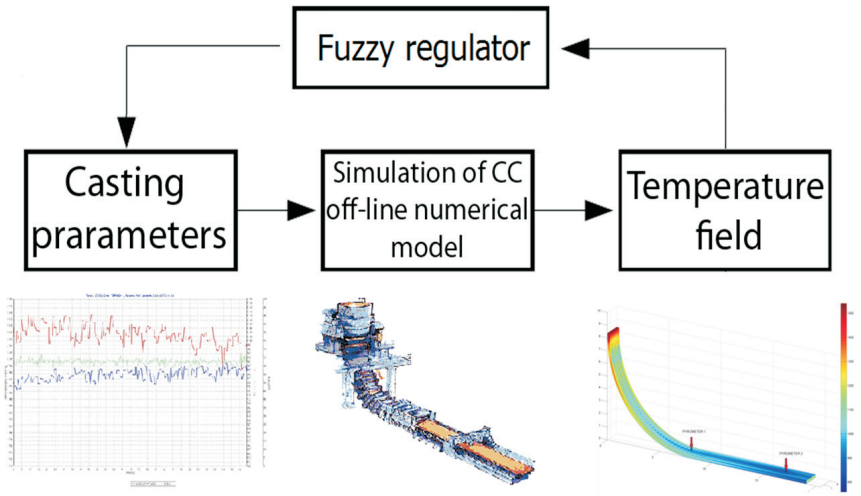

Fig. 1 Block scheme of off-line regulation model

The results show that the proper setting of secondary cooling cannot be done without a consideration of all main casting factors.

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MODELING OF MICRO-DAMAGE OF E-GLASS/EPOXY COMPOSITE

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The paper deals with gradual stiffness decrease of long-fiber E-glass/epoxy composite caused by micro-damage induced by cyclic loading. The objective of the research is to build the micro-mechanical model capable of predicting stiffness degradation of composite of any orientation or stacking sequence.

Extensive experimental testing has been carried out to both obtain input data for numerical models and to validate these models. Three sets of specimens ($[0]_8$, $[-30/30]_S$ and $[-60/60]_S$) were tested statically and in stress controlled fatigue to obtain input data for numerical models. Two sets ($[0_2/90_4]_S$, $[0;90_2;\pm45;90]_s$) were tested for validation. Maximal strain induced by constant amplitude of load is recorded as a function of loading cycles. In addition, micro-damage including failure mode was monitored using in-situ micro-camera. Ultimate loading, number of cycles, failure mode and failure density for the given material system for different material orientation is determined in this manner.

Above mentioned data have been used as the input parameters for numerical modeling of mechanical properties degradation. Micro-mechanics of failure (MMF) approach was chosen. This approach seems to be the most promising approach for predicting mechanical and fatigue response of composite materials. Representative volume element (RVE) was built using FEA and proper boundary conditions were applied. Material and failure models of the constituents were applied to RVE. Particular properties for this material system were back-calculated from basic fatigue testing (0°, 30°, 60°) using same micromechanical FEA model. Mechanical properties for more complicated layups were predicted then. Results were compared to the results of experimental testing.

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SIMULATION OF CONTINUOUS CASTING OF STEEL UNDER THE INFLUENCE OF EXTERNAL MAGNETIC FIELD BY USING LOCAL RADIAL BASIS FUNCTION COLLOCATION METHOD

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The purpose of the present paper is to present the initial results obtained by using Local Radial Basis Function Collocation Method (LRBFCM)[1] for a two-dimensional (2D), simplified continuous casting of steel model with external magnetic field. The model combines Navier-Stokes and Maxwell's equations, which are numerically solved for a non-uniform node arrangement. In the numerical procedure, explicit time stepping is used on an overlaping five-noded subdomains, where local collocation with Multiquadric Radial Basis Functions (MQ RBF) is implemented. The pressure-velocity coupling is solved with Fractional Step Method (FSM)[2].

The method has already been tested on several benchmark test cases, such as natural convection in cavity with magnetic field[3], lid driven cavity[4], and flow over the backward facing step with transverse magnetic field. The obtained results show good agreement with other numerical procedures, such as Finite Volume Method (FVM)[5]. The main advantages of the LRBFCM are its simplicity and the absence of polygonalisation, which can in more complex geometries present a serious problem.

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MICROWAVE ASSISTED SYNTHESIS OF Ag-ZnO SUB-MICROPARTICLES AND THEIR PROPERTIES

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Zinc oxide and silver sub-microparticles have shown strong antimicrobial activity towards gram-positive and gram-negative bacteria such as Staphylococcus aureus or Escherichia coli[1,2]. Non-destructible, highly efficient and environmentally friendly microwave assisted synthesis can be utilized in preparation of these sub-microstructures. For this purpose, one-step microwave assisted synthesis of Ag, ZnO sub-microparticles and their combination was employed. The influence of various concentrations of precursors and used reduction/precipitation agent on the properties and morphology was investigated. Prepared materials were synthesized by hydrothermal route in an open vessel microwave system with an external reflux cooler. Zinc acetate dihydrate and silver nitrate were used as source of zinc and silver ions, hexamethylenteramine was chosen as reduction and precipitation agent. X-ray diffraction (XRD), energy dispersive X-ray analysis (EDX) and scanning electron microscopy (SEM) were used for structure and morphology characterization.

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DEVELOPMENT OF TUNGSTEN CARBIDES NANO COMPOSITES FOR ULTRA HARD MATERIALS APPLICATIONS "SYNTHESIS AND CHARACTERIZATION"

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Nano ceramics and nano ceramic composites have received a great deal of attention in the last few decades due to their wide range of applications including but not limited to durable ceramic parts for automotive parts and cutting tools[1]. In the current study, comparison between two different nano-composites of tungsten carbides (WC-6 wt% 3Y-ZrO_2 and, WC-Co) is made, in order to distinguish between the effect of ceramic binder in what called "dry sintering", and metallic binder with wet phase sintering, on the toughness and hardness of the synthesized composites. Synthesis is made through pressure less sintering and hot isostatic pressing processes. Moreover, the effect of nano sized particles size was also studied. The mechanical properties, such as hardness, toughness, and wear factor are examined for both composites after different sintering routes, along with the XRD and SEM analysis for the powders before preparation, after mechanical milling, and after sintering. The new touch in the current work is the development of nano-nano structure of tungsten carbide composites, in order to enhance the toughness as well as elevated temperature properties[2].

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ELECTRICAL AND STRUCTURAL PROPERTIES OF SOLUTION ASSISTED MoS_2 LAYERS

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Molybdenum disulfide (MoS_2) has recently become of interest to semiconductor industry. However, the current methods for it synthesis require strict environments that are not compatible with standard fabrication processes. We report easy MoS_2 layer deposition method from some dispersive solutions [1].

The Raman spectrum of bulk MoS_2 showed two significant peaks: an in-plane (E_{2g}) mode located at 384 cm^{-1} corresponding to S atoms vibrating in one direction and Mo atom in the other. An out-of-plane (A_{1g}) mode which is located at 409 cm^{-1} corresponds to S atoms vibrating out of plane [2]. No other significant peaks were observed indicating only MoS_2 phase have formed.

TEM results also confirmed that MoS_2 particles have formed having hexagonal structure. Measured interplanar spacings 0.28 nm and 0.16 nm corresponds to the spacings of (100) and (110) of hexaganol MoS_2 structure recpectively [3]. This indicates c-axis being normal to sample surface, which was also validated by XRD method.

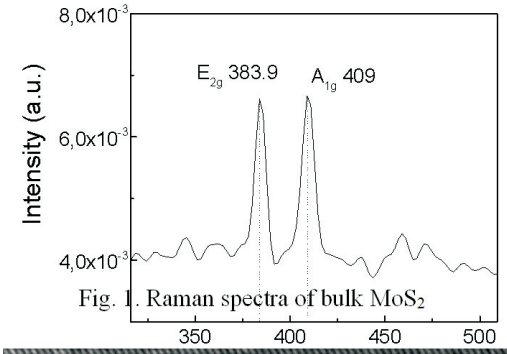
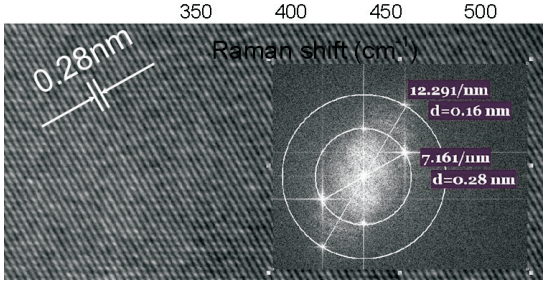


Fig. 1. Raman spectra of bulk MoS_2



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CORROSION MECHANISMS OF WE43 Mg-ALLOY IN A SIMULATED BODY FLUID

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Mg-alloys have recently caught interested as potential biodegradable materials for orthopedic and cardiovascular implant applications. This is because of its good biocompatibility and satisfactory mechanical properties. Mg-alloy biodegradation occurs by corrosion. However, the corrosion rate of Mg-alloys is too high, leading to a premature decrease in the mechanical properties and possible implant failure. In addition, hydrogen gas is formed at quantities that cannot be managed by the human body. Therefore, development of new Mg-alloys with improved corrosion resistance and biocompatibility is needed. However, this is hampered by the lack of a complete understanding of the Mg-alloy corrosion mechanism in the real physiological environment (human body) and by difficulties at emulating such environment *in vitro*. Therefore, the objective of this work was to investigate the short-term corrosion behaviour (up to 5 days) of WE43 Mg-alloy in a modified simulated body fluid, using a range of surface characterization, electrochemical and analytical experimental techniques.
Four stages of the WE43 Mg-alloy corrosion process were identified: Stage 1) Electrochemical oxidation of the α-Mg matrix with the formation of adsorbed Mg^{+} intermediates and chemical and electrochemical production of hydrogen gas. This is accompanied by the formation of an amorphous carbonated apatite/$Mg(OH)_2$ mixed corrosion layer; Stage 2) Increase in the corrosion layer thickness and protective ability leading to a decreased water access to the substrate/$Mg(OH)_2$ interface. Continued chemical reaction of adsorbed Mg^{+} intermediates leads to dehydration of the $Mg(OH)_2$ inner layer and to the subsequent formation of a MgO protective film; Stage 3) Decrease in corrosion rate due to the increased MgO inner layer coverage leading to a corrosion layer formation/dissolution equilibrium. A higher open circuit potential and the presence of aggressive chloride ions lead to local dissolution of the corrosion layer and onset of a localized corrosion process; and Stage 4) Lateral growth of stable pits due to an increased intermetallic region and local production of hydrogen gas, with the subsequent increase in water access and gradual destruction of the MgO inner layer. It was also concluded that the rate of corrosion process is influenced by the type of corrosion measurements done; batch (no electrolyte renewal), batch with daily electrolyte renewal, and continuous electrolyte flow.

THERMO-MECHANICAL TREATMENT OF Ti-Nb-V-B MICROALLOYED STEEL FORGINGS

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The work presents research results of the influence of thermo-mechanical treatment via forging on microstructure and mechanical properties of newly elaborated microalloyed steel containing of 0.28% C, 1.41% Mn, 0.028% Ti, 0.027% Nb, 0.019% V and 0.003% B. Conditions of forging with the method of thermo-mechanical treatment were developed basing on the analysis of precipitation kinetics of MX interstitial phases in a solid solution, plastometric examinations [1] and investigations of the kinetics of supercooled austenite phase transformations. Light microscopy and transmission electron microscopy techniques were used to reveal the microstructure of samples obtained as a result of the thermomechanical forging. Mechanical properties and hardness tests as well as resistance to cracking using Charpy V samples at room and lowered temperature were carried out. Applied thermo-mechanical treatment allows obtaining fine-grained microstructure of austenite during hot-working and production of forged parts, which acquire advantageous set of mechanical properties and guaranteed crack resistance after controlled cooling from finishing plastic deformation temperature and successive tempering. Forgings produced with the method of thermo-mechanical treatment, consecutively subjected to tempering in the temperature range from 550 to 650°C, reveal the values of $YS_{0.2}$ equal from 994 to 939 MPa, UTS from 1084 to 993 MPa, KV^{-40} from 77 to 83 J [2].
Executed analyses of mechanical properties, crack resistance and hardness in quenched and tempered state revealed full usability of elaborated microalloyed steel for production of forged machine parts with high strength and crack resistance, also at decreased temperature with the method of thermo-mechanical treatment. The applied thermomechanical forging conditions can be useful for elaboration of an industrial forging technology for selected forged elements of microalloyed steels with high strength and guaranteed crack resistance.

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ULTRASONIC PROPERTIES OF EPOXY RESIN/MARBLE WASTE POWDER COMPOSITES

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Non-destructive techniques are suitable alternatives for characterization of composites. Based on this, this work aims to analyze the composites of Epoxy Resin (ER) / Marble Waste Powder (MWP) were obtained by precipitating marble processing plant wastewater using different coagulants, such as sepiolite, pumice and zeolite in dosages of 0.5 and 4 g/500 mL. The effects of marble powder, coagulant type and dosage on the ultrasonic properties of ER/MWP composites were investigated. The ultrasonic wave velocities of composites were measured with the pulse-echo method at room temperature by a flaw detector. The values of the acoustic impedance, Poisson's ratio, and elasticity constants of the samples were calculated by the measured values of the densities and both longitudinal and shear ultrasonic wave velocities. According to the results, the ER/MWP composite using sepiolite coagulant in dosages of 4 g/500 mL showed the best values of elastic constants.
Key words: Ultrasonic testing, Marble waste, Composites, Ultrasonic properties.

COMPRESSION STRENGTH OF THE ALUMINIUM FOAM

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Compression strength of the aluminium foam and its deformation behavior during the loading are important properties for crash absorbing elements. This work is focused on evaluation of the compression strength's effect and effect of the foam's ductility on the deformation during the crash process. For this purpose foam samples of different aluminium alloys have been manufactured through the powder metallurgy route. Chemical composition of the used alloys corresponded to composition of 7075 and 6061 alloys. Expansion rate of the foamable samples was measured through the expandometer device. Resulting porosity was evaluated through the computer 3-D x-ray tomography. An additional heat treatment T6 has remarkable increased the strength and stability of the cellular structure and the observation effect of heat treatment on the load pressure test. The compression strength and deformation behavior were measured by un-axial compression test.

