25. MEDNARODNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH

16.–19. oktober 2017, Portorož, Slovenija

25th INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY

16–19 October 2017, Portorož, Slovenia

PROGRAM IN KNJIGA POVZETKOV

PROGRAM AND BOOK OF ABSTRACTS

INŠTITUT ZA KOVINSKE MATERIALE IN TEHNOLOGIJE, LJUBLJANA

25. MEDNARODNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH /
25th INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY

PROGRAM IN KNJIGA POVZETKOV / PROGRAM AND BOOK OF ABSTRACTS

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Legenda – Legend:
MM – Kovinski materiali/Metallic materials
CM – Kompozitni materiali/Composite materials
C – Keramika/Ceramic
P – Polimeri/Polymeric materials
MS – Modeliranje in simulacija procesov in tehnologij/Mathematical modeling and computer simulation of processes and technologies
NN – Nanoznanost in nanotehnologije/Nanosciences and nanotechnologies

YR – Mladi raziskovalci/Young researchers

25th INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY,
16–19 OCTOBER, 2017

Monday, 16.10.2017 Hall B

9:00	**OPENING CEREMONY – Chair of the Conference Matjaž Godec**		
9:15	**PLENARY LECTURE – Rettenmayr**		
10:00	**PLENARY LECTURE – Navard**		
10:45	**INVITED LECTURE – Mori**		
11:15	**Coffee Break**		
11:45	Mannsberger	11:45	**INVITED LECTURE – Timmel**
12:05	Gabor	12:15	**INVITED LECTURE – Lobnik**
12:25	Benčina	12:45	Loning
12:45	Alimadadi	13:05	Wendler
13:15	**LUNCH**		
14:40	Kevorkijan	14:40	**INVITED LECTURE – Kern**
15:00	Conradi	15:10	**INVITED LECTURE – Trimmel**
15:20	Kusič	15:40	Bele
15:40	Popescu	16:00	**INVITED LECTURE – Mozetič**
16:00	Loncnar	16:30	Kaszonyiová
16:20	M. Kovačič	16:50	Hetemi
16:40	Belič	17:10	Vohlidal
17:00	**POSTER SESSION**		

Tuesday, 17.10.2017 Hall C

9:00	**PLENARY LECTURE – Orlov**		
9:45	**INVITED LECTURE – Zaefferer**		
10:15	**INVITED LECTURE – Galtayries**		
10:45	**Coffee Break**		
11:00	Tripathi	11:00	**INVITED LECTURE – Pahovnik**
11:20	T. P. Kovačič	11:30	S. Kovačič
11:40	Štepanek	11:50	Ručigaj
12:00	Gartner	12:10	Maver
12:30	**LUNCH**		
13:30	**EXCURSION TO LJUBLJANA**		
19:00	**DINNER AT GOSTILNA NA GRADU**		
22:00	**LEAVING LJUBLJANA**		

Wednesday, 18.10.2017 Hall C

9:00	**PLENARY LECTURE – Dubois**	
9:45	**INVITED LECTURE – Hodnik**	
10:15	**INVITED LECTURE – Gregorčič**	
10:45	Promotional lecture Zeiss	
11:05	**Coffee Break**	
11:35	Grabnar – Balaško	Čontala – Parkelj
11:55	Fila – An	P. Quang – Suhadolnik
12:15	Skela – Malej	Arumugam – Čapka
12:35	Kelhar – Ikram	Tomanec – Makarovič
12:55	**LUNCH**	
14:00	Topole – Verbovšek	Matavž – Lampe
14:20	Kračun – Kosmač	Keerthiwansa – Zavacky
14:40	Robba – Leskovar	Dobravec – Hatić
15:00	D. Talian – Xu	Resnik – Pivec
15:20	Trafela – Tomše	Štirn – Weissl
15:40	Hren – Gangil	Schlemmer – Sampl
16:00	**Coffee Break**	
16:30	**INVITED LECTURE – Rouilly**	
17:00	Dresvyanina	
17:20	Nypeloe	
17:40	Ozkan	
19:00 21:00	**SOCIAL EVENT IN GH BERNARDIN**	

Thursday, 19.10.2017

09:00	**INVITED LECTURE – Donik**			09:00	Junkar
09:30	**INVITED LECTURE – K.-Iglič**			09:20	Spirk
10:00	**INVITED LECTURE – Kocijančič**			09:40	Bračič
10:30	**Coffee Break**			10:00	Mohan
11:00	**INVITED LECTURE – Oblak**	11:00	**INVITED LECTURE – Grainger**	10:20	Kargl
11:30	**INVITED LECTURE – Gorenšek**	11:30	Klobčar		
12:00	**INVITED LECTURE – Dolinar**	11:50	Petrič		
12:30	Jenko	12:10	Govekar		
12:50	**CLOSING CEREMONY**	12:30	**LUNCH**		
13:00	**LUNCH**				

PROGRAM 25. MEDNARODNE KONFERENCE O MATERIALIH IN TEHNOLOGIJAH
25th INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY: PROGRAM

Ponedeljek – Monday 16.10.2017 Hall B	
	Predsedujoči – Chair: M. Godec, B. Šarler
9:00	**ODPRTJE – OPENING CEREMONY – Matjaž Godec**
9:15	Alloy development using modern tools Markus Rettenmayr[1], Gunther Wiehl[2], Peter Siegmund[1], Martin Salge[1] [1]FSU Jena, [2]Umicore AG
10:00	Interrelations Between Genotypes, Year of Growth, Biochemical Composition, Histological Structure and Plant-Polymer Composite Mechanical Traits For Maize, Sorghum and Miscanthus Patrick Navard[1], Loan T. T. Vo[1], Jordi Girones[1], Lucie Chupin[1], Erika Di Giuseppe[1], Anne Clément Vidal[2], Armelle Soutiras[2], David Pot[2], Denis Bastianelli[3], Laurent Bonnal[3], Emilie Gineau[4], Matthieu Reymond[4], Catherine Lapierre[4], Lauret Cézard[4], Frédéric Legée[4], Grégory Mouille [4] Stéphanie Arnoult[5], Maryse Brancourt-Hulmel[6], Luc Vincent[7], Alice Mija[7], Lata Soccalingame[8], Stéphane Corn[8], Nicolas Le Moigne[8] [1]MINES ParisTech, PSL Research University, CEMEF** - Centre de mise en forme des matériaux, CNRS UMR 7635, CS 10207 rue Claude Daunesse 06904 Sophia Antipolis Cedex, France, [2]CIRAD, UMR AGAP, Avenue Agropolis, F-34398 Montpellier, France, [3]CIRAD, UMR SELMET, Avenue Agropolis, F-34398 Montpellier, France, [4]INRA, Institut Jean-Pierre Bourgin, UMR1318 INRA-AgroParisTech, ...
10:45	Contributions to the Understanding of Chloride Induced Stress Corrosion Cracking of Stainless Steels Gregor Mori[1], Stefan Holzleitner[2], Rainer Fluch [1]Chair of General and Analytical Chemistry, Montanuniversitaet Leoben, Austria, [2]MCL Forschungs GmbH, Austria, 3Bohler Edelstahl GmbH, Austria
11:15	**Coffee Break**
	Hall B
	Predsedujoči – Chair: D. Steiner Petrovič, B. Šarler
11:45	Monatomic and Cluster Argon Ion XPS Depth Profiling of $SrTiO_3$ and HfO_2 Christopher Deeks[1], Mark Baker[2], Paul Mack[1], Michael Mannsberger[3] [1]Thermo Fisher Scientific, The Birches Industrial Estate, East Grinstead, RH19 1 UB, UK [2]University of Surrey, Department of Mechanical Engineering Sciences, Guilford, GU2 7XH, UK [3]Thermo Fisher Scientific, Dresdner Straße 89, 1200 Wien, AT
12:05	Pulsed-Laser Deposition of $Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$ Thin Films on $SrTiO_3$: Nucleation and Initial Growth Urška Gabor, Matjaž Spreitzer, Danilo Suvorov Advanced Materials Department, Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia
12:25	Long-term superhydrophilic TiO_2 nanotubes Benčina M.,[1] Lampe T.,[2] Junkar I.,[1] Valant M.,[3,4] Kulkarni M.,[5] Mozetič M.,[1] Kralj-Iglič V.,[2] Iglič A.[6] [1]Jožef Stefan Institute, Jamova cesta 39, SI-1000 Ljubljana, Slovenia, [2]Laboratory of Clinical Biophysics, Faculty of Health Sciences, University of Ljubljana, Zdravstvena 5, SI-1000 Ljubljana, Slovenia, [3]Materials Research Laboratory, University of Nova Gorica, Vipavska 13, SI-5000 Nova Gorica, Slovenia, [4]Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, Chengdu 610054, China, [5]Regional Centre of Advanced Technologies and Materials, Department of Physical Chemistry, Faculty of Science, Palacky University, Slechtitelu 27, 783 71 Olomouc, Czech Republic, [6]Laboratory of Biophysics, Faculty of Electrical Engineering, University of Ljubljana, Tržaška 25, SI-1000 Ljubljana, Slovenia

12:45	Thermal Stability of Functionally Graded Nickel and Nickel-Tungsten Electrodeposits; A Comparative Study Hossein Alimadadi[1], Andrew Burrows[1], Alice Bastos Fanta[1], Marcel Somers[2], Karen Pantleon[2], Mohammad Hossein Allahyarzadeh[3], Mahmoud Aliofkhazraei[3] [1]Technical University of Denmark, Center for Electron Nanoscopy, Fysikvej, Building 307, 2800 Lyngby, Denmark, [2]Technical University of Denmark, Department of Mechanical Engineering, Produktionstorvet Building 425, 2800 Lyngby, Denmark, [3]Materials Engineering Department, Tarbiat Modares University, Tehran, P.O. Box: 14115-143, Iran
13:15	**LUNCH**
	Hall C
	Predsedujoči – Chair: J. Burja, D. Skobir Balantič
14:40	Big-Data Analytics for the Modelling of Wrought Aluminium Alloys Varužan Kevorkijan[1], Sara Hmelak[2], Branko Hmelak[2], Peter Cvahte[1], Borislav Hostej[1], Irena Lesjak[1] [1]Impol Aluminium Industry, Partizanska 38, 2310 Slovenska Bistrica, Slovenia, [2]Alcad d.o.o., IT Company, Zgornja Bistrica 4, 2310 Slovenska Bistrica, Slovenia
15:00	Surface Properties, Corrosion Resistance and Biocompatibility properties of Superhydrophilic and Superhydrophobic TiO_2/Epoxy Coatings on AISI 316L Stainless Steel M. Conradi[1], A. Kocijan[1], Č. Donik[1], M. Hočevar[1], D. Drobne[2] and M. Godec[1] [1]Institute of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia [2]Biotechnical Faculty, University of Ljubljana, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia
15:20	Detection of macro-cracks on engraving tool steel inserts using acoustic emission method Dragan Kusić[1], Aleš Hančič[1] and Janez Grum[2] [1]TECOS Slovenian Tool and Die Development Centre, Kidričeva 25, 3000 Celje, Slovenia [2]Faculty of Mechanical Engineering, University of Ljubljana, Aškerčeva 6, 1000 Ljubljana, Slovenia
15:40	TiZrNbTaFe High Entropy Alloy for Medical Applications Gabriela Popescu, Brandusa Ghiban, Cristian Popescu, Robert Bololoi University POLITEHNICA of Bucharest, Splaiul Independentei 313, 060042, Bucharest, Romania
16:00	The effect of acid pickling process on the microstructure of a nickel-iron-chromium alloy M. Loncnar[1], K. T. Cuznar[2], B. Bradaškja[3], P. Jan[3], E. Vidic[1], B. Novosel[2] [1]SIJ Acroni d.o.o., C. Borisa Kidriča 44, 4270 Jesenice, [2]Faculty of Chemistry and Chemical Tecnology, University of Ljubljana, Večna pot 113, 1000 Ljubljana, [3]RCJ d.o.o., C. Borisa Kidriča 44, 4270 Jesenice
16:20	Modeling of Roll Wear of the First Stand of Continuous Rolling Mill Miha Kovačič[1], Andrej Mihevc[2], Milan Terčelj[3] [1]Štore steel d.o.o., Železarska cesta 3, 3220 Štore, Slovenia, IMT, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]Štore steel d.o.o., Železarska cesta 3, 3220 Štore, Slovenia, [3]University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Matrials and Metallurgy, Aškerčeva cesta 12, 1000 Ljubljana, Slovenia,
16:40	Neural network supported 3D grain model Igor Belič IMT, Lepi pot 11, SI-1000 Ljubljana, Slovenia
17:00	**Poster Session**

Ponedeljek – Monday 16.10.2017 Hall D	
	Predsedujoči – Chair: R. Kargl
11:45	Biorefinery Activities In Austria – On The Example Of The Research Initiative Flippr Thomas Timmel Papierholz Austria GmbH, Frantschach 5 9413 St. Gertraud, Austria,

12:15	"RESYNTEX" - A new circular economy concept for textiles and chemicals Aleksandra Lobnik[1,2], Bojana Vončina[1], Alenka Majcen le Marechal[1], Julija Volmajer[1], Simona Vajnhandl[1,2], Mojca Poberžnik[2], Andreja Gutmaher[1,2] [1]University of Maribor, Faculty of Mechanical Engineering, Laboratory of Chemistry and Environmental Protection, Smetanova 17, 2000 Maribor, Slovenia, [2]IOS, Ltd. Institute of Environmental Protection and Senors, Beloruska ul, 7, 2000 Maribor, Slovenia
12:45	MER Non-woven - High performance thermal and acoustic insulation materials manufactured according to innovative MB technology Ch. Kindler[1], Y. Ewert[2], F. Meister[2], Ch. Löning[1] [1]Smartpolymer GmbH, Breitscheidstraße 97, 07407 Rudolstadt, Germany, [2]Thuringian Institute for Textile and Plastics Research (TITK), Breitscheidstraße 97, 07407 Rudolstadt, Germany
13:05	Embedding of lipophilic liquids in a cellulosic fiber ensuring textile refining Frank Wendler, Marcus Krieg, Frank Meister Smartpolymer GmbH, Breitscheidstr. 97, 07407 Rudolstadt, Germany
13:05	**LUNCH**
	Hall D
	Predsedujoči – Chair: K. Stana-Kleinschek
14:40	Anti-adhesive Layers on Stainless Steel Using Thermally Stable Dipodal Perfluoroalkyl Silanes Baris Kaynak[1], Cüneyt Alpan[1], Markus Kratzer[2], Christian Ganser[2], Christian Teichert[2], Wolfgang Kern[1] [1]Chair in Chemistry of Polymeric Materials, Montanuniversität Leoben, Otto Glöckel-Strasse 2, A-8700 Leoben, [2]Institute of Physics, Montanuniversität Leoben, Franz Josef Str. 18, A-8700 Leoben
15:10	Insights into the steel-rubber adhesion Gregor Trimmel Institute for Chemistry and Technology of Materials, Graz University of Technology, Stremayrgasse 9, 8010 Graz. Austria, Polymer Competence Center Leoben GmbH, Roseggerstraße 12, 8700 Leoben, Austria
15:40	High performance Pt-skin PtCu3/C intermetallic shell PEM-FC electrocatalyst M. Bele[1], N. Hodnik[1], M. Gatalo[1], P. Jovanovič[1], G. Dražič[1], F. Ruiz-Zepeda[1], M. Gaberšček[1] and S. Hočevar[1,4] [1]National Institute of Chemistry Hajdrihova 19, SI-1000 Ljubljana, Slovenia, [1,2]Mebius d.o.o., Na jami 3, SI-1000, Ljubljana, Slovenia
16:00	Surface functionalization and nanostructuring of polymers using non-equilibrium gaseous plasma Miran Mozetič Jozef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia
16:30	The Effect of Beta Irradiation on the Structural Changes of Isotactic Polypropylene Martina Kaszonyiová, Frantisek Rybnikar, Milena Kubišová, David Maňas Tomas Bata University in Zlin, Faculty of Technology, Vavreckova 275, Zlín 76001
16:50	Surface Modification of Polymers by Reaction of Alkyl Radicals Dardan Hetemi,[1,2] Catherine Combellas,[2] Frédéric Kanoufi,[2] Jean Pinson[2] and Fetah I. Podvorica[1,2] [1]Univ Paris Diderot, Sorbonne Paris Cité, ITODYS, UMR 7086 CNRS, 15 rue J-A de Baïf, 75205 Paris Cedex 13, France, [2]Pharmacy Department, Medical Faculty, University of Prishtina "Hasan Prishtina", Rr. "Dëshmorët e Kombit" p.n., 10000 Prishtina, Kosovo
17:10	Interesting Formation and Properties of Some New Dynamic Polymers Jiří Vohlídal Charles University, Faculty of Sciences, Department of Physical & Macromolecular Chemistry, Albertov 6, CZ-128 40, Praha 2, Czech Republic
17:00	**Poster Session**