MICROENCAPSULATED PHASE CHANGE MATERIALS FOR LATENT HEAT STORAGE: THERMAL CHARACTERISTICS AND BUILDING APPLICATION

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A significant problem of the utilization of renewable energy is the mismatch between the demand and availability. Heat storage can significantly contribute to meeting society´s needs for more efficient, environmentally benign energy use in building heating and cooling applications (Dinçer *et* Rosen, 2002). Heat can be stored by sensible or latent heat storage techniques. Nowadays, activated concrete structures are used as an alternative cooling and heating systems. Light-weight timber structures with equivalent heat storage capacity can be used instead of these heavy-weight structures. The latent heat storage with the use of microencapsulated Phase Change Materials (PCMs) is a way to provide an adequate thermal mass within small thickness of thermally activated structures (Koschenz *et* Lehmann, 2004). A suitable phase change temperature and a large melting enthalpy are two obvious requirements on the PCMs (Mehling *et* Cabeza, 2008). A series of experiments in the lab and the test rooms have been carried out to investigate thermal behavior of microcapsulated PCMs for building applications. Microencapsulated PCM Micronal® DS 5040 X was used as latent heat storage medium in combination with gypsum plaster. The Differential Scanning Calorimetry (DSC) was used for thermal analysis of the latent heat storage medium. The storage medium underwent thermal cycling for assessment of heat storage capacity changes during proposed service life. The floor structure and the plasterboards fixed on the ceiling and walls of the experimental room with integrated PCMs were thermally activated by capillary tubes. The performance of the system was continuously observed and evaluated.

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THE INFLUENCE OF THE STRAIN RATE ON THE PLC EFFECT AND ACOUSTIC EMISSION IN SINGLE CRYSTALS OF THE CuZn30 ALLOY COMPRESSED AT ELEVATED TEMPERATURE

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In many alloys during tensile (or compression) tests a heterogeneous plastic deformation is to be observed in the form of irregularities on the work-hardening curve. The earliest investigations concerning this phenomenon in medium-carbon steel and aluminium were published by Portevin and Le Chatelier in the year 1923, hence called PLC effect [1, 2]. One of the more recent methods of analyzing the phenomena occurring in the course of plastic deformation is the acoustic emission (AE). This method consists in the detection and analysis of the acoustic signal emitted by the material while it is mechanically loaded [3].

The aim of investigations was to determine the effect of the strain rate in the test of free compression of CuZn30 single crystals with a crystallographic orientation [$\bar{1}$39] at 300°C on the phenomenon of heterogeneous plastic deformation of the type Portevin - Le Chatelier. Moreover, the relations between the work-hardening curve σ-ε displaying the PLC effect and the characteristics of the signals of the acoustic emission generated in the uniaxial compression test have been determined. It has been found that the process of plastic deformation of the tested single crystals generates in the analyzed range of frequencies up to 35kHz differentiated sources of acoustic energy emission, generated mainly impulsive emission by signal events correlated with oscillations of stresses on the work-hardening curves σ-ε. The strain rate affects mainly changes in the intensity of oscillation typical for PLC effects.

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STUDY OF PHASE TRANSFORMATIONS IN Cr-V TOOL STEEL

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The properties of steels are very dependent on phases present in microstructure. Wear resistance and thermal stability of tool steels are achieved by the presence of different types of carbides. So the chemical composition and heat treatment play a crucial role in optimizing properties of tool steels.
The phase transformations in Cr-V tool steel were analyzed during heating from room temperature up to 1100°C using XRD, dilatometry and DSC techniques. After homogenization annealing the microstructure of investigated steel consists from ferritic matrix and M_7C_3 and MC carbides as determined using SEM, EDX and XRD techniques.
Experimental results were compared to computational results (Thermo-Calc, Dictra) and the kinetic models of ferrite-austenite transformations and dissolution of M_7C_3 carbide were proposed and the related parameters were evaluated.

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MACHINABILITY AND MICROSTRUCTURE INVESTIGATION OF ALUMINUM ALLOYS AA 6062

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Aluminium alloys AA 6062A-T6 (AlMgSiBiSn) is widely used as free machining aluminium alloys due to the environmental issue. In AA 6062A-T6 alloys Pb is substituted by Bi and Sn. The present paper presents the microstructural characteristics of an extruded AA6012A–T6 (AlMgSiBiSn) alloy and the microstructural changes occurring during different manufacturing operations and changing the parameters. The machinability of the AA6062A-T6 alloy is the most important property of those alloys. Theory indicates that the extensive plastic deformation induces a preferred orientation of the grain structure and secondary phases along the shear plane, and a local increase in the alloy temperature. Low melting point compounds, such as the Sn and Bi bearing particles, transform into a soft or liquid state, changing their initial compact shape to assume needle-like morphology. The β-Mg_2Si and α-Al(FeMn)Si particles are not influenced by the working temperature and keep their initial shape. However, the low melting point compounds enable the material during the machining to break in small chips.

There is also the possibility for a free machining aluminum alloy to contain an effective amount of one or more high melting point constituents that provide enhanced machining capability. The high melting point constituents occupy from about 0.1 to about 3.0 volume percent of the aluminum alloy. The constituents can be any material that is essentially insoluble in the aluminum alloy matrix so as to form a discontinuity and one that will resist deformation during machining to enhance the formation of voids between the matrix and the free machining constituents. The constituents include elements, nitrides, oxides, borides, carbides, silicides, aluminides and combinations thereof that have a high melting point and high strength and low solubility in aluminum at the elevated temperature so that the constituents resist deformation during the machining operation. The free machining aluminum alloy can be formed as a workpiece and subjected to any machining operation.

ELECTRODEPOSITED HARD MAGNETIC $Fe_{50}Pd_{50}$ NANOWIRES SYNTHESISED FROM THE AMMONIUM CITRATE BASED BATH

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The controlled growth of Fe-Pd-based nanowires has been a topic of many investigations in the last few years, because of their high magnetocrystalline anisotropy (high *H*a=280 kA/m) which is interesting for their potential applications as high density magneto recording media or in nano-electronic devices [1]. In this study densely packed near equiatomic Fe-Pd nanowires were synthesised via template-assisted electrodeposition method. The Fe-Pd nanowires were deposited from a single electrolyte based on $FeCl_3$, $PdCl_2$, $(NH_4)_2C_6H_6O_7$ and $NH_{3(aq)}$ with pH 9 into Al_2O_3 membranes with the pore diameter 200 nm (AAO). Densely packed 2.5 µm long $Fe_{54\pm4}Pd_{46\pm4}$ nanowires were synthesised using a pulse plating technique with deposition potential –1.4 V for 2 s and equilibrium potential –0.1 V for 10 s measured vs. Ag/AgCl electrode for 5000 cycles. The XRD pattern of the as-deposited Fe-Pd nanowires shows that they consist of the *fcc* Fe-Pd phase. To induce the phase transformation the Fe-Pd nanowires were annealed at 600 °C in forming gas (Ar + 7 % H_2) for 1h. The XRD pattern of the annealed Fe-Pd nanowires at 600 °C shows the development of the $L1_0$ phase for which a (200) peak splitting into (200) and (002) is characteristic, together with reflections of *bcc*-Fe phase. The magnetic properties of the as-deposited nanowires show a soft magnetic behaviour with low H_C and easy axis aligned perpendicular to nanowire axis. A significant improvement of coercivity in both measured directions $H_{C||}$=98.7 kA/m and $H_{C\perp}$=118.6 kA/m was achieved after annealing at 600 °C and can be attributed the development of the $L1_0$ phase having high magnetocrystalline anisotropy, and is in accordance with the XRD spectrum. Coercivity $H_{C\perp}$=118.6 kA/m represents the highest measured value for the $Fe_{50}Pd_{50}$ nanowires deposited in the alumina template until now.

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CHITOSAN-*GRAFT*-POLY(SODIUM-L-GLUTAMATE): SYNTHESIS AND APPLICATION (P, MR)

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Chitosan (Chi) is deacetylated chitin obtained from renewable resources. Due to its attractive properties, e.g., mucoadhesivness, biocompatibility, biodegradability, gel forming ability, antimicrobial activity, low toxicity and non-immunogenicity, it is widely studied for application in biomedicine.[1] Since Chi possesses primary and secondary hydroxyl functional groups as well as primary amino functional groups it can be chemically modified in several ways.[2] Polypeptides or poly(amino acids) are biocompatible and biodegradable polymers that have found application in biomedicine as drug delivery carriers.[3,4] Synthetic well-defined homo- and copolypeptides with narrow molecular weight distribution are conveniently prepared by ring-opening polymerization (ROP) of the á-amino acid *N*-carboxyanhydrides (NCA).[3,5]

Chi is known to be soluble in acid aqueous solutions, while multistep procedures are typically applied to prepare its organosoluble derivatives. To circumvent this limitation, we have prepared Chi salt of (±)camphor-10-sulfonic acid which is soluble in DMSO.[6] Chi (±)camphor-10-sulfonate salt was thus applied as a macroinitiator for the preparation of Chi-*graft*-poly(ă-benzyl-L-glutamate (Chi-*g*-PBGlu) with various lengths of the grafted PBGlu chains. The cleavage of the benzyl ester protective groups of the PBGlu has been successfully achieved by applying tetrabutylammonium hydroxide (TBAH)[7] to prepare chitosan-*graft*-poly(sodium-L-glutamate) (Chi-g-PGlu). Protected and deprotected graft copolymers were characterized by SEC-MALS and various NMR techniques (^{1}H, ^{13}C, COSY and gHSQCad), to confirm successful grafting of the poly(amino acid) moiety to the Chi backbone.

Chi-*g*-PGlu copolymers were loaded with Granulocyte Colony-Stimulating Factor (GCSF) with the addition of trimethyl chitosan as a positively charged polymer to form polyelectrolyte complexes. We achieved excellent results, where nanoparticles with mean diameter of 224-231 nm were formed. Association efficiences achieved were up to 82 % and the resulting final loadings reached up to 41 %.

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ELECTROCHEMICAL BEHAVIOR OF BIOCOMPATIBLE TITANIUM ALLOYS

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Titanium based materials are widely used as biocompatible implants in orthopedics, surgery and dentistry for their excellent mechanical, physical and biological performance. In spite of their good corrosion resistance, electrochemical behavior depends on many factors, like thermo mechanical treatment or type of corrosion environment. The electrochemical behavior of Ti6Al4V and Ti22Nb alloys has been studied in 0.15M (0.9%) physiological sodium chloride solution at room temperature (22±1°C). The experimental samples of Ti6Al4V alloy were in the different state of thermo mechanical treatment: as-received and heat worked. The samples of Ti22Nb were studied in as-cast, heat treated and aged stages. The microstructure of alloys was observed using light microscopy after polishing and etching in Kroll´s reagent. The corrosion rates were estimated by the Tafel extrapolation method.

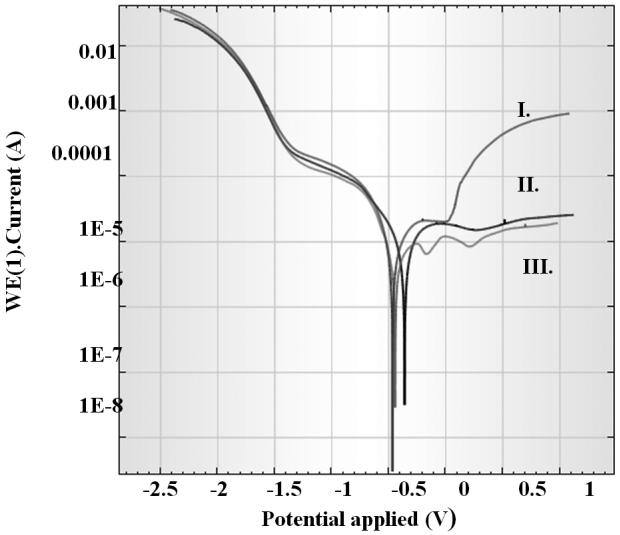

Fig. 1 Linear polarization curves obtained in 0.15M NaCl solution at room temperature for Ti6Al4V in stages: I. as-received, II. after heat working A, III. after heat working B.

Acknowledgment
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MATERIAL-TECHNOLOGICAL MODELLING OF DIEFORGING FOR COMPONENTS FROM 42CrMoS4 STEEL

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In accordance with the current trends towards economic savings, efforts are also being made in the field of forging to find new procedures leading to increased productivity and a reduction of manufacturing costs. Material-technological modelling is one possible instrument for the design and subsequent optimization of the realforming process. This is the thermomechanical treatment of small volumes of material using a thermomechanical simulator, which allows examination of the conditions of a real forming process. The results of material-technological modellingallowus to describe the effect of parameter change in the existing technologies, as well as to give an idea about the development of the structure and properties of the final product during implementation of new technologies.
This article deals with the development of a material-technological model for a real component made from 42CrMoS4 steel produced by die forging, which consisted of four operations. Initial data for describing the whole forging process was measured on real forging lines.These data were used for the whole FEM simulation. Atdifferent points duringforging, the true strain and temperature was obtainedby FEM simulation.A material-technological model based on data from the FEM simulation was subsequently tested on the thermomechanical simulator.The significant structural conformity (phase and morphological) between real forging and the model was achieved by application of the thermomechanical treatment. The structure consisted of ferrite-bainite mix with a hardness of about 300 HV10. The degree of conformity of hardness HV10 between real forging and the model was 99 %, which is significantly higher than usual results.

DECREASING OF CARBONITRIDES SIZE AND CONTENT IN AUSTENITIC STEEL BY MEANS OF HEAT TREATMENT

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Article deals with the heat treatment of AISI 321 steel and its variants used in energy industry. AISI 321 is typical austenitic stainless steel with combination of main alloying elements Cr-Ni in ratio ca 18/10 of weight percents. Experiment was focused on influence of heat treatment and thermomechanical processing on the microstructure and especially on the morphology and distribution of titanium carbo/nitrides and its clusters. Three experimental heats with various amounts of carbon, titanium and boron were prepared and subjected to different heat treatment regimes. Also different solution annealing after forging was applied. Microstructure of the samples was analyzed by means of optical and scanning electron microscopy. Numerical simulation in DEFORM HT software was used for simulation of cooling in different environments after forging.

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COMPONENT COATINGS - OVERVIEW, PROPERTIES AND CONCERNS IN COATINGS SELECTION

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In the last decades a tremendous progress has been done in the field of hard coatings and surface treatments. The majority of research work refers to improvement of mechanical and tribological properties of coatings, which in most cases are deposited on “hard” substrates, i.e. ceramics and high-speed steels, and used for cutting tools. However, requirements for forming tools and machine components are quite different from those for cutting tools. In addition to a hard, wear resistant surface with good frictional and anti-galling characteristics, a tough, fatigue resistant core is necessary. In the contrast to high-speed steels, hardened and tempered tool and low alloy steels reach lower hardness after heat treatment, but provide higher fracture toughness. On the other hand, high hardness and internal compressive stresses of the case formed by plasma nitriding can lead to simultaneous increase in load carrying capacity of the steel substrate as well as to improved tribological properties of the coated parts. Therefore, the combination of plasma nitriding and hard-coating would allow function sharing between the core material, the hardened case and the surface, which is of special interest for application in complex stressed machine elements. However, for successful use of coated components certain requirements need to be fulfilled in order to fully exploit coatings properties and benefits. Otherwise, instead of improved properties of the contact surface we might end up with catastrophic failure.

The intention of the present work is to make an overview of coatings used nowadays in the field of cutting tools, forming tools and machine components and to highlight their properties. However, the main focus of the presentation will be on the requirements of the substrate, coating deposition process and coating itself for successful application of coated components, followed by concerns when it comes to coating selection for a specific application.

NEURAL NETWORK AS A TOOL FOR AUTOMATIC PEAK IDENTIFICATION IN AUGER ELECTRON SPECTROSCOPY

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In our quest to automate the interpretation of the Auger electron spectra we are mainly working on two fronts. One is providing the processing software with the signal that is representative of the Auger electron emission only in order to quantify the spectra as accurately as possible. The removal of the background and the reduction of noise are two essential operations in order to obtain such a "clean" signal. The assessment of Fourier analysis for noise reduction is still a work in progress, while we have used neural network in our previous work for a rough estimation of the background [1].

Neural network has the potential to be used as a tool for achieving automatic qualitative interpretation as well. Some form of automatic peak identification is possible in the processing software already in use, but this task is performed with many errors, mainly due to noise. We could employ neural network to perform this task by training it to recognize peak shapes of specific elements. This could be done by providing the network with different examples of peaks of the already identified elements from previously measured spectra, and then running it on a newly acquired spectrum. Since neural network has the capability to recognize relationships from the data that the user provides, any other method of distinguishing the peaks apart from their peak shapes may also be used. Thus, the use of these methods to automate peak identification, their efficiency, and the obstacles that stand in the way are going to be discussed in this work.

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THE IMPACT OF pH of PHOTOCATALYTICALLY ACTIVE PRINTING INK ON ITS APPLICATION IN UV EXPOSURE INDICATOR

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It has been long known that UV light is hazardous to human skin and eye if its intensity is high (i.e. high irradiance) and/or a long exposure takes place. Most frequently we are exposed to natural UV radiation coming from the Sun, but artificial sources are important as well. To protect ourselves against the harmful effects of UV light, it is important to know how much and for how long human skin can be safely exposed to UV radiation. For this reason a UV dosimeter is needed, which can detect UV light both easily and accurately. A dosimeter could be prepared using photocatalytically active functional printing ink, which record exposure to UV light through reversible or irreversible changes of colour. Such an ink could change its colour if photocatalyst, redox dyes and other additives are used.

In this paper a UV dosimeter based on photocatalytically active functional printing ink is described. Ink is consisted of hydroxyethylcellulose – HEC, a photocatalyst – TiO_2, redox dye – 2,6-dichloroindophenol, a reducing agent – glycerol, and some additives. Two kinds of ink were prepared – one containing a buffer to obtained high pH, and the other without a buffer for a lower pH. The prepared mixtures were applied onto foil by means of a cube applicator, dried, and tested in a UV chamber for different exposure times. The obtained colour changes were analyzed colorimetrically by means of a spectrophotometer.

The results showed that the pH value of the photocatalytically active printing ink had a crucial influence on the colour of the samples, as well as on the rate and mechanism of discoloration of the ink. The results confirmed that it is possible to prepare a functional printing ink which could satisfy all the basic demands for the preparation of a good UV dosimeter. The application of a buffer is crucial for a reversible or irreversible mechanism, as well as for the rate of discoloration of the ink. This regulates the color changes of the UV indicator and defines its application area.

RESISTANCE TO ELECTROCHEMICAL CORROSION OF EXTRUDED MAGNESIUM ALLOY AZ80 IN NaCl SOLUTIONS

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Magnesium alloy AZ80 features the best mechanical properties among magnesium alloys of Mg-Al-Zn type after plastic working. However, its application in the aircraft and automotive industries is limited by low susceptibility to plastic working. Both, alloy AZ80 and other magnesium alloys, have a defect: their low electrochemical corrosion resistance, especially in chloride solutions. [1-5].

The purpose of the study was evaluation of electrochemical corrosion resistance of extruded magnesium alloy AZ80 in NaCl solutions. Resistance to electrochemical corrosion was evaluated on the ground of registered anodic polarisation curves. Potentiodynamic tests were performed in solution with concentration of 0.01-2 M NaCl. In addition, immersion tests were performed, and they enabled to determine corrosion rate. Scanning microscopy was applied to picture microstructure after immersion tests (after removing corrosion products). Optical profilometer was used for measurement of geometrical features of the surface of the alloy.

The results of performed tests prove explicitly deterioration of corrosion characteristics of the alloy with the increase of molar concebtration of NaCl solution. Decrease of corrosion potential and polarisation resistance was observed, as well as increase of corrosion current density. It was proved that irrespective of concentration, pitting corrosion can be found on the surface of the alloy. The potential to use extruded magnesium alloy AZ80 in the aircraft and automotive industries is connected with the necessity to apply protective layers on elements made of the tested alloy.

Acknowledgements

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PEROVSKITE STRUCTURE MATERIALS FOR PHOTOCATALYTIC PROCESSES OBTAINED BY SOLID-STATE REACTIONS

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Perovskite structure materials are studied in respect to numbers of application in this catalytic reactions [1]. As a model compounds with perovskite structure strontium titanate or potassium niobate are often treated. The popular method for preparation polycrystalline materials is solid state route. $SrTiO_3$ and $KNbO_3$ can be manufactured by reaction between relevant oxides and carbonates (TiO_2 and $SrCO_3$ or Nb_2O_5 and K_2CO_3 respectively). The proper selection of manufacturing conditions (e.g. proportion of reactants, temperature, …) will be discussed.

It is also known that to increase of specific surface area of photocatalityc materials the grinding process is often necessary. Specific surface area BET, Scaning Electron Microscopy SEM, UV-VIS Spectrometry, X Ray Photoelectron Spectroscopy XPS to study the influence of the milling processes on the perovskite structure samples were used. In addition to fragmentation of the powders grains some instabilities in their phase and electronic structure were found. The changes resemble instability of perovskite structure materials upon heat treatment [2] and were attributed to reorganization of strontium-oxygen or potassium-oxygen layers in the vicinity of surface region of powdered grains.

The impact of substitutions of the cations in perovskite matrix by selected elements on electronic and phase structure was also studied. The observed changes, especially in the electronic structure were tested practically. The ability to phenol photodegradation in aqueous solutions in presence of manufactured powders were examined.

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PVD OF SnS THIN FILMS FOR SOLAR CELL APPLICATIONS

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Recently, tin monosulfide (SnS) thin films has been used as promising low-cost material in the fabrication of solar cells as an absorber layer due to its non-toxic and abundant elements [1]. SnS has been attracted the researchers because of its near optimum band gap (~1.3 eV) close to the ideal band gap (1.5 eV) for solar photovoltaic conversion and has high absorption coefficient ($>10^4$ cm^{-1})[2]. In the present study, thin films of SnS photoabsorber have been deposited onto molybdenum covered soda-lime glass substrates by high-vacuum evaporation (PVD) with two different thicknesses of 500 nm and 1μm. The changes in structural, morphological and photoelectrochemical properties with the film thickness has been studied.The films showed polycrystalline nature with orthorhombic SnS crystal structure and exhibited (040) as preferred orientation. It was observed that at a thickness of 1 μm the films have improved crystallinity with an evaluated average crystallite size of 55.1 nm. Raman analysis showed the presence of single phase SnS without any other binary phases in. SnS layers grown at a thickness of 1μm showed high photosensitivity and could be considered as an absorber layer for solar cell application.

Figure SEM picture of SnS thin film at a thickness of 1μm

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ON THE USE OF OXIDATION INDUCTION TIME FOR QUANTIFYING RESIDUAL STABILIZERS DURING POLYOLEFINS THERMAL OXIDATION (P)

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Due to their intrinsinc chemical unstability, polyolefins cannot be processed, stored or used without the addition of several stabilizers, which disappear whether by physical processes (evaporation-diffusion…) or chemical reaction with unstable moieties generated during the oxidation process. Understanding the mechanism of stabilizer loss is the key issue for improving the choice of stabilizer. Among the methods for quantifying stabilizer, Oxidation Induction Time measurements by DSC or chemiluminescence is one of the most popular because of its simplicity. This method is based on the assumption that DSC-OIT is actually proportional to the nominal quantity of unreacted stabilizer molecules[1]. It is for instance successfully used for highlighting migration profiles for PE pipes exposed in aqueous media[2], *i.e.* in the case of physical loss only.

This paper mainly focuses on the shape of $OIT_{200°C}$ versus time curves in the case of PE stabilized with 2,6 ditertbutyl phenols during their thermal ageing at 110 or 120°C. It was shown that $OIT_{200°C}$ decreases obeying a pseudo zero order law, which was already described in literature. This curve is discussed using:

- the "wear out" approach based on a plot of $OIT_{200°C}(t)/OIT_{200°C}(0)$ versus t/t_{ind} so as to possibly use residual $OIT_{200°C}$ value as a sort of milestone in the oxidation process,
- kinetic modeling developed in our lab: a previously published model was shown to simulate the carbonyl build-up curve for polyolefins + phenol materials[3]. It predicts an autoaccelerated decrease of phenol concentration inconsistent with OIT results. A kinetic explanation based on the OIT dependence to both residual phenol concentration and oxidation induced hydroperoxides build up was proposed. The implication of this kinetic analysis is that OIT can actually be used for detecting stabilizers in non oxidized materials but is not reliable in the case of polymers having undergone an oxidation.

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POSSIBILITIES OF ELIMINATION THE HIGHER AMOUNT OF IRON IN SECONDARY AlSi6Cu4 ALLOY (EN AC 45000)

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Due to increase requirements on the quality of castings, and also due to the pressure on price of final castings, it is necessary to search for compromises in the casting production from secondary alloys with the presence of various impurities. The main reason for initiating this work was lack of theoretical knowledge about using secondary Al-Si-Cu alloys with higher amount of iron and its appropriate and efficient elimination method in production of castings for automotive industry. The increased content of iron in alloy leads to excluding of intermetallics in various forms, which affect the final quality and durability of castings. Increased content of iron occurs mainly because of remelting or by production of secondary alloys, which are frequently used in automotive industry. The adverse effect of iron on the final properties of the casting is that it greatly affects the mechanical properties. Just small iron content in the alloy impacts the ductility because of the exclusion of β-Al_5FeSi particles in the form of self-excluded needles with different lengths. These needles are often initiators of tension, resulting in the formation of cracks, due to the brittleness their needles. Iron cannot be remove from melt by conventional procedures, but it is possible to eliminate the negative effect by the addition of other elements, which affect the exclusion of iron intermetallic phases in the form with smaller negative effects. The reason to solve this problem was knowledge of the literature, were are mentioned numbers of elements (e.g. Mn, Cr, Ni, V, Zr, Co), which affect the exclusion of iron based phases, but their using in practice is not widespread or implemented.

This article deals with influencing the iron based phases exclusion with nickel, which is in the literature known as an iron corrector. To evaluate the impact of nickel was used evaluation from record of thermal analysis of iron intermetallic, mechanical properties, hardness measurements, microstructure analysis, evaluation of fracture surfaces of bars from static tensile test and EDX analysis. The experimental work shows that increasing nickel content in the alloy does not impact the exclusion of iron based phases (β-phases), i.e. does not change their shape to favourable form. Based on the results of the experimental work it cannot be concluded that nickel is an iron corrector for investigated alloys.

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THE EFFECT OF SELECTED SYNTHESIS PARAMETERS ON THE STRUCTURAL AND FUNCTIONAL PROPERTIES OF NANOCRYSTALLINE TiO_2

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We have studied the influence of selected synthesis parameters on certain key properties (phase composition, specific surface area, microstructure and photocatalytic activity) of nanocrystalline titania. In order to produce the most photocatalytically active titania, especially in visible light region, we have varied parameters such as type of precursor, pH, temperature of hydrothermal treatment, and isopropanol addition. Additionally, various dopants were incorporated into titania.

To investigate the synthesized materials, several analytical tools have been employed. X-ray powder diffraction (XRD) has been used to identify titania phase composition, i.e. rutile:anatase ratio. FE-SEM has been used to determine particle size and morphology. Specific surface area of the samples has been determined by BET method. Thermogravimetry (TG) and differential scanning calorimetry (DSC) have been used to follow thermal decomposition of the prepared amorphous gel and its transformation to crystalline phase. Photocatalytic activity has been measured in a sealed gas-solid system utilizing FTIR spectroscopy. Isopropanol has been used as a model pollutant. To determine photocatalytic activity, acetone formation kinetics have been measured (acetone is the first product of isopropanol oxydation), using zeroth order reaction model.

The results have shown that pH value, the type and concentration of precursor, and isopropanol addition to the reaction mixture before heating have a significant effect on phase composition and consequently on morphology and particle size. These characteristics of titania particles directly affect their photocatalytic activity. Additionally it has been found that doping considerably affects photocatalytic activity under visible light. It has been shown that by varying the anatase:rutile ratio and by doping, photocatalysts with significant activity in visible light can be tailored.

CONCENTRATED INKS FOR SCREEN PRINTING THICK-FILM VARISTORS

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Zink oxide based varistors are very effective as surge and voltage protectors due to their highly non-linear current-voltage response. This is closely related to their microstructure which is composed of highly conducting ZnO grains and Bi_2O_3 rich grain boundaries that act as a potential barrier for electron flow. The voltage at which the grain boundary becomes highly conductive and current starts to flow is referred to as the break-down voltage and is ideally about 3V. The break-down voltage of a varistor is the sum of the break down voltages of grain boundaries between two electrodes and depends on grain size and thickness of the varistor. Varistor ceramic is usually sintered at about 1200 °C (± 100°C) for good densification and microstructure development.