Torek – Tuesday 17.10.2017 Hall C	
	Predsedujoči – Chair: B. Podgornik, M. Jenko
9:00	Magnesium Alloys: Concept of Design and Recent Developments Dmytro Orlov[1,2] [1]Division of Materials Engineering, LTH, Lund University, P.O. Box 118, 22100 Lund, Sweden; [2]Materials Research Laboratory, University of Nova Gorica, Vipavska 13, 5000 Nova Gorica, Slovenia
9:45	Using orientation microscopy to explore the correlation of materials properties and microstructures S. Zaefferer, L. Schemmann, G. Stechmann, F. Ram, F. Archie
10:15	Bioactive grafting on passive metals: interaction with protein solutions Anouk Galtayries Institut de Recherche de Chimie Paris, CNRS-Chimie ParisTech, Université de Recherche Paris Sciences et Lettres, Paris, France
10:45	**Coffee Break**
11:00	Resolution of EBSD in Light Metals: How good are we? Abhishek Tripathi, Stefan Zaefferer Max-Planck- Institute for Iron Research GmbH, Max-Planck-St.1, D-40237, Dusseldorf, Germany
11:20	INFLUENCE OF DIFFERENT CASTING CONDITIONS AND FILTERING PROCESS ON THE ELECTRICAL PROPERTIES OF DIFFERENT Al-ALLOYS Terezija Poženel Kovačič [1], Mitja Petrič[2], Vitoslav Bratuš[1], Maja Vončina[2] [1]Hidria Rotomatika, Spodnja Kanomlja 23, 5281 Spodnja Idrija, [2]Faculty for Natural Sciences and Engineering, Department of Materials and Metallurgy, Aškerčeva 12, 1000 Ljubljana
11:40	Microstructural Changes of ECAP Processed Magnesium Alloy AZ91 During Cyclic Loading at Different Stress Amplitude Levels Roman Štěpánek[1], Libor Pantělejev[1], Ondřej Man[1], Mario Guagliano[2], Maurizio Vedani[2], Ehsan Mostaed[2] [1]Institute of Materials Science and Engineering, Faculty of Mechanical Engineering, Brno University of Technology, Technická 2896/2, 616 69, Brno, Czech Republic, [2]Department of Mechanichal Engineering, Politecnico di Milano, Via Giuseppe La Masa, 1, 20156 Milan, Italy
12:00	Corrosion of Steel in Alkali-Activated Materials Nina Gartner, Tadeja Kosec, Miha Hren, Vilma Ducman, Andraž Legat Slovenian National Building and Civil Engineering Institute, Dimičeva ulica 12, SI-1000 Ljubljana,
12:30	**LUNCH**
13:30	Izlet v Ljubljano / Excursion to Ljubljana
19:00	Večerja v Gostilni na gradu / Dinner at Gostilna na gradu
22:00	Odhod iz Ljubljane / Leaving Ljubljana

Torek – Tuesday 17.10.2017 Hall D	
	Predsedujoči – Chair: A. Lobnik
11:00	Synthetic Polypeptides Prepared by Ring-Opening Polymerization of *N*-Carboxyanhydrides David Pahovnik, Ema Žagar Department of Polymer Chemistry and Technology, National Institute of Chemistry, Hajdrihova 19, 1001 Ljubljana, Slovenia
11:30	Emulsion-templated Polyelectrolytes for the Absorption of Water Contaminants Sebastijan Kovačič, Ema Žagar National Institute of Chemistry, Department of Polymer Chemistry and Technology, Hajdrihova 19, 1000 Ljubljana, Slovenia
11:50	Rheological Properties of Biorenewable PSA Hydrogels Aleš Ručigaj, Natalija Ravber, Matjaž Krajnc Faculty of Chemistry and Chemical Technology, University of Ljubljana, Večna pot 113, SI-1000 Ljubljana
12:10	Newly Developed 3D Printed Material For Treatment Of Chronic Wounds Tina Maver[1], Uroš Maver[2], Manja Kurečič[1,3], Karin Stana Kleinschek[1,3] [1]Univerza v Mariboru, Fakulteta za strojništvo, Laboratorij za obdelavo in preskušanje polimernih materialov, Smetanova 17, SI-2000 Maribor, Slovenija, [2] Univerza v Mariboru, Medicinska fakulteta, Inštitut za biomedicine vede, Taborska ulica 8, SI-2000 Maribor, Slovenija, [3]TU Graz, Rechbauerstraße 12, 8010 Graz, Avstrija
12:30	**LUNCH**
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19:00	Večerja v Gostilni na gradu / Dinner at Gostilna na gradu
22:00	Odhod iz Ljubljane / Leaving Ljubljana

Sreda – Wednesday 18.10.2017 Hall C	
	Predsedujoči – Chair: M. Mozetič, S. Kobe
9:00	Push-Pull Alloys: the nucleation of complexity in metallic alloys Jean-Marie DUBOIS[1,2,3], Luka KELHAR[2,3], Božo SKELA[2,3], Fabian BURKHARDT[2,3] and Spomenka KOBE[2,3] [1]Institut Jean Lamour (UMR 7198 CNRS – Université de Lorraine), Parc de Saurupt, CS50840, F-54011 Nancy; [2]Institute Jožef Stefan Institute, Jamova 39, SI-1000 Ljubljana; [3]International Associated Laboratory PACS2 CNRS-JSI
9:45	Platinum dissolution - from fuel cells degradation to recycling. Nejc Hodnik Department of Catalysis and Chemical Reaction Engineering, National Institute of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia
10:15	Laser Texturing – a Flexible and Efficient Tool for Producing Surfaces with Superior Wetting Properties Peter Gregorčič Faculty of Mechanical Engineering, University of Ljubljana, Aškerčeva 6, SI-1000 Ljubljana, Slovenia
10:45	Promotional lecture Zeiss
11:05	**Coffee Break**
	Hall C
	Evaluators: B. Podgornik - chair, D. Orlov, D. Skobir Balantič, P. Gregorčič
11:35	Role of material and surface treatment on premature failure mechanism of X37CrMoV5-1 HPDC tool Klemen Grabnar[1], Boštjan Taljat[1], Primož Mrvar[1], Matjaž Godec[2], Jožef Medved[1] [1]Faculty of natural sciences and Engineering, Department of Materials and Metallurgy, Aškrčeva cesta 12, 1000 Ljubljana, Slovenia, [2]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia
	High temperature oxidation of hot work tool steels Tilen Balaško[1], Maja Vončina[1], Jaka Burja[2], Jožef Medved[1] [1]Faculty of natural sciences and engineering, University of Ljubljana, Aškerčeva cesta 12, 1000 Ljubljana, Slovenia, [2]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia
11:55	Dynamic Testing of Advanced Cellular Metallic Materials Using Split Hopkinson Pressure Bar Tomáš Fíla, Petr Zlámal, Markus Felten, Michael Fries, Jan Falta, Ondřej Jiroušek, Anne Jung Czech Technical University in Prague, Faculty of Transportation Sciences, Konviktská 20, 110 00, Prague 1, Czech Republic
	Observation of dislocation evolution under shear fatigue in a TRIP steel Dayong An, Stefan Zaefferer Max-Planck-Institut für Eisenforschung GmbH, Max-Planck-Straße 1, 40237 Düsseldorf, Germany
12:15	Influence of microstructure and heat treatment on mechanical and wear properties of hot work tool steel Božo Skela, Marko Sedlaček, Jaka Burja, Bojan Podgornik Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia
	The microstructural changes in turbine blades of turbocharger turbine wheel Simon Malej, Barbara Šetina Batič, Franc Tehovnik, Jaka Burja, Matjaž Godec Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia

12:35	Amorphous alloys with variable amounts of immiscible Fe and Cu metals Luka Kelhar[1,3,4], Spomenka Kobe[1,3,4] and Jean-Marie Dubois[1,2,3,4] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova cesta 39, Ljubljana 1000, Slovenia, [2]Institut Jean Lamour (UMR 7198 CNRS-Université de Lorraine), Parc de Saurupt, CS 50840, 54011 Nancy Cedex, France, [3]International Associated Laboratory PACS2, CNRS-Nancy, France and JSI-Ljubljana, Slovenia, [4]International Postgraduate School "Jožef Stefan", Jamova cesta 39, Ljubljana 1000, Slovenia
	The magnetic properties of the recycled HDDR Nd-Fe-B powder consolidated with the Spark Plasma Sintering Awais Ikram[1], Farhan Mehmood[1], Spomenka Kobe[1,2], Saso Sturm[1,2], T. Tomse[1], R. S. Sheridan[3], Muhammad Awais[3,] Kristina Zuzek Rozman[1,2] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slo [2]Jožef Stefan International Postgraduate School, Jamova 39, SI-1000 Ljubljana, Slovenia [3]School of Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT, United Kingdom
12:55	**LUNCH**
14:00	Pulsed Electric Current Sintered Ti-CNT Metal-Matrix Composites Martin Topole[1], Elinor G. Castle[2], Michael J. Reece[2], Paul J. McGuiness[1] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, [2]School of Engineering and Material Science, Queen Mary University of London, Mile End Rd, London E1 4NS
	Surface Treatment of Stainless Steel and Its Effect on Gas Flow Conductance Tim Verbovšek[1,2], Barbara Šetina Batič[1], Janez Šetina[1] [1]Institute of Metals and Technology, IMT, Lepi Pot 11, SI-1000 Ljubljana, [2]Jozef Stefan International Postgraduate School, Jamova cesta 39, 1000 Ljubljana, Slovenia
14:20	Effect of Al_2O_3 nano-particles on the tribological properties of stainless steel Ana Kračun[1,2], Franc Tehovnik [1], Fevzi Kafexhiu[1], Tadeja Kosec [3], Bojan Podgornik[1] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenija. [2]International postgraduate school Jožef Stefan, Jamova cesta 39, 1000 Ljubljana, Slovenija. [3]Zavod za gradbeništvo Slovenije, Dimičeva ulica 12, 1000 Ljubljana, Slovenija.
	Extrusion of PPS-bonded Nd-Fe-B Magnetic Material Karla Kosmač[1, 4], Boris Saje[2], Marko Soderžnik[3], Spomenka Kobe[3] [1]Kolektor KFH, d.o.o, Vojkova ulica 10, 5280 Idrija, Slovenia, [2]Kolektor Magnet Technology GmbH, Zur Halbinsel 6, 45356 Essen, Germany, [3]Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia, [4]Jožef Stefan International Postgraduate School, Jamova cesta 39, 1000 Ljubljana, Slovenia
14:40	Electrochemical mechanism of C-S composite cathode in Mg-S batteries Ana Robba[1,2], Alen Vizintin[1], Jan Bitenc[1], Iztok Arčon[3], Matjaž Kavčič[4], Gregor Mali[1], Anna Randon-Vitanova[5], Robert Dominko[1] [1]National institute of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia, [2]Faculty of chemistry and chemical technology University of Ljubljana, Večna pot 113, 1000 Ljubljana, Slovenia, [3]University of Nova Gorica, Vipavska 13, 5000 Nova Gorica, Slovenia, [4]Institute Jožef Stefan, Jamova 39, 1000 Ljubljana, Slovenia, [5]Honda R&D Europe (Deutschland) GmbH, Carl-Legien-Strasse 30, 63073 Offenbach, Germany
	Development of a metal matrix composite reinforced with quasicrystalline particles Blaž Leskovar, Iztok Naglič, Boštjan Markoli University of Ljubljana, Faculty of Natural Science and Engineering, Aškerčeva 12, Ljubljana, Slovenia
15:00	Electrochemistry of carbon and lithium surfaces in the lithium-sulfur battery system Sara Drvarič Talian[1,2], Jože Moškon[1], Miran Gaberšček[1,2], Robert Dominko[1] [1]Department of materials chemistry, National institute of chemistry, Hajdrihova 19, SI-1000 Ljubljana, Slovenia, [2]Faculty of chemistry and chemical technology University of Ljubljana, Večna pot 113, 1000 Ljubljana, Slovenia

	Electrodeposition of Nd-Fe-based alloy from aqueous solution Xuan Xu[1,2], Špela Trafela[1,2], Sašo Šturm[1,2], Kristina Žužek Rožman[1] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova 39, SI-1000 Ljubljana, Slovenia, [2]Jožef Stefan International Postgraduate School, Jamova 39, SI-1000 Ljubljana, Slovenia
15:20	Electrodeposition and electro-catalytic properties of Ni based nanomaterials for formaldehyde detection in alkaline media Špela Trafela[1,2], Xuan Xu[1,2], Spomenka Kobe[1,2] and Kristina Žužek Rožman[1,2] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova 39, SI-1000 Ljubljana, Slovenia, [2]Jožef Stefan International Postgraduate School, Jamova 39, SI-1000 Ljubljana, Slovenia
	Multicomponent nanostructured Nd-Fe-B permanent magnets prepared by Spark Plasma Sintering technique Tomaž Tomše[1,2], Jean-Marie Dubois[1,2] and Spomenka Kobe[1,2] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova 39, SI-1000 Ljubljana, Slovenia, [2]Jožef Stefan International Postgraduate School, Jamova 39, SI-1000 Ljubljana, Slovenia
15:40	Characterization of chloride induced steel corrosion processes in blended cements Miha Hren, Tadeja Kosec, Andraž Legat Slovenian National Building and Civil Engineering Institute, Dimičeva 12, 1000 Ljubljana
	Surface nanocomposite fabrication on AA6063 aluminium alloy using friction stir processing: An investigation of the effect of shoulder diameter on composite microstructure Sachin Maheshwari[1], Arshad Noor Siddiquee[2], Namrata Gangil[1] [1]Department of Manufacturing Processes and Automation Engineering, Netaji Subhas Institute of Technology, New Delhi, 110078, India, [2]Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi, 110025, India
16:00	**Coffee Break**
	Predsedujoči – Chair: R. Kargl
16:30	Uniaxial high pressure thermocompression of cellulosic and lignocellulosic materials Thibaud Pintiaux, Virginie VanDenBossche, Antoine Rouilly Laboratoire de Chimie Agro-industrielle (LCA), Université de Toulouse, INRA, INPT, Toulouse, France
17:00	Elena Dresvyanina, Vladimir Yudin, Irina Dobrovolskaya, Pavel Popryadukhin, Alexandra Yudenko, Ekaterina Maevskaya, Anton Shabunin, Inna Lebedeva Peter the Great St. Petersburg Polytechnic University, Polytechnicheskaya, 29, 195251 St. Petersburg, Russia
17:20	Wood-biopolymer films as platforms for functionalization Tiina Nypelö[1,2], Hassan Amer[2], Christiane Laine[3], Tekla Tammelin[3], Ute Henniges[2], Antje Potthast[2], Thomas Rosenau[2] [1]Chalmers University of Technology, Department of Chemistry and Chemical Technology, Division of Applied Chemistry, Kemigården 4, Göteborg, Sweden, [2]University of Natural Resources and Life Sciences Vienna, Division of Chemistry of Renewables, Konrad Lorenz Strasse 24, 3430 Tulln, Austria, [3]VTT Technical Research Centre of Finland, P.O. Box 64, 02044 Espoo, Finland
17:40	Fast and simple method for the preparation of the biocompatible conductive film based on chitosan/conducting polymer and its optoelectrochemical properties Betul Cicek Ozkan[1], Tugba Soganci[2], Huseyin Turhan[1], Metin Ak[2] [1]Firat University, Faculty of Technology, Metallurgical and Materials Engineering Department, Elazig, Turkey, [2]Pamukkale University, Faculty of Art and Science, Chemistry Department, Denizli, Turkey
19:30-21:00	**SOCIAL EVENT AT ST. BERNARDIN**