Thick film varistors, made by screen-printing, can be used for overvoltage protection in microelectronics hybrid circuits. The screen-printing advantages are miniaturization, faster and easier production of complex structures and lower production cost. However, the successful realization of thick films varistors is hindered by the large vaporization of Bi_2O_3 due to the high surface to volume ratio in films. These make it necessary lower sintering temperatures and, usually, lower sintering times. However, such heat treatment can cause poor densification and microstructure development of thick films, even more so when the film has a low green density. For a dried printed film to have high green density, the highest possible solids loading of varistor powder is desired, consistent with the concentrated paste still having suitable rheological properties for good screen printing.

We optimized the rheological properties of concentrated paste; zero viscosity, infinite viscosity and rate of recovery by varying paste additives; binder, surfactant and concentration of solid load (varistor powder). Rheological properties were characterized using a rotating parallel plate viscometer and results were compared with the printing performance of pastes, evaluated from the characteristics of the printed films obtained, such as shape, dimensions, thickness, matrix imprints, surface roughness and densification. The optimal composition of additives for concentrated screen printing paste has been defined. The amounts of binder and of surfactant have marked influence on ink viscosity and hence printing performance. Some preliminary results about the characteristics of thick-film varistors sintered at 900ºC will be presented as well.

HYDROXYAPATITE COATINGS ON cp-Ti SURFACES PREPARED BY PLASMA SPRAYING

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The pure titanium (cp-Ti) surface has usually been modified chemically and/or physically in order to improve implant–tissue integration. Different treatments have been used to modify the titanium surface: Hydroxyapatite coatings, preceded or not by acid etching, oxide blasting treatments either with or without chemical etching, thick oxide films obtained by anodic or thermal oxidation etc. These treatments have been used to accelerate the osseo integration process.
The aim of this work is to produce thin hydroxide apatite (HA) coatings on the cp-Ti samples, with new high voltage (HV) pulse power equipment, in order to get a more stable structure which could be usable for further clinical applications. The comparative analysis is done by the use of the classical preparation method: Chemical etching in order to get information for new plasma technology. Microstructural observation of the modified implant surface was done by use of SEM imaging, as well as AES spectroscopy, with the aim of detecting the elements contained in the new surface of the samples.
Microstructural observation showed a modified surface which is very similar to the bone structure.
Key words: hydroxide apatite (HA), cp-Ti, plasma spray coating, characterization

CORROSION OF CrN COATED STAINLESS STEEL IN 3 wt.% NaCl SOLUTION

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Hard ceramic coatings such as CrN have been used mainly for tribological applications (e.g. plastic molding). CrN coatings possess excellent wear and oxidation resistance and low friction coefficients. CrN has been used for decorative applications (particularly for replacing decorative electroplating chrome coatings).

In this work, CrN coating was deposited by Arc PVD on EN 1.4034 stainless steel substrates at $1.1 \cdot 10^{-3}$ mbar nitrogen pressure. The CrN coatings were characterized by XRD and SEM. In-situ measurement of corrosion of CrN coated substrate was made by corrosion potential (Cor.Pot.), Polarization Resistance (PR) method and Electrochemical Impedance Spectroscopy (EIS) in 3 wt.% NaCl solution as a function of immersion time (about 24 hours). Semiconductor scale formed on CrN was identified by Mott-Shottky analysis as p-type semiconductor with flat band potentials, 0.49 V (SCE). CrN coating (0.5 μm thick) consisted of mixture of cubic Cr and hexagonal Cr_2N phases exhibited equiaxed grains and dense coating with small amount of pin holes, voids and porosities. The "transition in corrosion resistance" for CrN coatings at early stage was found based on Cor.Pot., PR and EIS data. CrN did not exhibit any pitting for about 24 hours while the corrosion resistance (R_p and R_{total}) decreased rapidly with time after 5 hours of incubation time.

The transition from high resistance (3 Mohm.cm^2) to low resistance (0.24 Mohm.cm^2) was explained as a result of penetration of electrolyte through Cr_2O_3 oxide layer to Cr_2O_3/CrN interface. Corrosion resistance (R_p and R_{total}) of CrN were greater than that of TiN and substrate [1] during about 24 hours of immersion in 3 wt-% NaCl solution. The cause of greater corrosion resistance of CrN was explained based on the greater blocking character of equiaxed dense CrN coating against penetration of electrolyte through coatings compared to columnar porous TiN coating.

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PYROLYTIC ROUTE FOR STRUCTURED CARBON FORMS: FROM NANOTUBES TO GRAPHEN

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Carbon is a truly unique element because it forms basis for myriads of organic substances. But even the carbon itself, namely its various allotropes, exhibit wide range of properties, sometimes opposite one to other. Typical examples are graphite and diamond: the former is very soft material with high electrical conductivity; meanwhile the latter is the etalon of hardness and an electrical insulation. Present work is focused on experiments for synthesis of different carbon forms – nanotubes, nanofibers, carbon ribbons, carbon coils, porous carbon, few layers graphen fragments or nanoshells. While fist four samples a geometrically anisotropic, others – exhibit 3D or 2D structure. Ribbons – filamentous carbon strips with the thickness of 30–100 nm, should not be confused with ribbons comprising of separate CNTs or graphene nanoribbons less than 1 nm in thickness. All these forms can be synthesized using same experimental basis by pyrolytic technique from aerosol of hydrocarbons (for some cases under presence of transition metals compounds) without hazardous carbon monoxide or sulphur compounds. All the materials obtained were thoroughly characterized by SEM, HRTEM, ED, XPS and thermal analysis.

The mechanism of the formation of such structures as well as specific routes to their characterization is under discussion. It is pointed out that nanoribbons with width of 0.5–4 μm made of concatenated carbon fibers were obtained from needle-shaped ferrocene crystals pyrolised together with corresponding saturated solution in benzene at 950 K and resulted from fast thermal decomposition of ferrocene crystals. This example demonstrates the possibility for template growth of carbon structures. The fact that needle-shaped particle retains its shape during the CVD process additionally supports vapour-solid-solid (VSS) model of carbon structures formation concluding in assumption that metal catalyst remain solid, meanwhile its outer layer is in disordered or quasi-molten state. It is through this layer the carbon diffuses to the growing carbon structures, but not through the bulk particle.

INFLUENCING FACTORS ON THE REACTIVITY OF THE SYSTEM $CaO/Ca(OH)_2$ AS MATERIAL FOR THERMOCHEMICAL ENERGY STORAGE

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The development of materials for thermochemical energy storage gains of interest regarding the economy of future power supply. Compared to materials for sensible or latent thermal energy storage, thermochemical energy storage materials possess a considerably higher storage density. However, the stage of development of such materials is still low, thus for the future there will be a significant necessity of scientific research. Beside the pure amendment of the material on the demands of a specific reactor type, there are various demands made on the storage material, as for example fast and reversible charging/discharging behaviour, cost efficiency and convenient material handling. Following these criteria, one of the most promising candidates for high temperature thermochemical energy storage is the oxide/hydroxide system $CaO/Ca(OH)_2$ with a reaction enthalpy of 104.4 kJ/mol and a temperature region of the hydration / dehydration reaction in the range of 500 °C[1]:

$CaO_{(s)} + H_2O_{(g)} \Leftrightarrow Ca(OH)_{2(s)} + \Delta H_R$

An integration of the material as storage medium in concentrated solar power plants (CSP) is of great interest with regard to an enhancement of the efficiency and economy of the CSP process. In laboratory scale the thermodynamic and kinetic properties of the hydration/dehydration reaction of the pure and modified storage material have been investigated, employing techniques of simultaneous thermal analysis (STA) and calorimetric measurements. Each material was also characterized by employing X-ray powder diffraction (XRD), particle size analysis (LG) and specific surface area analysis (BET). Regarding the reversibility of the hydration/dehydration reaction each material was cycled under steam/nitrogen atmosphere in STA measurements. Several modifications on the material as synthesis conditions, doping with other metal oxides and addition of catalysts were investigated to probe the possibility and the range of an adjustment of the material properties such as rate and temperature region of the hydration/dehydration reaction.

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MODIFIED HEAT TREATMENT FOR IMPROVED PROPERTIES OF DOUBLE-LAYER CAST ROLE

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In practice, wear resistance, lifetime and capability of components and tools to resist loading greatly depend on the residual stress field in the material. This is especially true for hot-rolling applications, which require rolls with hard heat and wear resistant surface, tough core and proper compressive residual stress level to resist Hertzian cyclic loading. If casting, heat treatment, cooling process and surface machining and grinding are not done properly very high and uneven tensile residual stress field may occur, causing drop in wear resistance, cracking or even fracture of the roll.

The aim of this work was to determine the impact of various heat treatments of the double-layer cast rolls no the values and distribution of residual stresses in the rolls made from Semi High Speed Steel with high content of Chromium (SHSS HCS).

Before heat treatment mechanical properties characterization (ovality, hardness and residual stresses) and microstructure of the rolls was checked after the stage of casting and rough grinding. Finite Element modeling was also used to determine the values and the distribution of stresses in the rolls when loaded. Wear resistance of roll outer layer were also determined.

Three different heat treatments were used (classical, shortened and at higher temperature of hardening) to determine its influence on the hardness and the values and distribution of the residual stresses in the rolls. Results showed that heat treatment creates uniform compressive field of residual stresses in the surface layer of the roller. After the classical heat treatment, the maximum value of residual stresses (400 MPa) appeared in the surface layer at the center of the roller and is then continuously reduced toward outer edges of the roller. Shortening the time of heat treatment leads to a 5-10% increase in residual stress in the surface layer of the roller and improves also the wear resistance of the roller material. A similar effect has also increased hardening temperature, where higher hardening temperature results in more than a 30% increase in the compressive residual stress fields.

ANTIBACTERIAL COMPOSITE BASED ON HIERARCHICAL MESOSCALE NANOSTRUCTURED ZnO PARTICLES AND POLYVINYL CHLORIDE

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The microwave assisted solvothermal synthesis of inorganic ZnO nanoparticles is facile method yielding broad variety of active fillers with specific properties. Mixing these particles with commercial polymers is one way how to obtain unique composite materials. Here we report on fast and simple preparation method of antibacterial composite system based on hierarchical mesoscale nanostructured zinc oxide (ZnO) particles and softened medical grade polyvinyl chloride (PVC) as a model polymer matrix with possible application for plastic medical devices. Synthesis of ZnO nanoparticles was carried out under continuous microwave irradiation from soluble zinc salts as precursors. Thus prepared ZnO particles were characterized by XRD, SEM and UV-VIS spectrometry. Mechanical properties and surface antibacterial properties of composite against gram-negative (*Escherichia coli*) and gram-positive (*Staphylococcus aureus*) bacteria species were evaluated.

COMPARISON OF PERMEATION OF ATMOSPHERIC GASES THROUGH VITON O-RING GASKETS FOR DIFFERENT INITIAL CONDITIONS

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Viton O-ring gaskets are frequently used in high vacuum technology for demountable flange and vacuum valves seals. Atmospheric gases and particularly water vapor from humid air permeate through Viton gaskets and thus limit the lowest attainable pressure level in vacuum systems.
In this work a comparison of a vacuum degassed Viton O-ring gasket and fully saturated gasket with atmospheric gases was performed. A reference measurement with an alternative soft metal (Al) gasket for KF type flanges was also done. Permeation rate of each individual gas from atmosphere (water vapor, N_2, O_2, Ar and CO_2) through Viton O-ring was measured using quadrupole mass spectrometer (QMS). The measured data with QMS were analyzed to obtain partial gas flow Q_{gas} which was determined from the ion current signals: $Q_{gas} = I^{+}_{gas} \cdot \Psi_{gas}$ (I^{+}_{gas} is the ion current signal and Ψ_{gas} is the conversion factor of gas flow). The partial gas flow curves Q_{gas} were also modeled using Finite Difference Modeling (FDM). From FDM it is possible to determine diffusion constant, permeability and solubility of the gas in the material. Comparison of measured and model data shows that diffusivity of all gasses is in the range of 10^{-8} cm^2s^{-1}. Regarding solubility, Ar and N_2 have lowest values while O_2 has 10 times higher value. But CO_2 and H_2O have almost 1000 times higher solubility than N_2. This explains why permeability of CO_2 and H_2O in case of Viton samples is so high compared to permeability of N_2, which is the main component of air. At 75% RH and temperature 23°C the water vapor represents only 2.25% concentration of air, and N_2 76.3%, but measured permeation rate of H_2O through Viton O-ring gasket was more than 10 times higher than N_2.

MODELING OF OPERATING PARAMETERS IN SOFC TESTING SYSTEM

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High temperature solid oxide fuel cells (SOFCs) are assembled of three solid components; electrolyte, anode and cathode. In this work samarium doped ceria (SDC) was used as an electrolyte material. Due to similar temperature expansion coefficient Ni-SDC cermet was used as an anode while Pt was used as a cathode.

The aim of this work was to study the materials' response during operation conditions in the testing set-up. Temperature gradients generated within the testing SOFC may cause high stresses in the materials which eventually lead to the delamination of layered structure. Since the accurate temperature control in several points of the multilayer SOFC system is rather difficult or even impossible, a model of mass and energy balances was written and subsequently solved with respect to the method of finite elements in two dimensions. The results of the mathematical modelling during warm-up, steady-state or cool-down periods were used to profile temperature within the testing SOFC set-up and for the prediction of the dimensional changes of individual layers in the SOFC multilayered structure. The influence of the temperature gradients was studied also experimentally.

Based on the modelling results optimization of operating conditions were proposed in order to reduce the thermal stresses built in the materials.

METALLOSILICATES PREPARED BY NON-HYDROLYTIC CONDENSATION REACTIONS

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Non-hydrolytic sol-gel reactions are efficient alternatives to classical aqueous techniques for synthesis of multimetallic oxides and inorganic-organic hybrid materials. We developed non-hydrolytic sol-gel routes to several groups of metallosilicate hybrid inorganic-organic materials based on polycondensation reactions.

Titanosilicate xerogels were prepared by reactions between $Ti(NEt_2)_4$ or $Ti(OR)_4$, R = O^iPr,O^tBu and $Si(OAc)_4$. These non-hydrolytic condensation reactions [1] lead to form Si–O–Ti bonds [2,3] and to release acetic acid ester and diethylacetamide as byproducts, respectively. Then the catalytic activity for epoxidation of cyclohexene was studied.

Alumosilicates were prepared by reactions between $Al(NMe_2)_3$ or $Al(O^iPr)_3$ and acetoxysilanes $R_{4-n}Si(OAc)_n$, n = 1-4 and R = Me, Ph, H, O^tBu. In this case these non-hydrolytic condensation reactions proceeded the formation of Si–O–Al networks [4] and dimethylacetamide or acetic acid ester and as byproducts as well. As a further step, bridged bis(triacetoxysilyl)alkanes $(AcO)_3Si(CH_2)_xSi(OAc)_3$, x = 1, 2, 3, 6 were used for the synthesis. Using alkylacetoxysilanes as silicon precursors we can modify some physico-chemical properties (hydrophobicity, porosity,...). We have examined also surface modification of xerogels to eliminate residual organic groups and to establish their acidic properties.

The resulting xerogels and volatile byproducts were characterized by liquid and solid-state NMR, IR, GC-MS, surface area analysis, TGA, and XRD.

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INVESTIGATION OF PHYSICAL PROPERTIES OF TUNGSTEN-BASED SINGLE CRYSTALS USING ULTRASONIC METHOD

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Using an ultrasonic method, the measurement of longitudinal and transversal velocity v of ultrasonic waves in major crystallographic directions of pure tungsten single crystal and tungsten single crystals alloyed with Ta and Mo was performed. Single crystals were prepared by plasma-arc melting with crystallographic orientation [110]. The crystal density ρ was also measured. The crystal elastic constants Cij, anisotropy factors A, Young modulus E, shear modulus G and bulk modulus B for given crystallographic directions, and mean values of longitudinal and transversal velocities of ultrasound according to Fochtu-Roisu-Chilly method, Young modulus, shear modulus, Poisson ratio and Debye temperature were calculated from the obtained data. The measurement of ultrasound rates was realized by means of pulse apparatus with the frequency of 10 to 30 MHz. It was found that the alloying of pure tungsten with elements, such as tantalum and molybdenum, led to decrease of the average magnitudes v, Cij, and B over various crystallographic and polarization directions, as well as the magnitude of ρ. The effect of alloying elements on the elastic properties of tungsten crystals was identical. It may be concluded on the basis of the obtained results that ultrasonic method can be used for quality control of purity of single crystals of tungsten and its low alloyed alloys by measurement of attenuation effects of ultrasound waves in various parts of the tested samples.

DETECTION OF MOISTURE FLOW IN THE BUILDING MATERIAL

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The text Moisture in building construction material affects the physical properties of buildings and he may lead to their degradation. With few exceptions, building materials are almost never dry. For the expected negative effect of moisture on building materials of structures is needed accurate method of determining the characteristics of their moisture as possible. To record the input data necessary to calculate the conductivity of the capillary conductivity, scientists from the Institute of Building Structures, Brno University of Technology, developed a measuring device.
Has been developed methodology for measuring moisture in the porous material using microwave radiation. The calculation of the coefficient of capillary conductivity and its dependence is based on the moisture curves in 3D in non-stationary state of wetting, determined by non-destructive method.

INFLUENCE OF HEAT TREATMENT ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF ALUMINIUM BRONZE

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Nickel-aluminium bronze CuAl10Ni5Fe4 ranks among copper alloys which retain high strength even at elevated temperatures and which possess good resistance to corrosion and high wear resistance [1, 2, 3]. It has two-phase microstructure consisting of poorly formable phase α and high-temperature phase β which exhibits excellent hot formability. The alloy possesses limited cold formability (due to rapid work hardening) but excellent hot formability in the $\alpha+\beta$ region.

Depending on the cooling rate and subsequent heat treatment, β phase may undergo martensitic transformation to the unstable phase β' which is very hard and brittle and increases the strength and reduces the ductility of the material. In addition, there are other phases in the microstructure termed κ, which consist mostly of Fe or Ni and Al [3, 4, 5], or γ_2 phases known to occur in Cu-Al binary alloys. These phases also increase the strength and reduce the ductility of the alloy. The microstructure therefore consists of the phase α and the $\alpha+\kappa+\gamma_2$ eutectoid.

Influence of thermal treatment on structure and mechanical properties of CuAl10Ni5Fe4 alloy was investigated. Alloy microstructure was observed by optical microscopy and scanning electron microscopy. $\kappa+\gamma_2$ phase morphology was investigated together with their influence on mechanical properties. Formation of κ resp. γ_2 phase was identified by DSC (Differential Scanning Calorimetry) and EBSD (Electron BackScattered Diffraction). The results were compared with high-alloyed bronze CuAl14Fe5.

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IRON-CONTAINING NANOPARTICLES ON THE SURFACE OF MULTIWALLED CARBON NANOTUBES

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Application of magnetic materials based on micro- and nanometer complex metal oxides is currently one of the most important areas of modern physics and chemistry of materials and electronics. In addition, a particular interest in the investigation of oxide particles of this size, put on an indifferent substrate, due to the possibility of use such objects in catalytic processes. Go to one of these systems include maghemite - iron oxide γ-Fe_2O_3 with spinel structure.

The samples of iron-containing multiwalled carbon nanotubes (CNT) were synthesized using injection methodics with a solution of Fe(II) acetylacetonate in benzene and ethanol as a precursor and technical nitrogen as a purge gas at 900 – 950 K.

Finally we get conductive iron-carbon structures with nonsignificant amount of amorphous carbon according to scanning electron microscopy of samples. The average diameter of synthesized nanotubes was approximately 30 nm and their length varied up to 250 microns.

^{57}Fe Mössbauer spectra measured in a wide temperature range of the samples represent a complicated magnetic structure, consisting of several magnetic subsystems: three magnetic subspectra (H_1, H_2, H_3) and a quadruple doublet (Q).

Magnetic subspectrum H_1 was fitted as quasidistribution of hyperfine magnetic fields and corresponds to γ-Fe_2O_3. Analysis of changes of the line width for this component is consistent with electron microscopy and indirectly confirms the assumption that a sufficiently wide size distribution of iron oxide nanoparticles γ-Fe_2O_3. The second component H_2, the contents of which are also much is a strongly broadened Zeeman sextet in its parameters and the corresponding Fe^{3+} cations in the oxygen environment [1]. Identification of this phase in this case is difficult, however, given the most significant decrease in the content of this component with increasing temperature (by increasing the components of Q), we can assume that the features of the formation of nanoparticles of iron oxides in different parts of the pipes are different under these conditions of synthesis. Finally, the third magnetic component H_3 corresponds Fe_3C [2].

In addition, it should be noted that the spectrum has no relaxation magnetic sextet component, which is characterized for a case of superparamgnetic behavior with “coupling” time of magnetic moment and has an activation character ($\tau = \tau_0 \exp(|K_e|V/kT)$) [3]. The appearance in the spectra of nanoparticles of this component is anticipated event, however, in the case of broad distribution of particle size of this component may be negligible in comparison with the magnetic and paramagnetic components.

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EVALUATION OF SLAG REGIME AND DESULPHURIZATION OF STEEL WITH SYNTHETIC SLAG CONTAINING CR_2O_3

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Synthetic slags are today commonly added into the ladle slags from the viewpoint of cleanness increasing of liquid steel by the creation of active slag for improvement of kinetic conditions and refining processes. The added synthetic slags influence the properties of the ladle slag not only by their chemical and phase composition but also by the manner of their preparation and by the grain size of used raw materials. Currently, synthetic slags are produced from natural or secondary raw materials and they usually contain in particular Al_2O_3, CaO, MgO, SiO_2 and on the other hand content of FeO, Fe_2O_3, MnO, Cr_2O_3 and sulphur is minimum. Mixtures of basic raw materials prepared in this way are further treated to synthetic slags in different forms (e.g. melted, sintered, pelletized, piece or powder mixtures). However, all above mentioned types of synthetic slags are used with certain limitations which follow from the choice of used raw materials and technology of the production [1, 2].
This paper builds on previous works of the authors [3, 4] and it shows the plant results and experience with the utilization of briquetted synthetic slags based on Al_2O_3 and containing different amount of Cr_2O_3 in the extent from 0.3 to 3.0 wt. % under the conditions of the steelwork VÍTKOVICE HEAVY MACHINERY a.s. The main aim of plant experiments was the comparison of achieved results with the utilization of two types of synthetic slags and the evaluation of the course of desulphurization, influence of oxide Cr_2O_3 on increase of chromium content in the steel and analysis of achieved chemical composition of slag during steel treatment in the secondary metallurgy. The work was created within the frame of the program MPO-TIP at solution of the projects reg. No. FR-TI2/319 and reg. No. FR-TI3/313.

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FATIGUE PROPERTIES OF SINTERED POWDER METAL DIN SINT D-30 BEFORE AND AFTER HEAT TREATMENT

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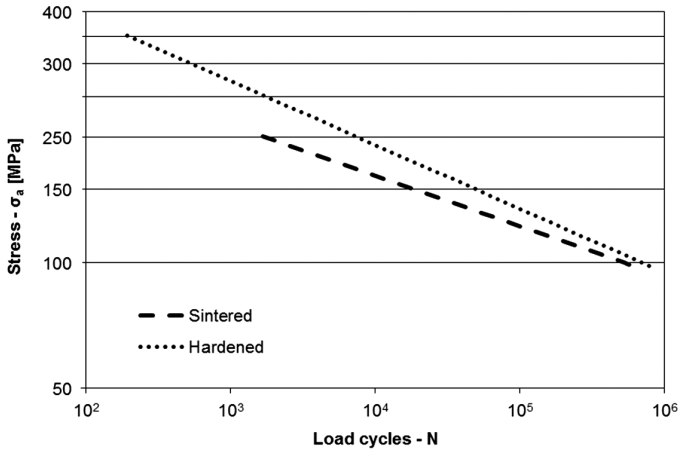
In the mass production of complex parts, powder metallurgy is becoming increasingly important production process for the future. Although powder metallurgy has some downsides, low material waste, low costs and good accuracy and possibility to produce complex parts are prevailing. After sintering, additional heat treatment of PM parts is also possible to increase strength and surface hardness.
This contribution deals with fatigue properties of sintered powder metal, which corresponds to DIN designation SINT D-30. After sintering, half of the specimens were additionally heat treated according to guidelines provided by powder manufacturer. Both sets of specimens were first tested for static strength, which showed that additional heat treatment increases ultimate tensile strength by more than 50% and reduces ductility.
However, the main focus of this study was the comparison of fatigue behavior between 10^4 and 10^5 cycles. Data suggests that in low cycle fatigue heat treatment has beneficial effect, but it gradually decreases when approaching 10^6 cycles. Fatigue parameters σ_f' and b have also been determined for both sets of specimens.



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INVESTIGATION OF BEHAVIOR OF CONSTITUENTS OF UNIDIRECTIONAL FIBER REINFORCED COMPOSITE SUBJECTED TO TENSILE CYCLIC TESTS USING MICROMODEL

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The main goal of the paper is to investigate behavior of each constituent of unidirectional carbon fiber reinforced composite subjected to tensile cyclic loading using non-linear finite element model of unit cell element representing the material microstructure. Firstly, static cyclic tensile tests on thin coupons with various fiber orientations were performed and force-displacement diagrams were obtained. Secondly, a finite element model that incorporates non-linear elastic behavior of fibers with stiffening in axial direction and elasto-plastic behavior of epoxy matrix considering Von-Mises plasticity was proposed. Thirdly, parameters of the model were identified using gradient optimization method by fitting the force-displacement diagrams obtained from the experiments. Finite element analysis software Abaqus 6.11, optimization software OptiSLang 3.2 and programming language Python 2.7 were used.

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DISSOLUTION OF THE COPPER WIRE DURING THE HOT-DIPPING PROCESS WHEN USING A SnCu1 LEAD-FREE SOLDER

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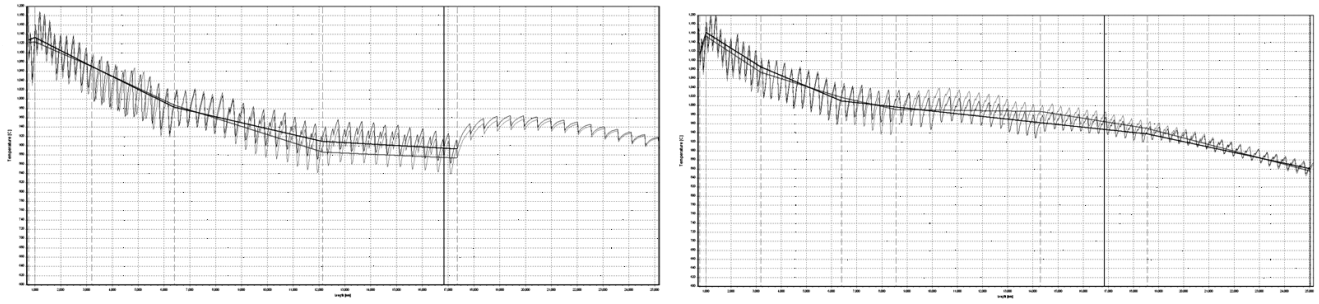
Thermodynamic arguments and calculations were used to describe the complete dissolution of the copper wire in a SnCu1 lead-free solder during hot-dipping at 400 °C. For the calculation of phase diagram newly reviewed Gibbs energies of phases were used. The thermodynamic assessment of Shim et al.[1] was the basis of the thermodynamic description of Sn-Cu system. The optimization was performed using ThermoCalc Classic (TCC). The experimental investigation involved a visual inspection, stereomicroscopy, scanning electron microscopy (FE-SEM/EDX) and thermal analysis (DSC). The results showed that the dissolution of the copper wire during the hot-dipping at a selected working temperature can be attributed to the increased solubility of the copper in the liquid solder and prolonged time of dipping. Thus, the applied temperature was too high for the geometry, volume to surface ratio, of the selected fuse element. Laboratory simulation tests performed at 303 °C showed much slower kinetics for the Cu pick-up. Better results for the hot-dipping would be obtained by lowering the temperature of the solder bath so that a layer of intermetallic compounds (IMCs) would form on the interface between the solder bath and the copper fuse element. By lowering the working temperature for the hot-dipping the solubility of copper in the solder would decrease and the nucleation of IMCs would be ensured.