Sreda – Wednesday 18.10.2017 Hall D	
11:05	**Coffee Break**
	Evaluators: B. Podgornik - chair, D. Orlov, D. Skobir Balantič, P. Gregorčič
11:35	Topochemical Conversion of $Bi_4Ti_3O_{12}$ to $SrTiO_3$ under Hydrothermal Conditions Alja Čontala[1,2], Marjeta Maček Kržmanc[1] and Danilo Suvorov[1] [1]Advanced Materials Department, Jožef Stefan Institute, 39 Jamova cesta, 1000 Ljubljana, Slovenia [2]Jožef Stefan International Postgraduate School, 39 Jamova cesta, 1000 Ljubljana, Slovenia
	Different Approaches to the Preparation of Sr Buffered Si (001) Surfaces Using Pulsed Laser Deposition Tjaša Parkelj, Matjaž Spreitzer Advanced Materials Department, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia
11:55	Isolating Reactions at the Picoliter-scale : Parallel Control of Reaction Kinetics at the Liquid-liquid Interface Gia Chuong (Gauss) Phan-Quang, and Xing Yi Ling Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, Nanyang Technological University, 50 Nanyang Avenue, 637371 Singapor
	Photo(electro)catalytic Degradation of Reactive Red 106 Dye Luka Suhadolnik[1,2], Andrej Pohar[3], Uroš Novak[3], Blaž Likozar[3], Miran Čeh[1] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova 39, SI-1000 Ljubljana, Slovenia, [2]Jožef Stefan International Postgraduate School, Jamova 39, SI-1000 Ljubljana, Slovenia, [3]Laboratory of Catalysis and Chemical Reaction Engineering, National Institute of Chemistry, Hajdrihova 19, SI-1000 Ljubljana, Slovenia
12:15	Study on In-plane Shear Performance of Spacer Fabrics in Composite Forming Veerakumar Arumugam[1], Rajesh Mishra[1], Maros Tunak[2], Blanka Tomkova[1] & Jiri Militky[1] [1]Department of Materials Engineering, [2]Department of Textile Evaluation, Faculty of Textile, Technical University of Liberec, Liberec, Czech Republic 461 17
	Dependability of Composites Construction Alexander Čapka, Soňa Rusnáková, Milan Žaludek, Konstantinos Karvanis Tomas Bata University in Zlín, Faculty of Technology, nám. T.G.Masaryka 5555, Zlín, Czech. Rep.
12:35	Use of Composite Materials for External Fixators Martina Kalova[1], Jiri Kohut[1], Filip Tomanec[2], Sona Rusnakova[2] [1]Faculty of Metallurgy and Materials Engineering, VŠB – Technical University of Ostrava. 17.listopadu 15/2172, 708 33 Ostrava. Czech Republic, [2]Department of Production Engineering, Faculty of Technology, Tomas Bata University in Zlín, Nad Stranemi 4511, 760 05 Zlín. Czech Republic
	Tailoring the conductivity of lead-free $BiFeO_3$-based piezoelectric ceramics Maja Makarovič[1,2], Andreja Benčan[1,2], Barbara Malič[1,2] and Tadej Rojac[1,2] [1]Electronic Ceramic Department, Jozef Stefan Institute, Jamova cesta 39, Ljubljana, Slovenia [2]Jozef Stefan International Postgraduate School, Jamova cesta 39, 1000 Ljubljana, Slovenia
12:55	**LUNCH**
14:00	Inkjet Printing of Metal-Oxide-Based Electronic Devices Aleksander Matavž, Barbara Malič, Vid Bobnar Jožef Stefan Institute, Jamova 39, Ljubljana, Slovenia, Jožef Stefan International Postgraduate School, Jamova 39, Ljubljana, Slovenia

	Formation of hexagonaly patterned nanomoss derived from TiO_2 surface structured by perpendicular nanotubes Lampe T.,[1] Benčina M.,[2] Junkar I.,[2] Valant M.,[3,4] Kulkarni M.,[5] Mozetič M.,[2] Kralj-Iglič V.,[1] Iglič A.[6] [1]Laboratory of Clinical Biophysics, Faculty of Health Sciences, University of Ljubljana, Zdravstvena pot 5, SI-1000 Ljubljana, Slovenia, [2]Jožef Stefan Institute, Jamova cesta 39, SI-1000 Ljubljana, Slovenia, [3]Materials Research Laboratory, University of Nova Gorica, Vipavska c. 13, SI-5000 Nova Gorica, Slovenia, [4]Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, Shahe Campus:No.4, Section 2, North Jianshe Road, 610054, China, [5]Regional Centre of Advanced Technologies and Materials, Department of Physical Chemistry, Faculty of Science, Palacky University, Slechtitelu 27, 783 71 Olomouc, Czech Republic, [6]Laboratory of Biophysics, Faculty of Electrical Engineering, University of Ljubljana, Tržaška c. 25, SI-1000 Ljubljana, Slovenia
14:20	Elastomer Testing: The Risk of Using Uniaxial Data Only for Fitting Mooney-Rivlin Hyperelestic Material Model Rohitha Keerthiwansa, Jakub Javorik, Jan Kledrowetz, Pavel Nekoksa Department of Production Engineering, Faculty of Technology, Tomas Bata University in Zlin, nam. T.G. Masaryka 5555, 760 01 Zlin, CZECH REPUBLIC.
	Advanced Material Model for Shotcrete – Calibration of Hardening Parameters Martin Závacký[1], Juraj Chalmovský[1], Lumír Miča[1], Petr Bílek[2,3] [1]Department of Geotechnics, Faculty of Civil Engineering, Brno University of Technology, Veveří 331/95, 602 00 Brno, Czech Republic, [2]GEOtest a.s, Šmahova 1244/112, 627 00 Brno, Czech Republic, [3]Institute of Forensic Engineering, Brno University of Technology, Purkyňova 118, 612 00 Brno, Czech Republic
14:40	A Cellular Automaton Model for Simulation of Microstructure Evolution during Solidification in Binary Eutectic Alloys Dobravec Tadej[1], Mavrič Boštjan[1] and Šarler Božidar[1,2] [1]Institute of Metals and Technology, Ljubljana, Slovenia, EU, [2]University of Ljubljana, Faculty of Mechanical Engineering, Ljubljana, Slovenia, EU
	Simulation of Macrosegregation in Direct Chill and Low-Frequency Electromagnetic Casting by a Meshless Method Hatić Vanja[1], Mavrič Boštjan[1] and Šarler Božidar[1,2] [1]Institute of Metals and Technology, Ljubljana, Slovenia, EU, [2]University of Ljubljana, Faculty of Mechanical Engineering, Ljubljana, Slovenia, EU
15:00	Cold Atmospheric Plasma Treated Polypropylene Tubes and Their Application in Medical Diagnostics Matic Resnik[1,2], Ita Junkar[1], Roman Štukelj[3], Veronika Kralj Iglič[3], Janez Kovač[1], Miran Mozetič[1] [1]Jožef Stefan Institute, Jamova c. 39, 1000 Ljubljana, Slovenia, [2]Jožef Stefan international postgraduate school, Jamova c. 39, 1000 Ljubljana, Slovenia, [3]Laboratory of Clinical Biophysics, Faculty of Medicine, University of Ljubljana, Zaloška c. 9, 1000 Ljubljana, Slovenia
	Chemical Structure And Bioactive Properties Of Rutin And Polyrutin Tanja Pivec[1], Rupert Kargl[1,2], Uroš Maver[3], Matej Bračič[1], Thomas Elschner[1], Ema Žagar[4], Lidija Gradišnik[3], Elsa Fabbretti[5], Karin Stana Kleinschek[1,2] [1]Laboratory for Characterization and Processing of Polymers (LCPP), Faculty of Mechanical Engineering, University of Maribor, Smetanova ulica 17, 2000 Maribor, Slovenia, [2]Institute for Chemistry and Technology of Materials (ICTM), Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria, [3]Institute for Biomedical Sciences, Faculty of Medicine, University of Maribor, Taborska ulica 8, 2000 Maribor, Slovenia, [4]National Institute of Chemistry Slovenia, Hajdrihova 19, 1000 Ljubljana, Slovenia, [5]Center for biomedical sciences and engineering, University of Nova Gorica, Dvorec Lanthieri, Glavni Trg 8, 5271 Vipava, Slovenia

15:20	Use of Diels–Alder Chemistry for Self-Healing Applications in Epoxy Materials Žiga Štirn, Aleš Ručigaj, Matjaž Krajnc Faculty of Chemistry and Chemical Technology, University of Ljubljana, Večna pot 113, SI-1000 Ljubljana, Slovenia
	Viscose based cellulose thin films, a new model system for studying cellulose surface interactions Michael Weißl[1],Katrin Niegelhell[2], David Reishofer[2], Stefan Spirk[2] [1]Institute for Chemistry and Technology of Materials, Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria, [2]Institute for Paper, Pulp and Fibre Technology, Graz University of Technology, Inffeldgasse 23, 8010 Graz, Austria
15:40	Microstructures and Wetting Behaviour of TMSC and Cellulose Thin Films on Diverse Substrates Werner Schlemmer[1], Katrin Niegelhell[2] [1]Institute for Chemistry and Technology of Materials, Graz University of Technology, Stremayrgasse 9, 8010 Graz, [2]Institute for Paper-, Pulp- and Fibre Technology, Graz University of Technology, Inffeldgasse 23, 8010 Graz
	Synthesis and Investigation of NQR-Spectroscopic Characteristics of Trivalent Organobismuth Compounds Carina SAMPL[1,2], Stefan SPIRK[3], Martin THONHOFER[4], Christian GÖSWEINER[5], Rupert KARGL[4], Karin STANA-KLEINSCHEK[4], Hermann SCHARFETTER[5], Roland FISCHER[1] [1]Institute of Inorganic Chemistry, Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria [2]Institute for Chemistry and Technology of Materials, Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria, [3]Institute for Paper-, Pulp- and Fibre Technology, Graz University of Technology, Inffeldgasse 23, 8010 Graz, Austria, [4]Institute for Engineering Materials and Design, University of Maribor, Smetanovaulica 17, 2000 Maribor, Slovenia, [5]Institute of Medical Engineering, Graz University of Technology, Stremayrgasse 16, 8010 Graz, Austria
16:00	**Coffee Break**

Četrtek – Thursday 19.10.2017 Hall B	
	Predsedujoči – Chair: M. Jenko, Č. Donik
9:00	The new approach in surface preparation of the biodegradable FeMn alloys Črtomir Donik[1], Aleksandra Kocijan[1], Irena Paulin[1], Matej Hočevar[1], Peter Gregorčič[2], Matjaž Godec[1] [1]Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, [2]Faculty of Mechanical Engineering, Aškerčeva cesta 6, 1000 Ljubljana
9:30	Organic and inorganic nanostructures; common concepts and mutual interactions [1]Veronika Kralj-Iglič and [2]Aleš Iglič [1]Laboratory of Clinical Biophysics, Faculty of Health Sciences, University of Ljubljana, Zdravstvena 5, SI-1000 Ljubljana, [2]Laborator of Biophysics, Faculty of Electrical Engineering, University of Ljubljana, Tržaška 25, SI-1000 Ljubljana
10:00	Complications with total hip arthroplasty Boštjan Kocjančič and Drago Dolinar Orthopedic Clinic of University Medical Center Ljubljana, Zaloška cesta 7, 1000 Ljubljana, Slovenia
10:30	**Coffee Break**
11:00	Zirconia Ceramics in Dentistry: Structure, Properties and Clinical Applications Čedomir Oblak[1], Andraž Kocjan[2], Peter Jevnikar[1] [1]Department of Prosthodontics,Medical Faculty, University of Ljubljana, Vrazov trg 2, 1000 Ljubljana, Slovenia, [2]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova 39,1000 Ljubljana, Slovenia
11:30	Toward the optimum spinal fusion device Matevž Gorenšek[1], Drago Dolinar[2] [1]MD Medicina, Bohoričeva 5, 1000 Ljubljana, Slovenia, [2]Orthopedic Clinic of University Medical Center Ljubljana, Zaloška cesta 7, 1000 Ljubljana, Slovenia
12:00	Biomaterials in endoprostetics Drago Dolinar Orthopedic Clinic of University Medical Center Ljubljana, Zaloška cesta 7, 1000 Ljubljana, Slovenia
12:30	The microstructure of cobalt-chromium-molybdenum and titanium alloys of retrieved implants Monika Jenko[1], Matevž Gorenšek[2], Matjaž Godec[1], Maxine Hodnik[3], Barbara Šetina Batič[1], Drago Dolinar[4] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]MD Medicina, Bohoričeva 5, 1000 Ljubljana, Slovenia [3]FTPO, Ozare19, 2380 Slovenj Gradec, [4]Orthopedic Clinic of University Medical Center Ljubljana, Zaloška cesta 7, 1000 Ljubljana, Slovenia
12:50	**CLOSING CEREMONY**
13:00	**LUNCH**

Četrtek – Thursday 19.10.2017 Hall C	
	Predsedujoči – Chair: M. Godec, B. Podgornik
11:00	Consolidation Of Metal Alloy Powders Into Functional Components Via Laser Based Additive Manufacturing (AM) Technique Lucy Grainger Renishaw, Stone Business Park, Stone, Staffordshire, ST15 0SH, UK.
11:30	Overview and Trends in Wire Arc Additive Manufacturing Of Metals Damjan Klobčar, Janez Tušek, Maja Lindič, Luka Selak, Gašper Škulj, Drago Bračun University of Ljubljana, Faculty of Mechanical Engineering, Aškerčeva 6, 1000 Ljubljana
12:00	3D natisnjeni modeli za litje prototipov / 3D printed models for prototype casting production Mitja Petrič, Primož Mrvar, Sebastjan Kastelic Faculty of Natural sciences and Engineering, University of Ljubljana, Aškerčeva 12
12:30	Annular laser beam based direct deposition of metal Edvard Govekar, Alexander Kuznetsov, Matjaž Kotar, Andrej Jeromen University of Ljubljana, Faculty of Mechanical Engineering, Aškerčeva cesta 6, SI-1000 Ljubljana
12:50	**LUNCH**

Četrtek – Thursday 19.10.2017 Hall D	
	Predsedujoči – Chair: M. Kurečič
9:00	Functionalized nanostructured surfaces for medical applications Ita Junkar Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia
9:20	Blend Biopolymer Thin Films Katrin Niegelhell[1], Katrin Jammernegg[1], Michael Süssenbacher[1], Thomas Ganner[2], Manuel Eibinger[3], Harald Plank[2,4], Stefan Spirk[1] [1]Institute for Paper, Pulp and Fiber Technology, Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria, [2]Institute for Electron Microscopy and Nanoanalysis, Graz University of Technology, Steyrergasse 17, A-8010 Graz, Austria, [3]Institute of Biotechnology and Biochemical Engineering, Graz University of Technology, Petersgasse 12, A-8010 Graz, Austria, [4]Graz Centre for Electron Microscopy, Steyrergasse 17, A-8010 Graz, Austria
9:40	Protein-repellent and antimicrobial nanoparticle coatings from hyaluronic acid and lysine-derived biocompatible surfactant M. Bračič[1], L. Fras-Zemljič[1], L. Perez[2], K. Kogej[3], K. Stana-Kleinschek[1,4], R. Kargl[1,4] and T. Mohan[5] [1]Laboratory for Characterization and Processing of Polymers (LCPP), Faculty of Mechanical Engineering, University of Maribor, Smetanova ulica 17, 2000 Maribor, Slovenia, [2]Department of Chemical and Surfactant Technology, Instituto de Química Avanzada de Cataluna, CSIC, Jordi Girona 18-26, 08034 Barcelona, Spain, [3]Department of Chemistry and Biochemistry, Faculty of Chemistry and Chemical Technology, University of Ljubljana, Večna pot 113, 1000 Ljubljana, Slovenia, [4]Institute for Chemistry and Technology of Materials (ICTM), Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria, [5]Institute of Chemistry, University of Graz, Heinrichstrasse 28, 8010 Graz, Austria
10:00	Characteristics and modification of nanometric polycaprolactone/cellulose thin films and its influence on the growth and viability of human primary endothelial cells Tamilselvan Mohan[1], Chandran Nagaraj[2,3], Rupert Kargl[1,4], Karin Stana-Kleinschek[1,4] [1]Laboratory for Characterization and Processing of Polymers (LCPP), Faculty of Mechanical Engineering, University of Maribor, Smetanova Ulica 17, 2000 Maribor, Slovenia, [2]Ludwig Boltzmann Institute for Lung Vascular Research, Graz, Austria, [3]Institute of Physiology, Medical University of Graz, 8010 Graz, Austria, [4]Institute for Chemistry and Technology of Materials (ICTM), Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria

10:20	Mass-Scale Deacidification and Strengthening of Cellulose-Based Artifacts Using a Prototype Process and Polysaccharide Composite Nanoparticles Tamilselvan Mohan[1], Rupert Kargl[1,2], Coco Marnul[3], Karin Stana-Kleinschek[1,2], Volker Ribitsch[3] [1]Laboratory for Characterization and Processing of Polymers (LCPP), Faculty of Mechanical Engineering, University of Maribor, Smetanova Ulica 17, 2000 Maribor, Slovenia, [2]Institute for Chemistry and Technology of Materials (ICTM), Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria, [3]Institute of Chemistry, University of Graz, Heinrichstrasse 28, 8010 Graz, Austria
12:30	**LUNCH**

POSTRSKA SEKCIJA – POSTER SESSION
Ponedeljek – Monday 16. 10. 2017 (17:00)

YR1	IMPACTION GRAFTING OF LARGE ACETABULAR DEFECTS Klemen Avsec, Boštjan Kocjančič, Lovro Suhodolčan, and Drago Dolinar Orthopedic Clinic of University Medical Center Ljubljana, Zaloška cesta 7, 1000 Ljubljana, Slovenia
YR2	Assessment of the usability of marine sludge in the clay brick sector Selena Bošnjak[1], Vilma Ducman[1] [1]Slovenian National Building and Civil Engineering Institute, the Department of Materials, Laboratory for Cements, Mortars and Ceramics, Dimičeva ulica 12, 1000 Ljubljana, Slovenia
YR3	Properties of Filling Materials in Inter-penetrating Phase Composites under High Strain-rate Impacts Tomáš Doktor, Tomáš Fíla, Petr Zlámal, Petr Koudelka, Daniel Kytýř, Ondřej Jiroušek Czech Technical University in Prague, Faculty of Transportation Sciences, Na Florenci 25, 11000 Praha 1, Czech republic
YR4	A method for detection of TiO_2 nanoparticles presence in food based on colorimetric assay Anja Drame[1,2], Martina Lorenzetti[2,3], Nataša Drnovšek[1,2], Saša Novak[2] [1]Jožef Stefan International Postgraduate School, Jamova 39, SI-1000 Ljubljana, Slovenia, [2]Jožef Stefan Institute, Jamova 39, SI-1000, Ljubljana, Slovenia, [3]GE Healthcare, Cardiff CF14 7YT, UK
YR5	Polyol Synthesis Of Silver Colloidal Nanoparticles With *N*-[3-(trimethoxysilyl)propyl]diethylenetriamine As Capping Agent Ajra Hadela[1], Aljoša Košak[1,2], Aleksandra Lobnik[1,2] [1]Faculty of Mechanical Engineering, University of Maribor, Smetanova ulica 17, 2000 Maribor, Slovenia, [2]Institute for Environmental Protection and Sensors, Beloruska ulica 7, 2000 Maribor, Slovenia
YR6	Local Mechanical Properties of Irradiated Crosslinked HDPE Lenka Hylova, David Manas, Miroslav Manas, Lenka Gajzlerova Tomas Bata University in Zlin, Nam. T.G.Masaryka 5555, 760 01 Zlin, Czech Republic
YR7	Local mechanical Properties of Irradiated crosslinked Polypropylene **Vaclav Janostik**, Lenka Hylova, David Manas, Miroslav Manas, Lenka Gajzlerova Tomas Bata University in Zlin, Nam. T.G.Masaryka 5555, 760 01 Zlin, Czech Republic
YR8	Mold Design for Rings of External Fixator Martina Kalova[1], Sona Rusnakova[2], Filip Tomanec[2], Jiri Kohut[3] [1]Faculty of Metallurgy and Materials Engineering, VŠB – Technical University of Ostrava, 17.listopadu 15/2172, 708 33 Ostrava. Czech Republic, [2]Department of Production Engineering, Faculty of Technology, Tomas Bata University in Zlín, Nad Stranemi 4511, 760 05 Zlín. Czech Republic, [3]Center of Advanced Innovation Technologies - VŠB-Technical University of Ostrava, 17. listopadu 15, 708 00 Ostrava-Poruba, Czech Republic
YR9	Improvement in Grain Growth of New-Generation ODS Alloys by Thermomechanical Treatments Bohuslav Mašek[1], Omid Khalaj[1], Hana Jirková[1], Jiří Svoboda[2] [1]The Research Centre of Forming Technology, University of West Bohemia, Univerzitní 22, 306 14, Pilsen, zech Republic, [2]Institute of Physics of Materials, Academy of Sciences of the Czech Republic, Žižkova 22, 616 62, Brno
YR10	Inhibition of W grain growth in W-based material for fusion application (CM) Matej Kocen, Petra Jenuš, Saša Novak, Andreja Šestan Department for Nanostructured Materials, Jožef Stefan Institute, 1000 Ljubljana, Slovenia Jožef Stefan International Postgraduate School, 1000 Ljubljana, Slovenia
YR11	Compressive Characteristics of SLS-printed Auxetic Lattices with Strain Rate Sensitive Filling Petr Koudelka, Daniel Kytýř, Tomáš Doktor, Tomáš Fíla, Ondřej Jiroušek Czech Technical University in Prague, Faculty of Transportation Sciences, Konviktská 20, 110 00, Prague 1, Czech Republic

YR12	Multi-parameter surface quality analysis Milena Kubišová, Vladimír Pata, Libuše Sýkorová, Oldřich Šuba Tomas Bata University in Zlín, Faculty of Technology, Vavrečkova 275 760 01 Zlín, Czech Republic
YR13	Dilatometric Study of Phase Transformation in SAE 9254 Spring Steel During Heat Treatment Silvano Leal, Sydney Ferreira Federal University of ABC, 09210-580 Santo André, SP, Brazil
YR14	Microstructure evolution in the Recycled Anisotropic HDDR NdFeB powders with Spark Plasma Sintering Treatment Magnets Muhammad Farhan Mehmood[1,2], Awais Ikram[1,2], Spomenka Kobe[1,2], Kristina Zuzek Rozman[1,2], Saso Sturm[1,2] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova 39, SI-1000 Ljubljana, Slovenia, [2]Jožef Stefan International Postgraduate School, Jamova 39, SI-1000 Ljubljana, Slovenia
YR15	Influence of Steam-Side Oxid Scales on Creep Life of Boiler Superheater Tube Tomáš Létal, Jiří Buzík, Pavel Lošák, Matrin Naď Brno University of Technology, Faculty of Mechanical Engineering, Institute of Process Engineering, Technická 2, 616 69 Brno, Czech Republic,
YR16	Effects of Fluoride Conversion Time on Properties of Films Formed on AZ31B Magnesium Alloy Leandro De Oliveira, Renato Antunes Federal University of ABC, 09210-580, Santo Andre, SP, Brazil
YR17	Synthesis of New Aromatic Polyazomethines with Thiophene, Naphthyl and Tetraphenylsilane Moieties in the Main Chain: Thermal, Optical, and Electrical Properties Patricio A. Sobarzo[1], Claudio A. Terraza[1], Luis H. Tagle[1], Alain Tundidor-Camba[1], Alexis F. González, Carmen M. González-Henríquez[2], Eva Maya-Hernández[3] [1]Pontificia Universidad Católica de Chile, Research Laboratory for Organic Polymers (RLOP), P. O. Box 306, Post 22, Santiago, Chile, [2]Universidad Tecnológica Metropolitana, Laboratory of Nanotechnology and Advanced Materials (LNAM), P.O. Box 9845, Post 21, Santiago, Chile, [3]Consejo Superior de Investigaciones Científicas, SCIC, España
YR18	Local mechanical Properties of Irradiated crosslinked Filled Poly (butylene terephthalate) (PBT) Pavel Stoklasek, Lenka Hylova, David Manas, Miroslav Manas, Lenka Gajzlerova Tomas Bata University in Zlin, Nam. T.G.Masaryka 5555, 760 01 Zlin, Czech Republic
YR19	Ageing of Al-Mg alloy Rok Rezar[1], Aleš Nagode[2], Milan Bizjak[2] [1]Institute of metals and technology, Lepi pot 11, Ljubljana, Slovenia, [2]Faculty of natural sciences and engineering, University of Ljubljana, Aškerčeva cesta 12, 1000 Ljubljana, Slovenia
1	Simulation of 3D Garment Strain using Virtual Prototyping Kristina Ancutiene Kaunas University of Technology, Faculty of Mechanical Engineering and Design, Studentu str. 56, Kaunas,LT-51424, Lithuania,
2	Influence of heating rate on transformation temperature of proeutectoid steels Boštjan Arh, Jaka Burja, Franc Tehovnik, Franci Vode, Simon Malej Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana
3	Increase of Nitrogen Content of High-alloyed Steel Melt by the Help of the Mixture $N_2 + O_2$ at Decreased Pressure Zdeněk Adolf[1], Jiří Bažan[1], Ladislav Socha[1], František Chowaniec[1], Petr Jonšta[2], Vladislav Kurka[3] [1]VŠB – Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Department of Metallurgy and Foundry, 17. listopadu 15/2172, 708 33 Ostrava – Poruba, Czech Republic, [2]VÍTKOVICE HEAVY MACHINERY a.s., Ruská 2887/101, Vítkovice, 70300 Ostrava, Czech Republic, [3]MATERIÁLOVÝ A METALURGICKÝ VÝZKUM s.r.o. Pohraniční 693/31, 703 00 Ostrava-Vítkovice, Czech Republic

4	Sigma Phase Precipitation During Isothermal Annealing of SAF 2205 Jaka Burja, Franc Tehovnik, Franci Vode, Barbara Šetina Batič Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia
5	EFFECT OF COOLING RATE ON WELD HAZ COARSE GRAIN MICROSTRUCTURE Roman Celin, Jaka Burja Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana
6	Processing and Mechanical and Thermal Properties of ABS Composites Containing Multi-walled Carbon Nanotubes Dongkyu Lee[1], Oh Hyeong Kwon[1], Won Ho Park[2], Donghwan Cho[1] [1]Department of Polymer Science and Engineering, Kumoh National Institute of Technology, Gumi 39177 Korea, [2]Department of Organic Materials Engineering, Chungnam National University, Daejeon 34134, Korea
7	Effect of High Pressure Hydrogen Environment on Fatigue Crack Growth Rate of 34CrNiMo6 Grade Steel Petr Čížek, Ladislav Kander, Šárka Stejskalová Material and metallurgical research, Ltd., Pohraniční 693/31, Ostrava-Vítkovice, Czech Republic
8	Comparison of Electrospinning and Wet Spinning Methods for Processing of Chitosan Based Composite Fibers Elena Dresvyanina, Vladimir Yudin, Irina Dobrovolskaya, Pavel Popryadukhin, Alexandra Yudenko, Ekaterina Maevskaya, Anton Shabunin, Inna Lebedeva Peter the Great St. Petersburg Polytechnic University, Polytechnicheskaya, 29, 195251 St. Petersburg, Russia
9	The Influence of Laser Processing Applications for Leather Laminates Comfortability Ada Gulbinienė Kaunas University of Technology, K. Donelaicio g. 73, Kaunas 44249, Lithuania
10	Influence of Heat Treatment Parameters on Mechanical Properties of Aluminum Borut Žužek, Agnieszka Guštin, Rok Rezar, Franci Vode, Bojan Podgornik, Varužan Kevorkijan and Boris Hostej Institute of Metals and Technology, Laboratory of Mechanical Testing, Lepi pot 11, 1000 Ljubljana, Slovenia Impol Aluminium Industry, Impol R&R, Partizanska 38, 2310 Slovenska Bistrica, Slovenia
11	Rolling Simulation for Finishing Rolling Mills Using a Meshless Method Umut Hanoglu[1], Božidar Šarler[1,2] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, SLOVENIA, [2]Faculty of Mechanical Engineering, University of Ljubljana, Aškerčeva 6, 1000 Ljubljana, SLOVENIA
12	Assessment of selected waste regarding its potential for alkali activation process Barbara Horvat[1], Alenka Pavlin[2], Vilma Ducman[1] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva ulica 2, 1000 Ljubljana, Slovenia, [2]Termit, Drtija 51, 1251 Moravče, Slovenia
13	TEM Studies of Different Ceramics in THR Darja Jenko[1], Monika Jenko[1], Drago Dolinar[2] [1]Institute of Metals and Technology, Laboratory of Applied Surface Science, Lepi pot 11, SI-1000 Ljubljana, Slovenia, [2]Orthopedic Clinic of University Medical Center Ljubljana, Zaloška cesta 7, SI-1000 Ljubljana, Slovenia
14	A statistical approach to size- and spatial distribution analysis of precipitates Fevzi Kafexhiu, Franc Vodopivec, Bojan Podgornik, Igor Belič Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia

15	Structure and Mechanical Properties of Welded Joints for Nuclear Power Plants of Type MIR 1200 Ladislav Kander[1], Petr Čížek[1], Šárka Hermannová[2], Zdeněk Říha[2] [1]Material And Metallurgical Research, Ltd., Pohraniční 693/31,703 00, Ostrava-Vítkovice, Czech Republic, [2]Vítkovice Power Engineering, a.s., Ruská 1142/30, 703 00, Ostrava-Vítkovice, Czech Republic
16	Transition-Metal Phthalocyanines on Graphene Ki-jeong Kim, and Bongsoo Kim Pohang Accelerator Laboratory, POSTECH, Pohang, Kyungbuk 790-784, Republic of Korea
17	An Easily Accessible Method For DNA Immobilization On Silicon Surfaces Jeho Park, Moonil Kim Hazards Monitoring Bionano Research Center, Korea Research Institute of Bioscience and Biotechnology, Daejeon 34141, Korea
18	Electrodeposition of Hydroxyapatite Coating on Biocompatible NiTi alloy A. Kocijan Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, Slovenia
19	Comparison of Surface and Anticorrosion Properties of SiO_2 and TiO_2 Nanoparticle Epoxy Coatings A. Kocijan, M. Conradi Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, Slovenia
20	Corrosion Degradation of Inert Anode Material in Molten Low-Melting Electrolyte. Kontrík Martin[1], Šimko František[1], Janíčkovič Dušan[2], Korenko Michal[1] and Boča Miroslav[1] [1]Institute of Inorganic Chemistry, Slovak Academy of Sciences, Dúbravská cesta 9, 845 36 Bratislava, Slovak Republic, [2]Institute of Physics, Slovak Academy of Sciences, Dúbravská cesta 9, 845 11 Bratislava, Slovak Republic
21	Ceramic shell molds hot gas permeability investigation Mateusz Konrad Koralnik[1],Pawel Wisniewski[1,2], Rafał Cygan[3], Jarosław Mizera[1] [1]Faculty of Materials Science and Engineering, Warsaw University of Technology, ul. Woloska 141, 02-507 Warszawa, Poland, [2]Functional Materials Research Center, Warsaw University of Technology, ul. Woloska 141, 02-507 Warszawa, Poland, [3]CPP Poland Sp. z o.o., ul. Hetmanska 120, 35-078 Rzeszów, Poland
22	Influence of multiple electron beam remelting on the characteristics of HVOF and CGDS sprayed CoNiCrAlY coatings Petra Krajňáková, Larissa A. Gouvêa, Jan Čupera, Vít Jan, Ivo Dlouhý Institute of Materials Science and Engineering, NETME center, Brno University of Technology, Faculty of Mechanical Engineering, Technická 2, Brno, Czech republic
23	Preparation And Characterization Of New Adsorbent Materials For Oil Spills Removal From Water Aljoša Košak[1,2], Aleksandra Lobnik[1,2] [1]University of Maribor, Faculty of Mechanical Engineering, Smetanova 17, SI-2000 Maribor, Slovenia, [2]Institute for Environmental Protection and Sensors (IOS) Ltd, Beloruska 7, SI-2000 Maribor, Slovenia
24	Experimental of Increasing the Nitrogen Content in High Chromium Steel Melt in Pilot Plant Metallurgical Unit Kurka Vladislav, Jonšta Petr, Carbol Zdeněk Material and Metallurgical Research Ltd., Pohraniční 693/31, 703 00 Ostrava-Vítkovice, Czech Republic, Vítkovice Heavy Machinery a.s., Ruská 2887/101, 703 00 Ostrava-Vítkovice, Czech Republic

25	X-ray-based Microstructural Analysis of Hydrogel-based Composites for Bone Tissue Engineering Daniel Kytýř[1], Nela Krčmářová[1,2], Tomáš Doktor[1,2], Ivana Kumpová[1], Veronika Koudelková[1], Kateřina Nepomucká[3], Josef Šepitka[4], Ana Gantar[5] [1]Institute of Theoretical and Applied Mechanics, CAS, v. v. i, Prosecká 76, 190 00 Prague, Czech Republic, [2]Czech Technical University in Prague, Faculty of Transportation Sciences, Konviktská 20, 110 00 Prague 1, Czech Republic, [3]Institute of Molecular Genetic, CAS, v. v. i., Vídeňská 1083, 142 20 Prague 4, Czech Republic, [4]Czech Technical University in Prague, Faculty of Mechanical Engineering, Technická 4, 166 07 Prague 6, Czech Republic, Jožef Stefan Institute, Department for Nanostructured materials, Jamova cesta 39, 1000 Ljubljana, Slovenia
26	Effective bone tissue engineering scaffolds fabricated by electrospinning and 3D printing methods Oh Hyeong Kwon[1], Young-Gwang Ko[1], Donghwan Cho[1], Won Ho Park[2] [1]Department of Polymer Science and Engineering, Kumoh National Institute of Technology, Gumi 39177, Korea, [2]Department of Organic Materials Engineering, Chungnam National University, Daejeon 34134, Korea
27	Steel Artefacts from Soča Front Nataša Lipovšek, Matjaž Godec, Matjaž Knap, Jakob Lamut Institute of metals and technology, Lepi pot 11, 1000 Ljubljan, Slovenia UL-NTF, Aškerčeva 12, 1000 Ljubljana, Slovenia
28	Non-Singular Method of Fundamental Solutions for Three-Dimensional Isotropic Linear Elasticity Problems Qingguo Liu[1] and Šarler Božidar[1,2] [1]Institute of Metals and Technology, Ljubljana, Slovenia, EU, [2]University of Ljubljana, Faculty of Mechanical Engineering, Ljubljana, Slovenia, EU
29	Leakage cause analysis of a flange joint designed according to standards Pavel Lošák, Tomáš Létal, Jiří Buzík, Martin Naď Brno University of Technology, Faculty of Mechanical Engineering, Institute of Process Engineering, Technická 2, 616 69 Brno, Czech Republic
30	Design Of Experiments As A Basis For Silicon Carbide Ceramics Development Evgeny Nazarov[1], Maksim Mararakin[1], Tatiana Guseva[1], Dmitry Zhukov[2], Maria Vartanyan[1], Nikolay Makarov[1] [1]D.Mendeleyev University of Chemical Technology of Russia, 125047, 9, Miusskaya sq., Moscow, Russia, [2]RUDN University, 117198, 6, Miklukho-Maklaya st., Moscow, Russia
31	XPS investigations of Tribofilms formed on CrN Coatings Djordje Mandrino, Bojan Podgornik Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia
32	Diffusion Behavior during Laser Welding of Al Alloy and Nitrated Ti Alloy Aline Capella de Oliveira[1], Natalia Maria Antonagelo Athanazio[2], Taisa Higino[1], Rudimar Riva[3] [1]Federal University of Sao Paulo, Rua Talim 330, Sao Jose dos Campos, SP, 12231-280, Brazil, [2]Aeronautics Institute of Technology, Pça Mal Eduardo Gomes 50, Sao Jose dos Campo, SP, 12228-900, Brazil, [3]Institute for Advanced Studies, Tv Cel Av. José A.A.do Amarante, 1, Sao Jose dos Campos, SP, 12228-001, Brazil
33	A Mathematical Model to Correct for Secondary Extinction of Pole Figures of Textured Samples Jesús Palacios-Gómez, Ramón Sebastián Salat-Figols, Ricardo Zamorano Escuela Superior de Física y Matemáticas, Instituto Politécnico Nacional, Av. Instituto Politécnico Nacional S/N, 07738 Mexico City, Mexico
34	Plastic flow at vicinal surfaces of nickel Nuša Pukšič, Matjaž Godec, Monika Jenko Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia

35	Synthesis of a Bioactive and Degradable 60Poly(35Lactic-co-65Glycoric Acid)/40(85SiO_2-15CaO) Composite with Dual Pore Structure Sang-Hoon Rhee Dental Biomaterials Science, School of Dentistry, Seoul National University, Daehak-ro 101, Jongno, Seoul 110-749, South Korea
36	The practical use of E-FMEA method in the automotive industry Monika Spilka, Aneta Kania, Marek Roszak Silesian University of Technology, Konarskiego 18a St., 44-100 Gliwice, Poland
37	Dynamic wear properties of coated tool steel - influence of the substrate hardness and fracture toughness M. Sedlaček[1], B. Šetina Batič[1], B. Podgornik[1], D. Česnik[2] [1]Institute of Metals and Technology, Lepi pot 11, Ljubljana, Slovenia, [2]Hidria Rotomatika d.o.o. Spodnja Kanomlja 23, Spodnja Idrija, Slovenia
38	Aseptic loosening of hip prosthesis - case report Marko Sedlaček[1], Fevzi Kafexiu[1], Boštjan Kocjančič[2], Drago Dolinar[2] [1]Institute of Metals and Technology, 1000 Ljubljana, Slovenia, [2]Orthopedic Clinic, University Medicine Centre Ljubljana, 1000 Ljubljana, Slovenia
39	Automatic Analysis of Steel Inclusions in Scanning Electron Microscope – Methodological Considerations Barbara Šetina Batič, Jaka Burja, Franci Vode, Nataša Lipovšek, Matjaž Godec Inštitut za kovinske materiale in tehnologije, Lepi pot 11, 1000 Ljubljana
40	PLA-Crosslinked PVA Porous Microparticles as Carriers of Nisin Bacteriocine Martina Hrabalikova, Pavlina Holcapkova, Vladimir Sedlarik Centre of Polymer Systems, University Institute, Tomas Bata University in Zlin, tr. T. G. Masaryka 5678, 76001 Zlin, Czech Republic
41	New Complex Catalysts For Hydrogenation Reactions Natalia Sienkiewicz, Krzysztof Strzelec, Tomasz Szmechtyk Institute of Polymer and Dye Technology, Faculty of Chemistry, Lodz University of Technology, Stefanowskiego 12/16, 90-924 Lodz, Poland
42	Synthesis and Chemistry of the New Rubidium-oxofluoroaluminate Material František Šimko[1], Aydar Rakhmatullin[2], Emmanuel Véron[2], Martin Kontrík[1], Zuzana Netriová[1], Catherine Bessada[2] [1]Institute of Inorganic Chemistry, Slovak Academy of Sciences, Dúbravská cesta 9, 845 36 Bratislava, Slovak Republic, [2]Conditions Extrêmes et Matériaux: Haute Température et Irradiation, CEMHTI, UPR 3079 -CNRS Univ. Orléans 450 71 Orléans, France
43	Grain Boundaries of Carbide Particles on Creep Resistant Steels, Their Stability and Effect on Creep Rate D. A. Skobir Balantič, M. Godec Institute of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia
44	Experimental Investigations Electro-Discharge Mechanical Machining Process of Manganese Cast Steel Sławomir Spadło, Piotr Młynarczyk Kielce University of Technology, al. Tysiąclecia P. P. 7, 25-413 Kielce
45	The effect of long-term aging on the degradation of the alloy properties the Inconel 740H alloy Marek Sroka[1], Adam Zieliński[2], Radosław Rozmus[2] [1]Institute of Engineering Materials and Biomaterials, Silesian University of Technology, Faculty of Mechanical Engineering, Silesian University of Technology, Konarskiego 18a Str., 44-100 Gliwice, Poland, [2]Institute for Ferrous Metallurgy, K. Miarki 12-14, 44-100 Gliwice, Poland

46	Microstructure inhomogeneities of pulse-laser-modified AlSi12CuNiMg alloy Darja Steiner Petrovič[1], Roman Šturm[2] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]University of Ljubljana, Faculty of Mechanical Engineering, Aškerčeva 6, 1000 Ljubljana, Slovenia
47	Simulation of Industrial Solidification Systems Under the Influence of Electromagnetic Fields Božidar Šarler[1,2], Tadej Dobravec[1], Vanja Hatić[1], Boštjan Mavrič[1,2], Robert Vertnik[1,3] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana [2]University of Ljubljana, Faculty of Mechanical Engineering, Aškerčeva 6, 1000 Ljubljana [3]Štore Steel, Železarska cesta 3, 3220 Štore
48	Modelling of Transient Temperature Field in Plastics During Laser Cutting Oldřich Šuba, Oldřich Šuba, jr., Milena Kubišová, Soňa Rusnáková, Libuše Sýkorová Tomas Bata University in Zlín, Faculty of Technology, Department of Production Engineering, Vavrečkova 275, Zlín, 760 01, Czech Republic,
49	Identification of Cr_2N-type nitrides and $Cr_{23}C_6$-type carbides in 2101 lean duplex stainless steel Franc Tehovnik, Jaka Burja, Barbara Šetina Batič, Franci Vode Institute of materials and technology, Lepi pot 11, 1000 Ljubljana, Slovenia
50	Tailoring Surface Properties of Polypropylene Used for Food Packaging Alenka Vesel[1], Tomislava Vukusic[2], Matej Holc[1,3], Miran Mozetic[1] [1]Jozef Stefan Institute, Department of Surface Engineering, Jamova cesta 39, 1000 Ljubljana, Slovenia [2]University of Zagreb, Department of Food Engineering, Pierottijeva 6, 10000 Zagreb, Croatia [3]Jozef Stefan International Postgraduate School, Jamova cesta 39, 1000 Ljubljana, Slovenia
51	A novel mathematical description of hot deformation stress-strain curves for steels Franci Vode, Franc Tehovnik, Simon Malej, Boštjan Arh, Jaka Burja IMT, Lepi pot 11, SI-1000 Ljubljana
52	Investigation of the properties of SiC-based shell molds with binder containing fibers using thermal imaging camera Pawel Wisniewski[1,2], Mateusz Koralnik[1], Ryszard Sitek[1], Rafał Cygan[3], Jarosław Mizera[1] [1]Faculty of Materials Science and Engineering, Warsaw University of Technology, ul. Woloska 141, 02-507 Warszawa, Poland, [2]Functional Materials Research Center, Warsaw University of Technology, ul. Woloska 141, 02-507 Warszawa, Poland, [3]CPP Poland Sp. z o.o., ul. Hetmanska 120, 35-078 Rzeszów, Poland
53	Influence on the Electrical and Thermal Conductivities of CNT-Polyamide Composite according to the Varying CNT Diameters and Quantities Myeong Han Yoo[1], Young Soo Park[1], Min Seok Moon[1], Jeha Oh[1], Geun Sung Jung[1], Na Ra Park[1], Sung Mo Yang[2], Joon Hyuk Song[1] [1]Korea Institute of Carbon Convergence Technology, #110-11,Banryong-ro, Jeonju, Republic of Korea, 54853, [2]Division of Mechanical System Engineering, Chonbuk National University, #562, Baekje-daero, Jeonju, Republic of Korea, 54896
54	Novel Materials Based on $La_{0,75}Sr_xA_{0,25-x}Cr_{0,5}Mn_{0,5}O_3$ (A=Ba, Ca, Mg) as Full Ceramics Anodes in High Temperature Fuel Cells Tina Skalar, Marjan Marinšek, Klementina Zupan Faculty of Chemistry and Chemical Technology, University of Ljubljana, Večna pot 113, 1000 Ljubljana, Slovenia
55	Failure Analyses of Nickel Alloy Fan Blade Borut Žužek, Jaka Burja Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia
56	XPS studies of UHMWPE tibial insert of retrieved knee prosthesis Djordje Mandrino[1], Monika Jenko[1], Boštjan Kocjančič[2] and Drago Dolinar[2] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia; [2]Orthopedic Clinic of University Medical Center Ljubljana, Zaloška cesta 7, 1000 Ljubljana, Slovenia

Thermal Stability of Functionally Graded Nickel and Nickel-Tungsten Electrodeposits; A Comparative Study

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Nickel and nickel alloy coatings are of high importance for various industrial applications. The ever increasing demand on enhancing the materials properties such as wear resistance, hardness, toughness, corrosion resistance, etc. of these coatings encourages deliberate tailoring of the microstructure and hence, properties. In addition to the as-deposited state, how the properties change over time often dictates the maximum service time/temperature. Thus, thermal stability is of high importance for many technological applications and achieving a higher thermal stability is of immense interest. There are two main routes to stabilize a microstructure: (i) kinetically and (ii) thermodynamically. In the kinetic approach, the grain boundary mobility is reduced and in the thermodynamic approach, the driving force of grain growth is reduced.