PREPARATION OF MAGNETIC NANOPARTICLES BASED ON COBALT FERRITE OR MAGNETITE

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Cobalt ferrite and magnetite nanoparticles are superparamagnetic materials. Stable suspensions of superparamagnetic nanoparticles are called magnetic fluids. Stable magnetic fluids are prepared with addition of surfactants in the supporting polar or nonpolar media. The main goal of this study was to prepare magnetic nanoparticles based on cobalt ferrite or magnetite and stabilize obtained product in aqueous suspension. Optimal co-precipitation time for cobalt ferrite at 90 °C is 2 hours. Under such conditions the product exhibited the lowest amount of amorphous phase (46,2 %) and relatively high proportion of agglomerated particles (~30 %). Product is therefore destabilized in aqueous solution of polyvinylpyrrolidone K. Optimal co-precipitation time for magnetite at 90 °C is 30 minutes. After 30 minutes product has no amorphous phase and the proportion of agglomerated particles is low. Product is poorly stabilized because proportion of agglomerated particles increases when magnetite is re-dispersed in aqueous solution of polyvinylpyrrolidone K. Magnetite prepared with Massart method has a low amount of amorphous phase and a low proportion of agglomerated particles and is therefore well stabilized in aqueous solution of polyvinylpyrrolidone K.
Keywords: cobalt ferrite, magnetite, superparamagnetic nanoparticles, co-precipitation, stabilization of magnetic fluids

THE INFLUENCE OF NANOPARTICLES ON THE WORKABILITY, SETTING TIME AND MECHANICAL PROPERTIES OF CEMENT PASTES

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The use of nanotechnology in research into cementitious composites has, over the last decade, revealed new possibilities about the understanding of their microstructure, and in particular of the hydration rate and mechanisms of such materials. Considerable scientific interest has also been shown in the potential uses of nanoparticles for this purpose. Nano-dimensional particles exhibit significantly different properties when compared to those of conventional, grain-sized materials of the same chemical composition. The addition of nanoparticles to cementitious materials has several benefits: they help to improve the mechanical properties of the material (such as its compressive, tensile and flexural strengths), they provide nucleation sites for hydration products due to their small size, and they accelerate the cement hydration process, thus shortening setting times and reducing porosity (i.e. densifying the microstructure). This makes it possible to reduce the mass of such concrete in comparison with that of conventional concrete, and thus also to reduce the environmental footprint of the new material.

In the present work the effects, on cement pastes, of a partial volumetric replacement of Ordinary Portland Cement with alpha aluminium oxide (α-Al_2O_3) nanoparticles are presented. Such partial replacement by α-Al_2O_3 nanoparticles was investigated at 3 wt. %, 5 wt. % and 10 wt. % of cement. The influence of the nanoparticles on the characteristics of the cement pastes was investigated in fresh mixes (workability and setting time), and in hardened test specimens (the mechanical properties). The effect of α-Al_2O_3 nanoparticles on the microstructure of cement pastes was also studied using scanning electron microscopy (SEM) and X-ray diffraction (XRD). The compressive and flexural strengths of the hardened test specimens were determined after 3, 7 and 28 days.

IMPROVING QUALITY AND PRODUCTIVITY CONTINUOUSLY CAST STEEL SLABS BY INCREASING THE NUMBER OF COOLING ZONES OF THE SECONDARY COOLING

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The quality and productivity of casting steel slabs in continuous casting is influenced by many parameters for radial caster[1]. One such parameter is the configuration and setup of secondary cooling. Now the influence of the configuration and setup of secondary cooling discussed in this paper. Secondary cooling is made up water or air mist cooling nozzles, which is a large number of more than 100. Ideally, the nozzles are located along the entire machine to the small and the large radius and the water flow is controlled at each nozzle. Given the large number of nozzles is not possible, because the nozzles are grouped into a cooling zone in which a controlled flow of water. This paper describes the use numerical model of temperature field, for optimal the design of the extension of secondary cooling and its division into multiple cooling zones[2]. The original radial caster had 9 cooling zones whose scope ending point for straightening as shown in Figure 1 by the design and the optimization of the secondary cooling extended until the end of the cage and the number of cooling zones are extended to 13 cooling zone The modifications allow to increase casting speed by approximately 20% and the ability to better control the surface temperature can be expected to increase the quality. In particular limitations central defects, because the liquid core is moved to the place straightening and surface defects because the surface temperature gradients could also be reduced[3].

Figure 1: Surface temperatures using 9 and 13 of cooling zones

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HEAT TREATMENT OF QUASICRYSTALLINE Al-Mn-Be-Cu ALLOY

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The aim of our research was the investigation of heat treatment possibilities for $Al_{94}Mn_2Be_2Cu_2$ alloy in which under certain conditions (sufficiently high cooling rate) the quasicrystalline icosahedral phase (QC i-phase) formed, in addition to other crystalline phases. In recent years the QC phases became interesting as additional possibility for an effective hardening within the multiphased microstructures of some alloys[1–4]. An $Al_{94}Mn_2Be_2Cu_2$ alloy was synthesized by melting and chill casting into mould which was in the shape of tensile specimen with 5 mm diameter. Our analyses were carried out with a help of several methods, like: microhardness measurements of the Al-rich matrix, LOM, SEM and EDS. Main goal was to determine whether it is possible to further strengthen the castings by precipitation hardening. Zupanič et al [1] observed that the solid solution heat treatment (500°C) of the $Al_{94}Mn_2Be_2Cu_2$ alloy enabled the dissolution of the θ-Al_2Cu phase. This represents the opportunity for the further strengthening by introducing the precipitation heat treatment. On the other hand, more recent literature[3, 4] found the classical T6 precipitation heat treatment to be ineffective in the case of melt spun $Al_{94}Mn_2Be_2Cu_2$ alloy since the solutioning does not result in a homogeneous solid solution.

In our presentation the microhardness measurements results of the various precipitation heat treatment regimes for the $Al_{94}Mn_2Be_2Cu_2$ alloy will be presented and the microstructures in combination with the EDS will be shown. The possible causes for the unsuccessful elevation or even decrease in hardness of the investigated alloy with the applied heat treatments will be discussed.

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Delo je delno sofinancirala Evropska unija, in sicer iz Evropskega socialnega sklada. Sofinanciranje se izvaja v okviru Operativnega programa razvoja človeških virov za obdobje 2007-2013, 1. razvojne prioritete Spodbujanje podjetništva in prilagodljivosti; prednostne usmeritve_1. 3: Štipendijske sheme.

STUDY OF ADSORPTION CAPACITY OF NANOSTRUCTURED CARBON MATERIALS ON DIFFERENT TYPES OF ELECTROLYTES IN SUPERCAPACITORS

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It is well-known that carbon nanomaterials are suitable for different kinds of applications, e.g. as electrode materials in various electrochemical devices such as supercapacitors, Li-ion batteries and ionistors, solar cells. For future development of this direction it is important to understand the mechanism of interaction between carbon materials and different types of electrolytes as impurities, most common from which are acetonitrile, imidazole based ionic liquids with BF_4 or PF_6 anions, moisture and ethanol. Carbon nanomaterials – carbon black, porous structured carbon, nanotubes, fibers, nanoshells – reveal different values of specific surface area and pore size distribution – from 100-3000 m^2/g. Nevertheless, this high value, measured by nitrogen adsorption and calculated from BET-model, usually does not correspond to adsorption value for other types of substrates. From this viewpoint it is interesting to measure the sorption ability of the liquids mentioned above on carbon materials. The main problem for the investigation of adsorption properties of ionic liquids is low vapour pressure. Since the size of the cation in electrochemically used ionic liquids is usually bigger or comparable with anion size, we used 1-methylimidazole for sorption measurements on carbon nanoshells, nanotubes and active carbon.

The experiments were performed using DVS Advantage instrument at 20, 30 and 40°C, total gas flow 100 ml/min, HPLC grade solvents were used. The solid sample of 20–30 mg mass was hung in thermostatic chamber from a microbalance in a sample pan. Dry nitrogen carrying the studied vapours was then passed over the sample at a well-defined flowrate and temperature. The specific surface areas measured by BET technique for these materials are: 1850 m^2/g for active carbon, >2000 m^2/g for nanoshells and 1531 m^2/g for nanotubes. Graphite powder was used as a reference non-porous substance.

Adsorption isotherms of 1-methylimidazole on all nanostructured samples shows no desorption of the solvent from the sample caused by chemical bonding of surface groups COO, COH. Reference graphite sample doesn't display such effect. The uptake of 1-methylimidazole on powder samples is greater than on compacted ones because of sealing of pores during compactification. Experimental surface area for 1-methylimidazole on active carbon is 393 m^2/g, on nanoshells 600,6 m^2/g, on nanotubes 411,9 m^2/g. Experimental heat of sorption of 1-methylimidazole on active carbon is –15,3 kJ/mol, on nanotubes –21,9 kJ/mol, on nanoshells –13,9 kJ/mol. Summarized electron density and polarizability of carbon nanotubes provide optimal adsorption conditions, carbon shells on the contrary are highly defective carbon material of high surface area so that adsorption of a large molecules as 1-methylimidazole or benzene is less than that of ethanol or water.

POROUS HYBRID INORGANIC-ORGANIC PHOSPHOSILICATE MATERIALS BY NON-HYDROLYTIC SOL-GEL POLYCONDENSATION

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Non-hydrolytic sol-gel reactions are viable alternatives to classical aqueous techniques in the area of synthesis of multimetallic oxides and inorganic-organic hybrid materials in the form of xerogels, nanoparticles, and thin films. We developed non-hydrolytic sol-gel route based on acetic acid ester elimination providing phosphosilicate hybrid inorganic-organic materials. The polycondensation reactions between $Si(OAc)_4$ and $OP(OSiMe_3)_3$ lead to microporous phosphosilicate xerogels with surface areas up to 568 $m^2\ g^{-1}$. The structure of xerogels was built up exclusively from Si-O-P bonds and contained octahedrally coordinated silicon atoms, which are characteristic for crystalline silicon phosphates. The consecutive substitution of Si and P precursors by acetoxysilanes $^1R_xSi(OC(O)CH_3)_{4-x}$ (^1R = Me, Ph; x = 1-2) and phosphonic acid trimethylsilylesters $^2RP(O)(OSiMe_3)_2$ (^2R = c-Hex, Ph) caused the decrease of surface areas and increase of average pore sizes because of the lower cross-linking ability of the substituted precursors. We avoided significant decrease of surface areas of hybrid xerogels by changing starting precursors to acetoxysilanes and phosphonic acid esters with bridging alkyl or aryl groups $(AcO)_3Si\text{-}(CH_2)_x\text{-}Si(OAc)_3$ (x = 1-3, 6), $(Me_3SiO)_2P(O)\text{-}^3R\text{-}P(O)(OSiMe_3)_2$ (^3R = C_2H_4, C_6H_4). Silicon in acetoxysilanes with both terminal and bridging organic groups was not able to acquire hexacoordination in contrast to Si in $Si(OAc)_4$. The change of the structure of the xerogels, which were in this case built up from SiO_4 tetrahedrons, was accompanied by the modification of textural properties – the hybrid phosphosilicates displayed significant mesoporosity. Our aim was to study the versatility of these reactions and tune the properties of resulting xerogels, such as surface area, pore size distribution, chemical and thermal stability. The prepared xerogels were characterized by solid-state ^{13}C, ^{29}Si, ^{31}P NMR, IR, surface area analysis, TGA and XRD.

OPTIMISATION OF UTILIZATION OF MICROWAVE RADIATION FOR THE EXTERMINATION OF WOOD-DESTROYING INSECTS

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The paper deals with experimental optimisation of microwave radiation for the extermination of wood-destroying insects. Until now, microwave radiation was and still is often used in the building industry because of its characteristics, especially when there arises a need to dry out some structures in buildings, since with the exposure of wet walls (for example) to electromagnetic radiation it comes to a relatively sharp disposals of mass of moisture from them. The cause of this can be found in the way, how water molecules in the structures do react to the electromagnetic radiation, since they begin to oscillate once affected by electromagnetic radiation [1]. This process results in a phase change of water into vapour, which then can evaporate from the wet materials, thus it leads to drying out of the structure.

A similar principle can be also used for the extermination of wood-destroying insects in timber structural elements. It is generally known that such organisms contain a significant portion of water, usually up to 80%. This water content, hence, can be removed from them by the application of microwave radiation similarly to wet structures.

The article describes the results of experiments conducted within the grounds of the Faculty of Civil Engineering, Brno University of Technology, which do demonstrate the efficiency of extermination of wood-destroying insects by microwave radiation. By analysing the results of the research the necessary conditions for the elimination were described with respect to the particular type of insect and the success rate of their extermination, including the optimal intensity of radiation and the length of exposure for a given species.

This method of biological curing of timber structures is a new possibility for the application of microwave radiation in the building industry, an economically and technologically undemanding way for extermination of wood-destroying insects.

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APPLICATION OF COBALT NANOPARTICLES IN HETEROGENEOUS CATALYSIS

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Heterogenic catalytic process of carbon oxide (CO) reduction (Fischer-Tropsch process) is being widely studied. At the same time, the process of reducing recovery of CO_2 is not explored sufficiently. As a rule, these reactions are conducted using metal-covered catalysts consisting of support (oxides or carbon materials including CNT – carbon nanotubes) with stabilized metal nanoparticles.

In the present work the effective catalysts based on nanoparticles of cobalt deposited on the CNT-M_2O_n (where M = Mg, Al) composites were studied. These composites were synthesized by pyrolysis of hydrocarbons (C_6H_6 or CH_4) under reducing atmosphere at 650 °C. Cobalt was deposited by impregnating CNT-M_2O_n with cobalt nitrate alcoholic solution with subsequent decomposition and reduction under hydrogen atmosphere. All materials produced were investigated by SEM, PEM, BET and X-Ray analysis. Resulting cobalt content was between 15 and 45 wt. %.

Efficacy of all catalysts was investigated with reduction recovery of CO and CO_2 at atmospheric pressure and temperature from 180 to 450 °C. High grades of conversion were confirmed (upto 25 % for CO and upto 100 % for CO_2). Selectivity of C_{5+} fraction of Fischer-Tropsch process was upto 52 %. CO_2 was selectively reduced to methane.

Loss of catalysts' activity during long-term exploiting caused by their exercising was insignificant. This can be explained by effect of stabilization of cobalt nanoparticles filling the pores in the structure of the support that compensates sintering of cobalt particles and formation of agglomerates.