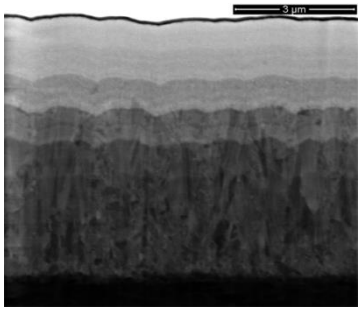

Fig. 1: Functionally graded Ni-W, after heat treatment at 500 ˚C for 30 min.

In a research project over several years, we have employed two different strategies. (1) Tailoring the microstructure of pure nickel with special focus on the low mobility and low energy twin boundaries to stabilize the microstructure. (2) Utilizing alloying elements such as tungsten to enhance thermal stability. In case of nickel-tungsten, chemical composition and microstructural features such as grain size and texture are interdependent, i.e. higher concertation of tungsten brings about grain refinement[1]. Applying pulse reverse electrodeposition and continuously altering the deposition conditions, functionally graded (FG) nickel-tungsten electrodeposits consisting of high tungsten nano-sized and low tungsten columnar grains are synthesized. Thermal stability of FG deposits (see Fig.1) is studied comparative to pure nickel with columnar and nanocrystalline microstructures. Mechanisms of microstructure and phase evolution in highly twinned pure nickel and nickel-tungsten alloys are discussed and microstructure engineering for high thermal stability is outlined.

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Observation of Dislocation Evolution under Shear Fatigue in a TRIP Steel

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Transformation-induced plasticity (TRIP) steel shows a good combination of strength and ductility under monotonic deformation. In this study, fatigue behaviour of TRIP steel is investigated. Shear fatigue was performed under DIC (digital image correlation) control and, ECCI images were taken after 50 and 100 cycles. We observed that during cyclic load intensive planar slip occurred from few sources. All dislocations were split into partials with leading and trailing Shockley dislocations. Dislocations from intersecting slip planes interacted and formed Lomer-Cottrel locks. At a later stage we observed the rearrangement of these dislocations to form tangles which elongated to form dislocation walls during further cycling. Furthermore, we found that dislocation structures are closely related to the Taylor factor. In detail we observed that, as expected, the dislocation density inside of individual grains increased with increasing Taylor factor. However, passing a critical value of the Taylor factor the dislocation density decreased again.

Simulation of 3D Garment Strain using Virtual Prototyping

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Virtual prototyping and 3D CAD provides high potential in clothing industry [1, 2]. It could be used not only for realistic 3D view presentation, but also for garment fit simulation to design comfortable and well fitted garments. Computational model of garment mechanical behavior during wear incorporates simulation and prediction of garment strains, pressure and stresses. Virtual prototyping enables detection of errors and correction of patterns, also allows proper selection of fabrics [1]. Mannequin and 3D garment modelling now are the most interesting topics in textile engineering, computer graphics and 3D garment CAD [3, 4]. Today, most CAD systems for pattern design have 3D simulation software for virtual garment prototyping and fit evaluation [5].

The aim of this research was to investigate tensile strain distribution in 3D close-fitting virtual garment depending on fabrics mechanical/structural properties. The virtual woman mannequin was covered with virtual garment stitched in Modaris 3D (CAD Lectra). For the simulation five denim fabrics with elastane were used. It was defined that tensile strain distribution in virtual garment depends on body posture and mechanical also structural properties of selected fabric. It was confirmed that virtual prototyping has a great potential as a tool to simulate strain distribution and to evaluate the fit of garment. This work provides important information for the researchers to identify future research directions in 3D garment comfortability investigations.

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Influence of heating rate on transformation temperature of proeutectoid steels

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The temperature of microstructural evolution is studied during heating rate by using dilatometric analysis. Dilatometry is a thermo-analytical technique for the measurement of expansion or shrinkage of a material when subjected to a controlled temperature/time program. The temperature and type of transformation also depend on steels chemical composition. Proeutectoid steels have a stable ferrite-austenite area in the phase Fe-C diagram above the A1 temperature. The formation of high temperature austenite structure was take place from pearlite and ferrite dissolution to austenite transformation at A3 temperature. The phase transformation is time – temperature dependent. The reactions have a certain temperature interval, that is also dependet on the heating rate. The temperatures of transformation to austenite formation increase with increasing heating rate.

The influence of heating rate on the transformation temperature of carbon steels to 0,5 %C is studied in this work. The experiments are done by using a quenching dilatometer. The influence of high heating and cooling rates and applied load on the kinetics of solid state phase transformation can be reseaeched using this instrument.

Study on In-plane Shear Performance of Spacer Fabrics in Composite Forming

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The shearing behavior of a fabric determines its performance properties when subjected to a wide variety of complex deformations during its use. Shear properties are important not only for standard fabrics but for textile reinforced composites preforming as well. Shear is one of the most common flaws that occur during textile composite reinforcement forming processes. To ensure the production of high-quality textile fabric reinforced composites when forming complex shapes, the potential for in-plane deformation of the fabrics reinforcements must be taken into consideration. This research paper will present the emerging textile fabric of this decade commonly known as 3D spacer fabric which could be used as reinforcements for complex shaped composites. Spacer fabric is a three-dimensional network which has two outer layer structure connected with spacer yarn. Since the middle layer comprised of monofilaments or yarns, the fabrics possess special characteristics in which its third dimension (thickness) is significant. The objective of this study was to study the shear behavior of 3D spacer knitted fabrics by using a picture frame fixture. The images acquired during loading process were used for analysis in order to obtain the full-field displacement and shear angles at chosen points on the surface of test specimen. To determine its suitability for measuring in-plane shear properties of 3D knitted spacer fabrics, an experimental and analytical investigation of picture frame shear fixture was conducted. The nonlinear behavior of shear force versus shear angle and the deformation mechanism were analyzed. Load–displacement curves of intra-ply shear tests were also analyzed. In addition, a MATLAB program was developed using Hough transform to analyze the shear angle in the real-time image taken during displacement of specimen at various positions. The image analysis results were compared with the actual experimental results. These findings are important requirements for using 3-dimensional textile fabrics as a reinforcement during composite formation.

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IMPACTION GRAFTING OF LARGE ACETABULAR DEFECTS

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Revision surgery of the hip on the acetabular side is a challenge, especially in the presence of extensive bone loss. Although the impaction allografting of morsellised bone combined with the cement fixation of acetabular implants is still commonly used in revision hip surgery, it fails in most extensive acetabular defects. A series of twelve impaction allograft acetabular revisions is presented. Eleven defects were combined defined as cavitary and segmental. In one case, there was only medial bone loss, with intact and supportive columns. Of the total number of revised hips, four needed to be re-revised and were considered failures, while two of them suffered repeated dislocations. All failures were observed in the Paprosky type IIIB group. Taking aseptic loosening as an end-point, the overall reconstruction survival rate was 66.7% at an average of 58.4 months. In patients with uncontained segmental acetabular wall defects, we prefer the use of supplemental devices in order to close the peripheral defects combined with a bone-impaction technique. The use of either an acetabular reconstruction ring or trabecular metal acetabular components with augments in combination with impacted bone allografts initially offers a more stable construct, while the impacted allografts are incorporated into the host bone. AES, XPS, and SEM analyses of the retrieved metal meshes and a new one will also be presented.

High Temperature Oxidation of Hot Work Tool Steels

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Hot work tool steels have very good mechanical properties, especially strength, hardness and wear resistance at high temperatures. Therefore hot work tool steels are used for different applications, such as high-pressure die casting of light alloys, extrusion of polymers and forging. Since all those processes are operating at high temperatures, the main focus of this research was to investigate high temperature oxidation resistance of tool steels. We investigated high temperature oxidation at two different temperatures: 500 °C and 700 °C. The following tool steels were analyzed: HTCS-130, W600, RavnexHD and Dievar. Tests were made in air atmosphere, while heating and cooling were made in controlled argon atmosphere. Simultaneous thermal analysis (STA 449 C Jupiter), scanning electron microscopy (EDS and linear analysis) and XRD (X-ray diffraction) were used as investigations methods. Results showed that at high temperature oxidation at 500 °C Dievar steel has the best oxidation resistance, followed up by RavnexHD, HTCS-130 and W600. However, at 700 °C results were different, HTCS-130 had the best oxidation resistance, followed up by Dievar, W600 and RavnexHD.

Increase of Nitrogen Content of High-alloyed Steel Melt by the Help of the Mixture $N_2 + O_2$ at Decreased Pressure

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Theoretical analysis of nitrogen dissolution in the steel with regard to temperature, pressure and chemical composition of steel is made in this paper. Equilibrium contents at 100 Pa to 0.1 MPa and temperature until 1800 °C are calculated.
Oxygen reacts with the elements in the steel at usage of the mixture $N_2 + O_2$, the speed of nitrogen dissolution is limited by its diffusion from the surface into the volume. Oxidation of the iron and elements in the steel is an exothermic reaction, it warms the bath and in this way, dissociation of molecular nitrogen and following diffusion into the metal volume are accelerated. In the occurrence of chromium, its unwanted oxidation is ensured by vacuum and increased temperature [1, 2].
Parallel blowing of $N_2 + O_2$ can accelerate the process of nitrogen absorption as a result of increased temperature in the reaction zone. The blown oxygen can influence the kinetics of the process of nitrogen assimilation. However, it does not influence its dissolvability.
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High Performance Pt-skin PtCu3/C Intermetallic Shell PEM-FC Electrocatalyst

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The efficiency of PEMFC is still limited by high activation overpotential in oxygen reduction reaction (ORR) and poor stability of the catalysts. Among the promising materials with highest specific (SA) and mass activities (MA) are Pt-alloyed catalysts[1]. In these catalysts the activity of surface Pt is enhanced due to the so-called strain and/or ligand effects induced by the alloyed transition elements[2]. The PtCu alloy system has shown exciting results so far. We present here selected recent results on ORR activity and stability of a novel carbon supported Pt-skin $PtCu_3$ intermetallic shell on $PtCu_3$ alloy core catalyst.

The modified sol-gel synthesis method was optimised to achieve the formation of (i) 2 to 3 layered Pt-skin, (ii) the presence of ordered intermetallics (Pm-3m) phase in the shell, (iii) firm embedment of catalyst nanoparticles into carbon matrix (Figure 1) and (iv) possibility of large-scale production[3]. The annealing (15 min 750 °C followed by 1 hour at 500 in 5 % H_2-Ar) has a crucial influence on at least three material's properties: particle size distribution, formation of intermetallic shell, and Pt segregation on the surface (Pt-skin formation)[4].

The catalyst was thoroughly characterised by several methods:

- structure and composition determination by Powder XRD, SEM, STEM-HAADF with simultaneous EDX, HRTEM, ICP-MS;
- ESA determination by CV (H_{UPD}, CO stripping);
- activity determination by RDE and single cell test (50 cm^2);
- stability determination by (potential cycling) CV (ESA stability),
- RDE (SA and MA stability),
- identical location IL-SEM and IL-TEM (morphology and structure stability).

Analysis of particles reveals that the ordered phase always forms a shell around the disordered core, reflecting the surface-to-core phase growth during the annealing procedure. This shell enhances the electrocatalytic activity and stability of the catalyst[4,5]. Furthermore, the existence of a Pt-skin was demonstrated on the surface of particles and their tight embedment into carbon support was observed. The latter prevents particles to detach, migrate and agglomerate. The new catalyst produced in 20 g batches highly outperforms the conventional Pt/C benchmark electrocatalyst and markedly exceeds the US Department of Energy targets for 2017. Very importantly, our catalyst exhibits a marked decrease of Pt dissolution compared to the Pt/C benchmark electrocatalyst under potentiodynamic treatment[6].

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Neural network supported 3D grain model

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At modelling of polycrystalline materials the representation of the main constituent element - the grain - is of vital importance. The formalization of the material's basic building blocks essentially influences both the ease of the microstructural model manipulation as well as the memory space needed to hold the microstructural data. The presented concept falls into the category of non-mesh grid modelling.

The grains are randomly shaped and initially represented by geometrical formalisms. Geometrically represented shape provides the grain surface points which are being used to train the neural network in order to model the grain's surface. Once trained, the complete grain surface is being represented by the number of neural network weights which are being stored where each set of weights represent one particular grain. The set of weights also completely defines the shape of the grain which can be regenerated in near infinite density.

The neural network supported grain shape is encapsulated in the computational concept named object, meaning that it does not only hold the shape, but it also provides the procedures to extract further information of interest such as the volume, grain cross-section area (crossed by an arbitrary 3D plane), grain surface, grain elongation, grain rotation, grain center of gravity, the positioning of grain in 3D space, grain non-linear reshaping etc. Due to the use of neural network all the object procedures are executed very fast since no time consuming geometric calculations are needed.

Further step to create the virtual 3D microstructure is to form the large repository of randomly created grains. When used such grains are randomly selected and are placed into the 3D space, scaled, rotated and fit to the grains that already occupy the 3D space.

Long-term Superhydrophilic TiO_2 Nanotubes

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Over the past decades, vertically-aligned highly ordered arrays of titanium dioxide (TiO_2) nanotubes (NTs) synthesized on Ti metallic substrates by electrochemical anodization attracted significant scientific interest, mainly due to their potential for using in biomedical applications, e.g. dental and orthopedic implants, biosensors, coronary stents and drug delivery systems. These nanotubular structures integrate highly controllable geometry at the nanoscale with fascinating chemical and biological properties, different from plain Ti material.

The aim of this study was to fabricate long-term super-hydrophilic TiO_2 nanotubular surfaces, which would promote protein and cell adhesion. Our results indicate that hydrophilicity of the TiO_2 NTs is highly affected by post treatment - annealing in the conventional furnace and oxygen plasma treatment, which is often used to simultaneously clean and sterilize medical devices. To the best of our knowledge, this is the first study to show that oxygen plasma treatment induces crystallization of amorphous TiO_2 NTs to anatase and/or rutile phase. Moreover, the crystallization happens in just few seconds without changing the topological properties of TiO_2 NTs. Annealing sharply decreases the water contact angle (WCA) of the TiO_2 NTs surfaces, which is correlated to improved hydrophilicity. WCA measurements during aging demonstrated that annealed TiO_2 NTs maintained their hydrophilicity significantly longer than as-synthesized amorphous TiO_2 NTs.