MORPHOLOGICAL AND MICROSTRUCTURAL FEATURES OF AL-BASED ALLOYED POWDERS FOR POWDER METALLURGY APPLICATIONS

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Powder metallurgy procedures (P/M) are one of the most efficient technologies for the mass production of small complex functional and structural products. Conventional sintering technology is the most convenient and popular technology among all of P/M procedures. Fine metal powder is firstly die compacted into final shape of product with automatic mechanical or hydraulic presses and then sintered (diffusion bonding of powder particles) in a protective atmosphere at temperatures between approx. 0.8 and 0.9 of melting point of metal powder. The result of this procedure is partially porous or completely dense metal product, which can be additionally improved by the heat and/or mechanical treatment. Fe and steel based P/M products are mainly produced with this procedure. These are sintered steel gears, spurs, locking mechanisms, porous filters, sliding bearings, as well as other machine and structural elements. Sintered soft/hard magnetic actuators and sensors are also very popular. Automotive industry is the most important end-user of sintered parts. But, small complex sintered parts can be frequently used also in furniture and house hold industry, precise mechanics, articles for recreation and sports etc. High alloyed sintered metal parts can be also used for very demanding marine, aeronautic, military and space applications. Besides polymers and ceramics, recently, light metals; i.e. Al, Mg and Ti based materials are recognized as future materials for different kinds of advanced applications. Al and its alloys have acceptable price, excellent corrosive resistance, good mechanical and other physical properties. Therefore, they are also put in force in the P/M technology field. P/M technology of Al materials is very demanding and has its own specifics compared to the sintering technology of iron and steel.

Relatively large quantity of Al-based alloy powder forms during production of slugs/discs in Al factory Talum, Kidričevo, Slovenia. Therefore, we analysed and investigated its practical usability for production of advanced products by P/M technology. Formed Al-based powder was compared with commercially available Al-based powders, which are generally used for conventional sintering technology. Which types of Al-based powders are generally used for the production of sintered parts, what are demanding parameters and why; all this will be presented in this contribution, firstly. Then, we will present the results of analyses and investigations of morphological and microstructural characteristics of selected commercial Al-based powder. The comparison with Al powder from Talum and its potential for P/M applications will be also given.

Keywords: Al-based alloy powders, morphology and microstructure, LM and SEM/EDS characterisation

DSC/TG OF Al-BASED ALLOYED POWDERS FOR P/M APPLICATIONS

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Al-based alloyed powders, appropriate for sintering procedure (P/M, Powder Metallurgy) are surface oxidised because of high affinity of Al to oxygen. Therefore, its sintering is very complex. Generally they are sintered in pure nitrogen (N_2, 5.9) with low dew point (below –40°C). Al-based alloyed powders consist alloying elements with high solid solubility in Al (Cu, Zn, Mg etc.) enabling reaction and liquid faze sintering, respectively. Besides, these type of powders have 1 to 1,5 wt. % of polymeric binder, which reduces friction on die walls during automatic die compaction into final compact shape of product. This binder has to be removed slowly during first stage of sintering in order to prevent deformations and cracking of product. Optimal sintering conditions are generally determined on the basis of light (LM) and scanning electron microscopy (SEM/EDS). The investigation can be also completed very successively with differential scanning calorimetry and thermo gravimetry (DSC/TG). The first method (DSC) enables insight into exothermic/endothermic reactions occurring during of heating/cooling of compact, and the second method (TG) enables insight into weight reduction (binder removal) and weight increase (oxidation), respectively. DSC/TG of three commercial Al-based alloyed powders was performed in the frame of our investigations. The results were compared with theoretical thermodynamic based (Thermocalc) calculation and optimal sintering conditions were proposed.

Keywords: Al-based alloyed powders, sintering, differential scanning calorimetry and thermo gravimetry (DSC/TG)

LABORATORY HOT WORKING OF SUPERAUSTENITIC STAINLESS STEEL

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The high-alloyed austenitic grades of stainless steels exhibit greater corrosion resistance and higher strength compared with more common grades of stainless steel, for example ferritic or austenitic grades. Compared to conventional austenitic stainless steels, superaustenitic stainless steels have a similar microstructure, but have higher content of some elements, as chromium, nickel, molybdenum, copper and nitrogen, which give superior strength and corrosion resistance. As the content of alloying elements increases, problems associated with industrial processing become more severe. To avoid excessive mill loading, hot working is often carried out at high rolling temperatures. As austenite is characterized by low stacking fault energy (SFE), both dynamic recrystallization (DRX) and static recrystallization (SRX) play an important role in microstructural evolution during and after hot deformation. The present study is aimed to investigate a part of the complex processes that take place in the narrow processing window of AISI 904L, an industrially important superaustenitic stainless steel.

CONDUCTION AND CONVECTION HEAT TRANSFER CHARACTERISTICS OF NON-NEWTONIAN Au NANOFLUID IN CUBICAL ENCLOSURE WITH DIFFERENTIALLY HEATED SIDE WALLS

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The present work deals with the laminar natural convection in a cubical cavity filled with homogenous 0,4 wt. % aqueous solution of carboxymethyl cellulose (CMC) based Au nanofluids obeying the Power law rheological model. The cavity is heated on the vertical and cooled from the adjacent wall, while the other walls are adiabatic.

The governing differential equations have been solved by the standard finite volume method and the hydrodynamic and thermal fields are coupled together using the Boussinesq approximation. Grid refinement study is performed in order to obtain the mesh independent results and to assess their numerical accuracy, while the numerical approach is validated with comparison of the present results with the results of other author authors.

The main objective of this study is to investigate the influence of the nanoparticles' volume fraction on the heat transfer characteristics of CMC based nanofluids over a wide range of the base-fluid's Rayleigh number.

Accurate numerical results are presented in the form of the mean Nusselt number and heat transfer enhancement. It is shown that adding nanoparticles to the base fluid delays the onset of natural convection. Contrary to what is argued by many authors, we show by numerical simulations that, just after the onset of natural convection, adding nanoparticles reduces the mean Nusselt number value for any given base-fluid's Rayleigh number.

Key words: Natural convection, Au nanofluid, Heat transfer, Nusselt number

SUBSTITUTION OF PRIMARY AlSi5Cu1Mg ALLOY WITH ALLOY MADE OF RECYCLED ALUMINIUM

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Due economic reasons the primary AlSi5Cu1Mg alloy should be replaced with alloy made of recycled aluminium. The condition is, the composition and mechanical properties should remain within the prescribed properties. The tests of casting of alloys, modified with Sb, Sr and Na, into metallic and sand forms were performed. The samples for metallography and for mechanical test were cut from the castings in the region of thin and thick wall. The tensile tests were done on as cast and on heat treated (T6) samples. Beside mechanical tests also metallograpy is presented as well as EDS analyses of intermetallic phases, with an emphasis on intermetallic phases based on Fe.

NADOMEŠČANJE ZLITINE AlSi5Cu1Mg IZ PRIMARNEGA ALUMINIJA Z ZLITINO IZDELANO IZ RECIKLIRANEGA ALUMINIJA

Iz ekonomskih razlogov obstaja želja, da se zlitino AlSi5Cu1Mg iz primarnega aluminija nadomesti z zlitino iz odpadnega aluminija. Pogoj je, da ostanejo sestava in mehanske lastnosti zlitine v okviru predpisanih. Izvršeni so bili preizkusi ulivanja zlitine modificirane s Sb, Sr in Na, v kokilo in v peščene forme. Iz ulitkov so bili iz področja s tanko in debelo steno izrezani vzorci za metalografske preiskave in mehanske preizkuse materiala v litem stanju in v toplotno obdelanem stanju (T6). Poleg mehanskih lastnosti je prikazana še metalografska analiza in EDS analiza intermetalnih faz, s poudarkom na intermetalnih fazah Fe.

EFFECTIVE PREPARATION OF NON-LINEAR MATERIAL MODELS

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Progressive methods and technologies are the key to the dynamic development of the automotive and electrical engineering industries. Processes in sheet metal processing have fundamentally changed since the end of the nineties of the last century. Previously, operations such as cutting, punching holes etc. were carried out separately on different press machines. These operations can be integrated into a single tool on one press machine
due to the development of progressive tools and especially fineblanking technology. The result is already completed component that can be used for assembly. Development of progressive tools must be supported by FEM simulations, which are dependent on their inputs. Therefore, only a correct material model can be expected to provide right results.
For the reasons described above an experimental program dealing with measuring and fitting the data to models with orthotropic material properties such as rolled sheets was designed and implemented. The aim is to obtain material models of rolled sheets of selected aluminium, copper and steel alloys representatives. One of the objectives of the solution is to provide more efficient and more accurate data fitting because the more accurate the input material data are, the more accurate simulation results are reached.
The optimization script using the simplex method was made for fitting. The main function of the optimization script is to specify parameters of the material model iteratively and to compare simulation results and mechanical tests results. The script was programmed in the Python environment for MSC.MARC/MENTAT software using the Johnson-Cook plasticity model. Fitting the data from pressure tests by Rastagaev at different loading speeds is presented. The difference between the measured and simulated curves is less than 1%.

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COMPREHENSIVE MONITORING OF LIGHT GUIDES WITH RESPECT TO BUILDING PHYSICS

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Architecture and the building industry it self consists of several minor fields, which do come together when a building object of any kind is designed and erected. One of those is the field of building physics, a field primarily focused on the evaluation of constructions, structures and spaces as a whole with respect to thermo-technical conditions[1], humidity, acoustics, daylighting and many many more.

It is said, that among the above mentioned sub-fields of building physics, daylighting is the most important, because it influences the health of every human being. Nonetheless, it also enables a person to see the colours, faces and objects surrounding him. Therefore, buildings do have to be equipped with a kind of daylighting system to bring the natural light into indoor spaces. Before, rooms in the centres of buildings or underground were illuminated solely by luminaries of higher intensities. Nowadays it is possible to use one of the available indirect passive daylighting systems, like optic fibres or light guides[2].

In Central Europe the application of light guides in buildings increases year by year. The manufacturers do say, that it handles about a great, maintenance free system. A system that brings natural light into the buildings, thus helps to save up money normally spent for electricity.

On the contrary however, their design is not the simplest. Not just when talking about daylighting, but when talking about thermo-technical or moisture design too. A huge amount of light guides does have issues with condensation of water inside of the pipes as a side effect of a non-air tight solution or just incorrect thermal analysis.

The paper is focused on several aspects of the design of light guiding systems, regarding daylighting and thermal and moisture processes, via computer simulations.

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THE CONTROL OF THE METALLURGICAL PROCESSING OF THE ICDP CAST IRONS

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This paper deals with the possibilities of the process control of metallurgical processing of the special ICDP cast iron used for the production of centrifugally cast cylinder rolling mills.
The metallurgical processing of the ICDP cast iron is conducted on the basis of the evaluation of the record of the cooling curve (KO) and of the activity measurement of oxygen (a_O) in the molten cast iron. The measured characteristics of the cooling curve of samples of the cast irons and their oxygen activity during melting in an electric induction furnace and after vaccination in the ladle are compared with the metallographic evaluation and with the properties of the ICDP irons.
Key words: oxygen activity, cast iron, modification, metallurgical quality.

MINI-THIXOFORMING OF VARIOUSLY MODIFIED STATES OF TOOL STEEL X210Cr12

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Thixoforming is an alternative method of forming due to the pass to the semi-solid state. Thanks to the forming temperature, in excess of the solidus curve, offers the utilization of the conventional materials in which microstructure after processing in semi-solid state appearing structural components in the arrangement, which would other commonly used methods, either molding or casting, wouldn´t be achieved. Very innovative approach is thixoforming of steels, which compared to the non-ferrous metals, is still in an area of the basic research. The sheer novelty of the method is the use of mini-thixoforming, where compared to the classic "thixo" the highly rapid heating and cooling gradients and much faster feedback control and monitoring of the process can be achieved in addition.
The article is focused on the description of the influence of different procedures prepared input structure to structure development during processing in a semi-solid state. The experimental program was conducted on steel X210Cr12. It is a tool steel with a high proportion of alloying elements and the wide interval between the solidus and liquidus. Two different input states were processed by mini-thixoforming. The first condition was in a state of soft annealed with a hardness of 211 HV10 and grain size of. 13 microns approx.. The second condition was treated by SPD method ECAP. This led to the intensive grain refinement to 1 micron approx. and an increase in hardness to 370 HV30.
Comparison of the input structures for mini-thixoforming and structures acquired by the processing in semi-solid state the methods of light and scanning electron microscopy were used EBSD including. For mechanical comparison hardness test was used. The experiment proved that it is possible to prepare microstructure semi product to affect the microstructure obtained after thixoforming, especially from the perspective of changes in the shape and size of the structural components.
Key words: semi-solid, thixoforming, mini-thixoforming, ECAP, EBSD, X210Cr12

OFF-LINE EMPLOYMENT OF MATHEMATICAL-MODEL FOR Al-COILS HEAT-TREATMENT PROCESS

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Once mathematical model (MM) of certain process is developed and calibrated, it can be employed for various purposes, which are without MM not possible. For the process of Al-coil heat-treatment a calibrated MM was available and the challenge was to use the existing on-line model for off-line simulations of various reheating strategies such as change in furnace temperature, timing, coil material and dimension data, etc.. Under-laying technology, which enables these off-line simulations is another mathematical model, which predicts furnace-air temperatures from furnace-air-temperature set-points.

The background idea for the furnace-air-temperature model is predictable, closed-loop controlled, furnace-air-temperature response. For the Al-coil heat-treatment a typical prescription is a series of constant temperatures for a certain time, e.g. {(2h, 280°C), (3h, 460°C),…} for furnace-air-temperature. The target reheating furnace is equipped with PID temperature controllers which drive gas-burners to match the desired temperatures. For constant parameters of PID controllers, the temperature response to series of step-like changes of set-point can be accurately approximated with first order system (FOS) model. The FOS model was calibrated on 10 furnace-measured air-temperature for various coils (dimensions&grades) and time-temperature profiles. The stationary state furnace-air-temperature-predictions using FOS model match exactly the actual temperatures, if PID controllers achieves exactly the temperature set-point. The transient accuracy of FOS model for 10 measured time-temperature furnace-air profiles is within ±10°C. The FOS model is integrated in Graphical User Interface of existing Al-coil-temperature model.

Employing FOS model for prediction of furnace-air temperatures enables use of Al-coil-temperature model for off-line simulations at various reheating conditions, which are otherwise impossible. The ‘price’ for off-line coil-temperature-simulations are slightly decreased coil-temperature prediction accuracies.