Transition-Metal Phthalocyanines on Graphene

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Monolayer epitaxial graphene (EG) was prepared on 6H-SiC(0001) substrates by thermal annealing under ultrahigh vacuum (UHV) conditions. Phthalocyanine molecules were vapor-deposited onto monolayer EG surface to serve as reactive ligands for the direct synthesis of nickel phthalocyanine in-situ in UHV chamber. The surface-confinded coordination reaction between a phthalocyanine monolayer and co-adsorbed Ni as well as the structure of phthalocyanine multilayer films on EG surface was characterized by synchrotron radiation photoemission spectroscopy (SRPES), and near-edge X-ray absorption fine structure spectroscopy (NEXAFS). The results indicate that the vapor-deposited phthalocyanine multilayer on EG has a high degree of ordering with a preferential orientation of the molecular plane relative to the substrate. There is a strong interaction of the phthalocyanine with the EG substrate that is mediated primarily via the iminic nitrogen. The metalation of phthalocyanine can be happened spontaneously on the EG surface through reaction of the phthalocyanine monolayer with postadsorbed Ni atoms.

Assessment of the Usability of Marine Sludge in the Clay Brick Sector

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Disposal of large quantities of sediment dredged from ports presents a serious environmental problem all around the world. In the USA alone, there was approximately 2.4 million m^3 of dredged material per year from 2011 to 2018. In Germany, one single port produces 600,000 m^3 of dredged sediment. In 2009 alone, 80 million m^3 of sediment was dredged in Brazil. However, water sediments represent a huge potential for being used as raw materials in the building sector. Depending on their chemical and mineralogical composition, their main potential lies in soil stabilisation processes and in the clay based industry. Namely natural resources of clays are not in abundance and the clay based sector constantly searches for suitable additives or replacements.

In Slovenia as well (the Port of Koper), dredged sediments represent an environmental burden; therefore, marine sediment was analysed regarding its suitability as an additive in the brick making sector. For this purpose, chemical and mineralogical analyses were performed, and environmental parameters were evaluated as well. Then illitic brick-making clay obtained from a local brick producer was mixed with the marine sediment in different proportions. Mixtures were extruded on a laboratory vacuum extruder and the influence of these additions on the properties of the thus prepared specimen was determined; such as shrinkage after drying, water absorption, bulk density, frost resistance, bending, and compressive strength after firing at two different temperatures. It was confirmed that marine sludge can replace virgin clay by up to 50 wt.% without detrimentally affecting the final properties of a specimen.

Protein-repellent and Antimicrobial Nanoparticle Coatings from Hyaluronic Acid and Lysine-derived Biocompatible Surfactant

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Biofilm formation triggered by uncontrolled protein adsorption, on medical devices is the leading causeof catheter-associated urinary tract infections (CAUTI) during implantation. Herein, we report a waterbased, green and one-step strategy to functionalize surfaces of silicone catheters, polydimethylsiloxane (PDMS), with antifouling and antimicrobial substances to avoid uncontrolled protein adsorption and microbial attachment. A novel synergetic formulation consisting of an anionic glycosaminoglycan (hyaluronic acid, HA) and a lysine-derived biocompatible cationic surfactant (Ne-myristoyl-lysine methylester, MKM) was prepared, resulting in the formation of nanoparticles (NPs, ca. 100–250 nm). Besides their high stability and long-lasting hydrophilicity in ambient and aqueous environments for 60 days, the nanometric layers (48 ± 3 nm) of HA–MKM NPs on PDMS showed no adsorption of BSA and lysozyme and substantially lower adsorption of fibrinogen as revealed by a quartz crystal microbalance with dissipation(QCM-D). In vitro antimicrobial test with S. aureus, E. coli, P. aeruginosa, P. mirabilis, C. Albicans microbes under dynamic conditions revealed that the microbial growth was hampered by 85% compared with unmodified PDMS. Given the multiple functionalities, charges and diverse physiochemical properties of polysaccharide-lysine-based surfactant mixtures, this approach can be easily extended to the development of novel coatings on other silicone-based materials, thereby broadening potential applicability of PDMS-based biomaterials/devices in microfluidics, diagnostic biosensors and others.

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Sigma Phase Precipitation During Isothermal Annealing of SAF 2205

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SAF 2205 duplex stainless steel has good corrosion resistance, mechanical strength, weldability at relatively low price. But it has a disadvantage in detrimental sigma phase precipitation. The effects of time and temperature on the intermetallic phase precipitation and phase transformations in SAF 2205 were investigated. The specimens were isothermally annealed at different temperatures from 800 to 950 °C for 1 min, 10 min, 100 min, 1000 min and 10000 min. The specimens were investigated by optical microscopy, hardness measurements, ferritoscope measurements and SEM analysis with EDS technique. EBSD technique was employed for detailed phase identification. It was found that the phase composition is near equilibrium after 10000 min, especially for temperatures below 950 °C. Sigma phase precipitation was also linked to hardness HV10, it can only be detected at higher contents (20 %).

Diffusion Behavior during Laser Welding of Al Alloy and Nitrated Ti Alloy

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The use of laser beam to joining dissimilar metal has been considered to applications in structural components of aircrafts [1]. A common phenomenon involving Ti / Al joints is the presence of brittle intermetallic compound (IMC) in the interface region. The introduction of additional elements or compounds in the joint interface has shown considerable influence on the interfacial reaction mechanism, promoting the change of IMC type, depressing the growth of brittle IMC and improving the joint mechanical properties [2]. In this work, titanium nitrides was generated on Ti-6Al-4V substrates by Yb: fiber laser with beam diameter varying from 0.3 and 0.5 mm, 80 W laser power and 100 mm/s, process speed, considering N2 flux fixed at 25 L/min. After, nitrated Ti-6Al-4V and AA6013 sheets were joined by a Yb: fiber laser welding system. Butt joint conditions were: laser average power, 1200 W, welding speed of 25 and 50 mm/s, and laser offset toward Al alloy, 0.3 mm. EDS line scanning evaluated the elemental distribution at the joint interface with and without the introduction of titanium nitrides. A decreasing of intermetallic layer was observed in joints with the introduction of titanium nitrides, when compared to an autogenous joint. The thickness of interfacial IMC layer, formed mainly by TiAl3, was about five times lower than the interfacial IMC layer of joint without the introduction of the compounds, reaching the mean values between 10 and 15 µm. Mechanical behavior was evaluated as well. The best joint mechanical strength was obtained when the welding speed was 50 mm/s, being Ti-6Al-4V substrate previously nitrated by laser using a lower beam diameter, 0.3 mm, 80 W of laser power and process speed of 100 mm / s. For these conditions, the mechanical strength of welded samples was 156 MPa which is 70 % higher than the autogenous ones.

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Effect of Cooling Rate on Weld HAZ Coarse Grain Microstructure

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A weld heat affected zone (HAZ) in the weldment is the weakest zone from where failure can occur. Especially, the region close to the weld fusion line called coarse grained heat affected zone (CGHAZ) is the most critical. In CGHAZ region, during welding temperature reaches well above 1100 °C and this causes excessive grain growth of austenite in steel. The effect of cooling rate on weld HAZ coarse grain microstructure of a HSLA (high strength low alloy) steel was investigated. Steel samples were heated to a peak temperature of 1350 °C and cooled at different cooling rates. The dilatation curves generated during simulation were analysed and phase transformation temperatures determined. Phase transformation points were obtained from time – temperature data recorded during simulation. Microstructures and hardness at room temperature were determined corresponding to simulated samples of weld CGHAZ thermal cycles. Based on microstructures, hardness and transformation temperatures, properties for the HSLA steel weld CGHAZ region were determined.

Processing and Mechanical and Thermal Properties of ABS Composites Containing Multi-walled Carbon Nanotubes

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Thermoplastic polymers have been widely used in diverse industries because it can increase a production speed through extrusion and injection molding processes. Especially, Acrylonitrile-butadiene-styrene (ABS) resin exhibits a wide range of mechanical properties and performances, depending on acrylonitrile, butadiene and styrene contents and it also has good mixing ability with various additives and reinforcements. ABS resin has been frequently used in various applications such as impact protection parts, automobile parts, and home appliances. The effect of carbon nanoparticles such as carbon nanotubes (CNT) and graphite nanoplatelets as reinforcement for composites has been studied. When such carbon nanoparticles are properly incorporated into a polymer matrix resin, they may provide increased mechanical properties, with increased interfacial contacts between the carbon nanoparticles and the matrix resin. Recently, when CNT is mixed with thermoplastic polymers, the dispersion of CNT and the tensile strength of the polymer composites depend on the CNT concentration [1,2].

The objective of the present study is to produce ABS composites containing multi-walled carbon nanotubes (MWCNT) by twin-screw extrusion and injection molding processes and also to investigate the effect of MWCNT on the mechanical and thermal properties. The MWCNT concentrations were varied with 0, 0.25, 0.5, 1, 2, and 5 wt%. After the extrusion and drying the MWCNT/ABS pellets, MWCNT/ABS composites were produced by injection molding process. The tensile, flexural, impact, and dynamic mechanical properties and heat deflection temperature were characterized. The mechanical and thermal results are consistent with each other.

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Surface Properties, Corrosion Resistance and Biocompatibility properties of Superhydrophilic and Superhydrophobic TiO_2/Epoxy Coatings on AISI 316L Stainless Steel

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We report on TiO_2/epoxy coatings that were applied on the surface of AISI 316L stainless steel to change the wetting properties with the aim to improve corrosion resistance and biocompatibility of superhydrophobic/superhydrophilic surfaces. Contact angle measurements revealed wetting properties of non-coated, epoxy coated, as-received TiO_2/epoxy coated and fluoroalkylsilane (FAS)-TiO_2/epoxy coated substrates. As-received TiO_2/epoxy coating and FAS-TiO_2/epoxy coating showed superhydrophilic and superhydrophobic characteristics, respectively. The average surface roughness (S_a) of superhydrophobic surface was higher compared to the superhydrophilic surface due to the formation of agglomerates. Electrochemical impedance spectroscopy established enhanced corrosion resistance of surface-modified stainless steel, especially in the case of superhydrophobic FAS-TiO_2/epoxy coating. The biocompatibility evaluated by cell attachment showed that AISI 316L stainless steel with hydrophilic nature and low S_a is the most favourable surface for bone osteosarcoma cells (MG-63) growth. On the other hand, the two limiting cases of surfaces, superhydrophilic and superhydrophobic coatings with increased roughness compared to AISI 316L, showed lower biocompatibility.

Dependability of Composites Construction

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Polymer composite sandwich panels (PCSP) are used in many sectors of industry, particularly in aerospace and defense industry and in great scale also in public transport industry. Sandwich panels consist of two facing skins and the core. Products of all industry sectors have to meet requirements on their dependability. This research paper deals with a proposal of the most appropriate methodology for dependability testing of PCSP´s products used in transport industry. Dependability is a global concept that includes terms of availability, reliability, durability, maintainability, supportability, etc. The experiment have shown S-N curves with damages and without damages of PCSP. An important part of dependability is to find limit states of studied object, which are for PCSM characterized by fiber cracking and (core) delamination. Dependability evaluation consists of analysis and tests. For every test, it is necessary to develop the test plan. Facing skin components of the sandwich panels may particularly be damaged. There are several methods of non-destructive testing, which can be used to determine the damage of facing skins of sandwich panels. Infrared thermography (IRNDT) is one of them. IRNDT utilizes thermo-physical properties of the materials, including thermal diffusivity.

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Effect of High Pressure Hydrogen Environment on Fatigue Crack Growth Rate of 34CrNiMo6 Grade Steel

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Paper deals with evaluation of effect of high pressure hydrogen environment with actual pressure of hydrogen up to 30 MPa on fatigue crack growth rate properties of structural steel used for cylinders production. 34CrNiMo6 grade steel was used for experimental programme. A unique new testing equipment (hydrogen autoclave), which was built to servohydraulic testing machine, was developed in MATERIAL & METALLURGICAL RESEARCH, Ltd. to study degradation mechanism of high pressure hydrogen environment on mechanical properties including fracture mechanics properties of structural materials. ½ C(T) specimens with initial crack were used for fatigue crack growth rate testing in the air and in high pressure hydrogen environment. Potential method was used for crack growth monitoring in the hydrogen autoclave as well as in the air during cycling. Comparison of results is presented in this paper. Effect of hydrogen is presented on fractographic examination, change in fracture morphology was found on fracture surfaces of tested specimens due to presence of high pressure hydrogen.

Topochemical Conversion of $Bi_4Ti_3O_{12}$ to $SrTiO_3$ under Hydrothermal Conditions

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$SrTiO_3$ is a widely known ABO_3-type perovskite. Due to the symmetric crystal structure, $SrTiO_3$ particles tend to grow in an isotropic shape like cubes and spheres. Anisotropic $SrTiO_3$ particles such as platelets are one of the most important template seeds for textured perovskite ceramics. In order to prepare plate-like $SrTiO_3$ particles we employed topochemical conversion from $Bi_4Ti_3O_{12}$ under hydrothermal conditions. The effect of experimental parameters such as stirring, reaction time, temperature, NaOH and $Bi_4Ti_3O_{12}$ concentrations and Sr/Ti ratio on the morphology, growth mechanism and kinetics was studied. Formed $SrTiO_3$ particles existed in three types of morphology: cube-like, frame-like and plate-like depending on the reaction conditions. $SrTiO_3$ particles was found to maintain the plate-like morphology of the $Bi_4Ti_3O_{12}$ template in a very narrow window of experimental conditions. Progressive product phase formation was investigated using powder X-ray diffraction (XRD), Energy Dispersive X-ray Spectroscopy (EDXS), Scanning and Transmission Electron Microscopy (SEM, TEM) and Selected Area Electron Diffraction (SAED). Results suggest that $SrTiO_3$ particles preserved the plate-like shape of the $Bi_4Ti_3O_{12}$ template when the hydrothermal conditions favor the dominance of Frank-van der Merwe (layer-by-layer) over the Stranski-Krastanov (layer plus island) and Volmer-Weber (island formation) growth. The effect of reaction parameters on particle's morphology, mechanism and kinetics of conversion will be discussed. Presented procedure could be applied also to other perovskites ($BaTiO_3$, $CaTiO_3$).

A Cellular Automaton Model for Simulation of Microstructure Evolution during Solidification in Binary Eutectic Alloys

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A two-dimensional model to simulate the microstructure evolution during the solidification of binary eutectic alloys is developed. A cellular automaton method is adopted to simulate the nucleation of the solid phase and the movement of the solid-liquid interface. The solute diffusion equation is solved in the solid and liquid phases by using an explicit finite volume method as locally isothermal conditions are assumed. An adaptive mesh refinement, based on the quadtree algorithm, is constructed to refine and de-refine the regions of the computational domain with the highest and the lowest solute concentration gradients, respectively. The originality of the work is in the 1.) novel adaptive approach to the efficient and accurate solution of the solute diffusion equation and 2.) novel approach for the accurate calculation of the normal to the solid-liquid interface and mean curvature by using local polynomial weighted least squares fitting of the shape of the inter-phase boundary. The model is verified and assessed by comparison with the analytical results of the Lipton-Glicksman-Kurz model for the steady growth of a dendrite tip and the Jackson-Hunt model for the lamellar eutectic growth. Several examples of typical microstructures are calculated and the features of the method as well as further developments are discussed.

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Properties of Filling Materials in Inter-penetrating Phase Composites under High Strain-rate Impacts

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Cellular materials provide favorable energy absorption capabilities which may be further extended when the lattice is equipped with a suitable filling material to form inter-penetrating phase composite (IPC). The filling has to provide a good strain energy absorption while preserving the lightweight nature.
In this study behavior of selected types of filling material were tested in compressive loading mode at high strain rates.
Four types of filling material were tested, (i) ordnance gelatin, (ii) low expansion polyurethane foam, (iii) thixotropic polyurethane putty and (iv) silicon putty. To evaluate their contribution to the impact energy absorption in IPC bulk samples of selected materials were subjected to high strain rate compression.
The high strain rate compressive loading was provided by Split Hopkinson Pressure Bar (SHPB) which was adjusted to be able to test cellular and soft materials. From the tests stress-strain diagrams of investigated materials were obtained, which provided relevant mechanical properties (plateau stress and strain, strain energy density). Moreover a high speed camera was used to capture the loading scene which enabled a visual inspection of the deformation behavior of the tested specimens.