POTENTIODYNAMIC AND XPS STUDIES OF X10CrNi18-8 STEEL AFTER ETHYLENE OXIDE SERILIZATION

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Innovative development in treatment methods of heart as well as blood and vascular system diseases with application of low-invasive techniques led to development of new forms of tools (among other things: cardiologic guide wires) made of X10CrNi 18-8 steel. These tools, due to their direct contact with blood, must feature a proper set of electrochemical properties also determined by conditions of medical sterilisation [1,2]. Therefore, the authors of this study made an attempt at evaluation of the impact of one of medical sterilisation methods, i.e. ethylene oxide sterilisation of wire made of X10CrNi1 8-8 steel after electrochemical polishing and after chemical passivation. One of the basic criteria which decide about suitability of a specific material for a vascular tool is proper corrosion resistance in blood environment. It is directly connected with chemical composition of the surface layer. Therefore, evaluation was made on the ground of pitting corrosion tests and tests of chemical composition of the surface layer by means of XPS method. Samples were subject to tests before and after ethylene oxide sterilisation. Obtained results prove explicitly that chemical passivation process of X10CrNi18-8 steel will improve its resistance to corrosion in blood environment. It is connected with creation of a thin passive layer mainly built of Fe_2O_3 and Cr_2O_3 on its surface, which was proved in XPS tests. Next, sterilisation in ethylene oxide had a favourable influence on electrochemical properties of X10CrNi18-8 steel, irrespective of the way of surface preparation. Presence of alloying elements in oxidised form was also detected in the surface layer, which contributes to improvement of corrosion resistance in contact with blood.

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SYNTHESIS AND CHARACTERIZATION OF Ti-$TiAl_3$, Ti-Nb-$TiAl_3$ METALLIC-INTERMETALLIC COMPOSITE PRODUCED BY POWDER METALLURGY TECHNIQUE

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In this study, it was investigated fabrication of in situ metallic intermetallic Ti-$TiAl_3$ and Ti-Nb-$TiAl_3$ composites from powder mixture containing 40wt% titanium-60wt% aluminum with (5wt% and 10wt%) and without metallic niobium addition. Powder mixtures without binder was compressed uniaxially under 130 MPa of pressure and sintered at 2200 A current for 20 minutes in a steel mould using electric current activated sintering method. The advantageous of using this technique are; faster heating rate, lower sintering temperature, shorter holding time, elimination of the need of sintering aid, etc [1].

Microstructures of sintered samples were investigated by optic and scanning electron microscopes, phases in samples were analyzed by XRD and their hardness was measured by Vickers hardness tester.

Optic and scanning electron microscopes (EDS) investigations showed that microstructures of no reinforced titanium-aluminum samples were consisting of two components: Main component was titanium aluminide and other was metallic titanium. Also there was a trace amount of aluminium oxide in the sintered body. XRD analyses also demonstrated that main phase in the composite is $TiAl_3$. When it comes to XRD analyses of samples reinforced %wt5 and %wt10 niobium for enhance of ductility of the body [2,3], it was determined that metallic niobium has remained in the sample as well as Ti-$TiAl_3$ main phases.

In addition that average hardness values of samples for no reinforced Ti-$TiAl_3$ composite, 5wt%Nb reinforced Ti-$TiAl_3$ composite and 10wt%Nb reinforced Ti-$TiAl_3$ composite were measured about 759, 669, and 600 HV respectively.

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PREPARATION AND APPLICATION OF PIM INCLUDES ALAMINE 336 FOR EXTRACTION OF METALS FROM AQUEOUS SOLUTION

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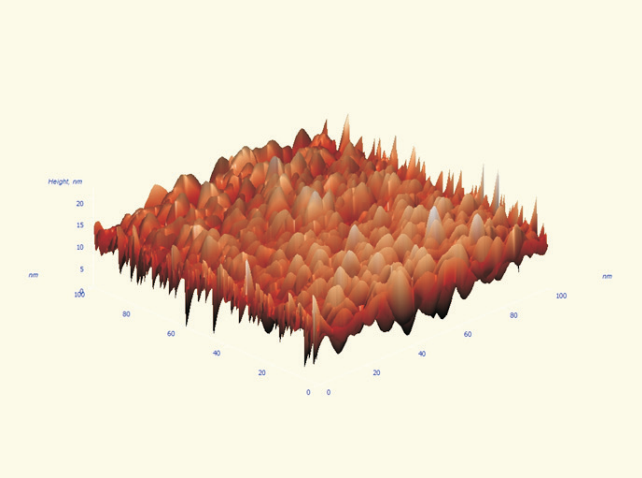
Polymer inclusion membranes (PIMs) present an attractive approach for the separation of metals from aqueous solution [1]. The specific advantages are effective carrier immobilization, easy preparation, versatility, stability, better mechanical properties and good chemical resistance [2].
The present study is about the application of Alamine 336 as an ion carrier in PIMs. The separation of copper (II), cobalt (II), nickel (II) and cadmium (II) from aqueous solution by polymer inclusion membranes were investigated. PIMs are formed by casting a solution containing a carrier (extractant), a plasticizer and a base polymer, such as cellulose tri-acetate (CTA) or poly(vinyl chloride) (PVC), to form a thin, flexible and stable film [3].
Several important transport parameters such as type and amount of plasticizer, concentration of carrier, thickness of membrane, pH of acid in donor phase and concentration of base in acceptor phase were discussed. The membrane was characterized to obtain information regarding its composition by AFM (Fig.1), FT-IR and SEM (Fig.2).



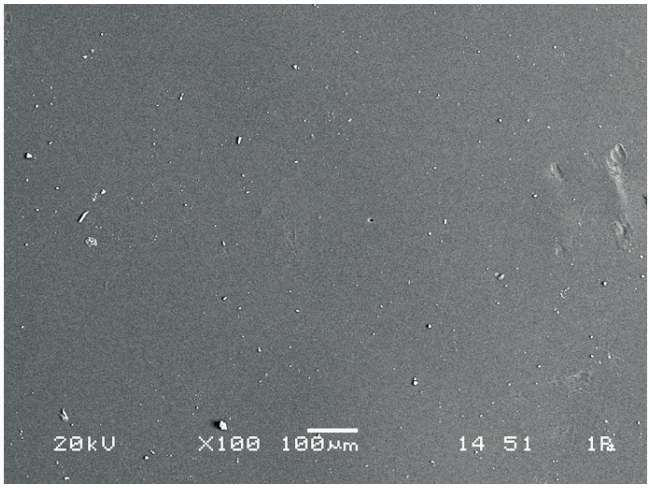


Fig 1. Alamine 336 /CTA, AFM images Fig.2. Alamine 336 /CTA, SEM images

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COMBINING STATISTICAL AND ANN MODEL WITH FINITE ELEMENT METHOD FOR ASSESSING UNDERCUT GEOMETRY STRESS FIELD DURING INJECTION MOLDING PROCESS

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Current engineering trends for designing thermoplastic products are significantly influenced by design for manufacturability guidelines. This guidelines prescribe that injection molded products have complex geometry with many undercut areas, which are used for quick assembling of products. Undercut areas can be properly manufactured in injection mold by using complex mechanical systems or by forced ejection, in case that local geometry allows this. When forced ejection principle is used, product undercut geometry has to be thoroughly evaluated in order not to exceed elastic deformation during ejection. Analysis of stress field in area of product undercut geometry represents an important step in product development process. For determining stress field finite element numerical methods (FEM) are commonly applied. Since they represent a single point solution, which also requires significant time consumption to obtain, it is important to develop a response model that properly describes relationships between input variables and corresponding responses. In this study, based on design of experiment (DOE) and an artificial neural network (ANN) model was developed to assess relationship between main geometrical features and maximum stress in product undercut area when forced ejection is used in injection molding process. Both analysis of variance and ANN model confirmed that most influential geometrical input variable is draft angle, followed by product wall thickness. By using proposed response model the assessment of undercut geometry can be quickly and accurately carried out, without necessity for additional FEM analysis. Although the model solution is developed for specific undercut geometry, presented paper offers generalized approach for defining undercut geometry solutions.

Keywords: thermoplastic polymers, injection molding, finite elements method, design of experiments, artificial neural networks

LONG-TERM DURABILITY PROPERTIES OF POZZOLANIC CEMENT MORTARS

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Within the scope of this study the durability properties of mortars prepared with pozzolanic cement were examined. The pozzolanic cement used was a mix of calcareous fly ash and Portland cement clinker (CEM IV/B-W 32.5 N). The physical-mechanical properties of the mortars were determined after their exposure to various aggressive media (a sodium sulphate solution, a magnesium sulphate solution, sea water, and a solution of NO_3^{2-}, SO_4^{2-}, and NH_4^-) and freeze-thaw cycling. Additionally, the depth of carbonatization of the mortars was determined.

The resistance of the investigated mortars to sulfate attack was investigated and evaluated using the Koch-Steinegger test. The strengths of mortar specimens that had been immersed in 4.4% Na_2SO_4 and 3.73% $MgSO_4$ solutions were determined and compared with those of samples that had been immersed in deionised water. The results showed that the mortar containing pozzolanic cement was sulfate resistant, but when it was exposed to the solution of NO_3^{2-}, SO_4^{2-}, and NH_4^- its strength was significantly reduced. However, there is a difference in the initial strengths, depending upon which solution, i.e. deionised water or lime-saturated water, was used to cure the specimens prior to the test. Deionised water behaves as aggressive solution as compared to lime-saturated water. On the other hand, the mortar was found to be sensitive to freezing/thawing in both the presence and the absence of salts (3% NaCl), as its compressive strength decreased by 50%, and its bending strength by as much as 82%.

Due, especially, to its lack of resistance to freezing and thawing, the investigated pozzolanic cement mortar is limited to indoor applications.

COMBUSTION DERIVED $La_{1-x}Sr_xMn_{0,5}Cr_{0,5}O_{3\pm\delta}$ (x=0,20, 0,25) PEROVSKITE: PREPARATION, PROPERTIES, CHARACTERIZATION

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Lanthanum-strontium-manganese-chromium oxide based ceramics are a proper alternative to custom anode cermets in high temperature fuel cells based on nickel and doped zirconia since they much less sensitive to impurities in fuel, especially sulphur. Moreover, they do not catalyze side reaction of carbon deposition during hydro-carbon fuel oxidation. $La_{1-x}Sr_xMn_{0,5}Cr_{0,5}O_{3\pm\delta}$ (x = 0.20, 0.25) perovskite (LSCM) was prepared by citrate nitrate combustion reaction. Since any secondary phases developed during the synthesis may influence final anode material properties, phase development during the gel transformation was followed by high temperature X-ray analysis, EDS and thermal analysis. Microstructure of powders sintered at different temperatures was studied in correlation with electrical properties and described in accordance to the sine-wave model.
Keywords: citrate-nitrate combustion synthesis, oxide LSCM anode, phase development, sine-wave model

Z ZGOREVANJEM PRIDOBLJEN PEROVSKIT $La_{1-x}Sr_xMn_{0,5}Cr_{0,5}O_{3\pm\delta}$ (x=0,20, 0,25): PRIPRAVA, LASTNOSTI, KARAKTERIZACIJA

Keramika na osnovi lantan-stroncij-mangan-krom oksida predstavlja alternativo običajnim anodam na osnovi kermetov niklja in dopiranega cirkonijevega oksida v visokotemperaturnih gorivnih celicah, ker niso občutljive na nečistoče v gorivu, posebej na žveplo. Prav tako pa v mnogp manjši meri katalizirajo stransko reakcijo odlaganja ogljika pri oksidaciji goriva. $La_{1-x}Sr_xMn_{0,5}Cr_{0,5}O_{3\pm\delta}$ (x = 0,20, 0,25) perovskit (LSCM) smo pripravili z zgorevanjem citratno nitratnega gela. Ker med sintezo nastale morebitne sekundarne faze lahko vplivajo na lastnosti končnega produkta, smo razvoj faz pri pretvorbi gela zasledovali z visokotemperaturno rentgensko analizo, EDS in termično analizo. Proučevali smo mikrostrukturo vzorcev sintranih pri različnih temperaturah v povezavi z električnimi lastnostmi, kar smo opisali s »sine-wave« modelom.
Ključne besede: citratno nitratna zgorevalna reakcija, oksidna LSCM anoda, razvoj faz, sine-wave model

SYNTHESIS AND APPLICATION OF NOVEL POLYMER CARRIERS FOR DELIVERY OF ACTIVE PHARMACEUTICAL INGREDIENTS

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Chitosan is deacetylated chitin which is obtained from renewable resources. Due to its properties such as mucoadhesivness, biocompatibility, biodegradability, gel forming ability, antimicrobial activity, low toxicity and non-immunogenicity, it is widely studied for application in biomedicine. Chitosan possesses primary and secondary hydroxyl and primary amino functional groups, which can be modified in several ways to tune the properties of the carrier for specific applications.

Polypeptides or poly(amino acids) are biocompatible and biodegradable polymers which can be conveniently prepared by ring-opening polymerization (ROP) of *N*-carboxyanhydrides of á-amino acids (NCA). The NCA ROP offers preparation of high molecular weight (co)polypeptides with narrow molecular weight distribution in good yields.

Dendrimers are highly branched, three dimensional structures with a large number of functional groups and well-defined, monodisperse molecular weight. These unique novel materials have emerged as potential drug delivery devices and a number of applications of dendrimers in the biomedical field have been reported.

In this presentation the preparation of different biodegradable and biocompatible polymeric drug carriers will be presented such as poly(ester-amide) dendrimers for improved solubility of low molecular weight active pharmaceutical ingredients as well as trimethychitosan, chitosan grafted with polyaminoacids and hydrophobically modified polyglutamate for formulation of protein/peptide drugs (biopharmaceuticals) into delivery systems in the form of nanoparticles.

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EFFECT OF CARBIDE PARTICLES DISTRIBUTION ON CREEP DEFORMATION ACTIVATION ENERGY

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The aim of this study was to investigate the effect of carbide particles distribution on creep activation energy of steel. Examined steels were X20CrMoV12-1 (X20) and X10CrMoVNb9-1 (P91), both 9-12% chromium creep resistant steels. With annealing at 800 °C for 2 h or for 400 h two different distributions of carbide particles were achieved. After 2 h of annealing the carbide particles were smaller in size and distributed mainly in stringers along grain boundaries and sub-grain boundaries. With annealing for 400 h at 800 °C more uniform distribution of carbide particles were achieved with reduced number and increased size of particles and particle spacing.

Creep tests at 550, 580, 610 and 640 °C with applied stress 170 MPa were performed and experimental activation energy calculated. Also theoretical activation energy was determined using modified creep rate equation taking into account the size of particles and their spacing. For both steels investigated the activation energy deduced from creep tests had the same value for both annealing times, confirming, that the distribution of carbide particles has no effect on the activation energy. However, activation energy obtained from experimental creep rates is significantly higher than the theoretical activation energy. The difference between theoretical and experimental creep activation energy will be presented.