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Biomaterials in endoprostetics

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The endoprosthetics of hip- and knee-joint replacements is currently the most common and successful method in advanced surgery to treat degenerative joint disease, for relieving pain and for correcting deformities.

Cobalt-chromium-molybdenum alloys, titanium alloys, trabecular tantalum, biolox ceramics, UHMWPE polyethylene and PMMA bone cement are the most common biomaterials used in endoprostetics.

The published results of long-term investigations demonstrate the excellent clinical results from at least 15 years after TJR surgeries. Using new, improved surgical operation methods as well as new, improved implants of advanced biomaterials, the greater success with clinical results is expected.

While these surgeries have positive outcomes, approximately 10% of the implants fail prematurely. Aseptic loosening and periprosthetic joint infection are the main causes of failure for joint arthroplasty.

The Orthopedic Clinic Ljubljana performs between 80 and 100 revision surgeries of knee and hip endoprostheses per year. The most common causes for revision surgeries are aseptic loosening and implant infection. For all treated patients the clinical course of treatment including X-ray documentation is precisely followed. The retrieved endoprostheses are sent for bacteriological analysis, while the endoprosteses are preserved for further investigations.

The biotribology analyses of retrieved hip and knee endoprostheses were performed in cooperation with IMT Ljubljana using advanced analytical and integrated electron spectroscopy techniques. Two new and two retrieved endoprostheses were studied. The surface chemistry and microstructures of both the new and used titanium alloys and CoCrMo alloys used for hip and knee endoprostheses were determined using SEM (morphology), EBSD (phase analysis), and AES and XPS (surface chemistry). SEM SE and BE images showed their microstructures, while EBSD provided the phases of the materials. During the production of hip and knee endoprostehses, these materials are subject to severe thermomechanical treatments and physicochemical processes that are decisive for CoCrMo alloys. The AES and XPS results showed that thin oxide films on (a) Ti6Al4V are a mixture of primarily TiO_2 with a small amount of Al_2O_3, while the V is depleted, (b) Ti6Al7Nb is a mixture of primarily TiO_2 with a small amount of Al_2O_3 and Nb_2O_5, and (c) CoCrMo alloy is a mixture of primarily Cr_2O_3 with small amounts of Co and Mo oxides. Biolox ceramic delta and forte were investigated by HR-TEM and UHMWPE polymer by differential scanning calorimetry (DSC) and differential thermal analysis (DTA).

The new approach in surface preparation of the biodegradable FeMn alloys

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The interest in biodegradable metallic materials for the application as temporary implants has been continuously increasing within the last years. Due to the progressive degradation after providing a temporary support on healing process of a diseased tissue, disadvantages of permanent implants, such as further surgery, may overcome. Due to the broad range of mechanical properties and the excellent process-ability iron-based alloys are of great scientific and economic interest for stent application. However, because of the very low degradation rate of pure iron in physiological media, such implants are considered to reveal reactions similar to those found in permanent applications. In order to increase the degradation rate of Fe-based materials three different approaches have been employed. First approach is *chemical* modification of the alloy with different amounts of Mn as low as 17 wt% up to 35 wt% Mn, which exhibited an increased degradation rate with respect to pure iron. Nevertheless, compared to magnesium alloys, the degradation rate of Fe–Mn alloys is still at least one order of magnitude lower and considered too slow for many temporary implant applications.

The second approach is *electrochemical* approach, where more noble metals (Pd, Pt...) with low solubility are added to the matrix of the alloy for inducing isles of corroding areas to the alloy. This method increases the biodegradability with increasing the production cost for few times.

The third approach is surface modification of the alloy to increase the exposed area with laser, sandblasting etc. In our recent study, we report for the first time on the influence of laser texturing on the controlled biodegradability of an Fe–Mn alloy used for medical implants. We were able to achieve super-hydrophilic wetting properties by texturing with a nanosecond Nd:YAG laser. XPS revealed that the oxide layer on the laser-textured Fe–Mn alloy consists mainly of Fe_2O_3 and FeO, with the content of Mn in the oxide layer being significantly higher than in the bulk material. Using the results of the electrochemical measurements we were able to clearly demonstrate the superior biodegradability of the laser-textured Fe–Mn alloy.

A method for Detection of TiO_2 Nanoparticles Presence in Food Based on Colorimetric Assay

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For achieving added-value of food (freshness, new tastes, flavors, textures), newer materials and procedures are being applied into the food production by manufacturers, among them are nanoparticles used as food additives and supplements. They can be part of edible food coatings, food contact materials, and manufacturing process[1]. Titanium dioxide is an approved food colorant used in confectionary products and anticaking agent in powder food. A portion of TiO_2 food grade powder has already been shown to have nano dimensions[2]. Due to their small size and tendency for changing properties in different environments, nanoparticles are presenting potential problems in biological systems. Detection of their presence is challenging due to the presence of other molecules, which can be adsorbed on their surface and cause agglomeration[3].

Recently, a method for detection of Ag, Au, SiO_2, VO_2 and CeO_2 nanoparticle presence in complex matrices as lake water, urine, and blood serum was developed on the basis of the simple colorimetric assay[4]. The method is based on the redox reaction between reducer $NaBH_4$ and organic dye methylene blue. In this reaction, nanoparticles act as a catalyst, therefore in their absence, the reduction of dye does no occur.

The aim of the present work is to adapt the abovementioned method for the detection TiO_2 nanoparticles in complex matrices as food samples.

Figure 1: Schematic presentation of the purpose of this study.

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Comparison of Electrospinning and Wet Spinning Methods for Processing of Chitosan Based Composite Fibers

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Chitosan, a derivative of the natural polysaccharide chitin, has a biocompatibility, biodegradability, bactericidal activity, lack of toxicity and high sorption characteristics. Due to such properties chitosan based materials find a lot of applications in medicine including cell replacement technologies and tissue engineering.

The aim of this work is to compare the processing of chitosan fibers by two methods. Chitosan chitosan with similar deacetylation degree and different molecular mass have been used for processing the fibers. The chitin nanofibrils CN (Mavi Sud s.r.l, Italy) have been used as the filler. The chitosan fibers have been spun by coagulation method from 2% acetic acid aqueous solution of chitosan. It has been shown that chitosan molecular mass effected on the wet spinning process and on the mechanical properties of chitosan fibers. Fibers of the best mechanical properties have been prepared with 210 kDa chitosan sample, whose fibers have a strength 190 ± 9 MPa and Young modulus 12 ± 0,6 GPa. The incorporation of 0.1–0.3 wt% CN into chitosan matrix has contributed to an increase in strength and Young modulus of the composite fibers. The chitosan solutions containing chitin nanofibrils have possessed the necessary rheology characteristics preserving the laminarity of the jet in the coagulation bath after the flowing of the solution through the die hole [1].

The chitosan fibers have been spun by electrospinning from 70 % acetic acid aqueous solution of chitosan. It has been established that optimal chitosan molecular mass for electrospinning is close to 70 kDa. However the processing of fibers from chitosan by electrospinning is very difficult. Nanofibers have been only prepared from mixed solution containing 10 wt % PEO and 1–30 wt% CN. The introduction of CN into chitosan solutions accelerates considerably the quality of nanofibers at electric field and decreases the amounts of defects in them. It was found that the optimal concentration of CN is 20 wt% to process defect-free chitosan nanofibers [2].

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Electrochemistry of carbon and lithium surfaces in the lithium-sulfur battery system

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The commercialization of the lithium-sulfur battery technology, a promising new system with high energy densities and specific capacities, is impeded by multiple factors. The mechanisms behind the processes taking place during discharge and charge are not well known, which is a major setback.
We have explored the electrochemistry of the materials on the basis of the internal resistance of the battery cells, which is one of the basic characteristics. It directly influences the voltage and the capacity and through these parameters, the power and energy. Since the lithium–sulfur battery system is a very complex one, the amount of research in that field is limited[1-3].
From symmetrical cells we have determined that the bulk of the resistance comes from the cathode made of carbon–sulfur composite. With purpose-designed electrochemical cells consisting of carbon or lithium electrodes, this resistance was further studied. We were able to distinguish between the contribution of the electrochemical reactions of polysulfide species on the electrode surface and the diffusion resistance. Although the anode resistance was determined to be negligible, lithium still influences the resistance of the battery cell through a chemical reaction which changes the response of the positive electrode[4].

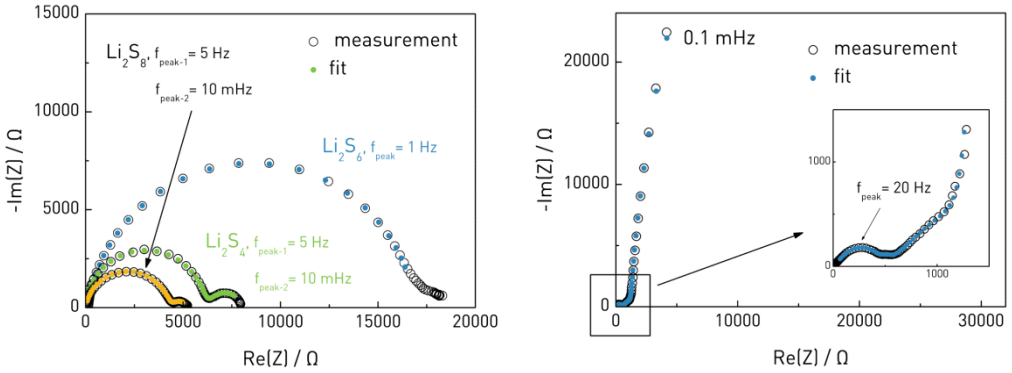

Figure 1: EIS response and fit of symmetrical carbon cells with different polysulfides in the electrolyte (left) and battery cells (right)

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Push-Pull Alloys: the Nucleation of Complexity in Metallic Alloys

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Wedraw attention toA-B-C ternary alloys, in which the elemental constituents A, B and C are chosen in such a way that B-C interactions are repulsive, but A-B and A-C are attractive in the respective binary systems. Such“**push-pull alloys”** are reminiscent of amplifiers designed to amplify electric signals. Push-pull alloys amplify complexity, forming complex intermetallics with tens to thousands atoms per unit cell. Few of them lead to the ultimate degree of complexity, when quasiperiodic order substitutes for crystal periodicity, which opens the way to discovering unprecedented properties such as heat insulation in Al62Cu25Fe13 (at. %). Many more compounds are known today, which share the same elemental characteristics (the picture may be extended to specific binary alloys). The case of push-pull alloys will be exemplified with electronic structure data already published as well as with original material obtained on ternary systems such as Gd-Ca-Cu and Al-Sc-Cr alloys as well as in (Ce,Al)-Cu-Fe metallic glasses.

Dynamic Testing of Advanced Cellular Metallic Materials Using Split Hopkinson Pressure Bar

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Modern manufacturing technologies such as foaming of metals, advanced coating procedures or additive manufacturing allow for development of advanced cellular metallic materials. This type of materials can be used for energy absorption applications and their mechanical properties can be tailored and optimized for a given usage. Testing of the materials at dynamic conditions is necessary to evaluate mechanical properties relevant for the proposed application. In this paper, a Split Hopkinson Pressure Bar (SHPB) apparatus is used for impact loading of the selected cellular metallic materials. The experimental setup is arranged as a modified Kolsky setup. The incident bar, the transmission bar and the striker bar have 20 mm in diameter and are made of high-strength aluminum alloy to minimize the difference in mechanical impedance between the bars and the samples. The bars are guided using low-friction polymer-liner slide bearings with aluminum housing. The gas-gun system consists of a steel barrel connected to a 20 l air reservoir using a high-flow fast release solenoid valve. The impact velocity of the 500 mm long striker can be set in range from 8 m/s to 50 m/s. Hydro-pneumatic damper is used as an absorber of the residual kinetic energy of the experiment. The generated strain pulse is measured using foil and semiconductor strain gauges located in the middle of the bars (foil type) and in the vicinity of the specimen (semiconductors). Strain gauges in half-bridge arrangement are powered by battery source to reduce noise of the measured signal. The signal is amplified and sampled with 20 MHz sample rate. Strain wave dispersion and ramp-in effect are reduced using annealed copper pulse-shaper located on the impact face of the incident bar. The experiment is observed using a high-speed camera for assessment of in-plane displacement and strain fields in the sample using digital image correlation (DIC). The functionality of the system is demonstrated on experiments where additively manufactured metallic auxetic lattices and nickel-coated open-cell polyurethane foam were used as specimens.

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Pulsed-Laser Deposition of $Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$ Thin Films on $SrTiO_3$: Nucleation and Initial Growth

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Single crystals of relaxor ferroelectric $Pb[Mg_{1/3}Nb_{2/3}]O_3$-$PbTiO_3$ (PMN-PT) exhibit excellent piezoelectric properties, such as piezoelectric constant d_{33} of 2500 – 2800 pC/N and electromechanical coupling coefficient exceeding 90 %.[1,2] The giant piezoelectricity of their thin film counterparts[3] makes them a prime candidate for the active layer in microelectromechanical systems (MEMS). For the application of longitudinal (d_{33}) MEMS energy harvesters, which offer higher electromechanical coupling compared to the transverse type, PMN-PT needs to be grown directly on insulating substrates or buffer layers. $SrTiO_3$ (STO) is a commonly used non-conductive template, due to its small lattice mismatch with most perovskite functional oxides. However, in the case of pulsed-laser-deposited PMN-PT, we found that the perovskite phase is significantly more stabilized when using $LaNiO_3$ (LNO) electrode layers as compared to growing directly on $SrTiO_3$, despite the larger lattice mismatch between PMN-PT and LNO. In order to explain these results, we used in-situ reflection high-energy electron diffraction (RHEED) to monitor the growth of the first few monolayers of PMN-PT on TiO_2-terminated STO. Substrate surface modifications were made in order to improve the wettability. The heterostructures were then examined by atomic force microscopy (AFM) and the growth mode of the films was determined. The results of this study highlight the significance of total surface energy on the growth of epitaxial thin films, especially in the case of materials with highly volatile constituents, such as Pb.

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Surface Nanocomposite Fabrication on AA6063 Aluminium Alloy Using Friction Stir Processing: An Investigation of the Effect of Shoulder Diameter on Composite Microstructure

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In this work, surface metal matrix composites (SMMC's) were fabricated on AA6063 base metal through friction stir processing (FSP). In all samples for surface composites, grooves of 2×2 mm^2 were made along the centreline of plates and TiB_2 powder (~80 nm) was filled and compacted in these grooves. A pinless tool was employed to initially cover and compact the grooves filled with TiB_2 particles to prevent it from sputtering during FSP. Tools of different shoulder diameter (16, 18, and 20 mm) with anti-clockwise scrolls on shoulder surface were used for FSP with constant pin diameter and pin length. Tool rotational speed, traversing speed, and tilt of 900 rpm, 40 mm/min, and 2°, respectively, kept constant for all the experiments. Macro, optical micro images and micro hardness test were used to evaluate the particle distribution. Powder agglomeration was observed in retreating side of samples processed with 16 and 18 mm shoulder diameter tools. On the other hand, significant improvement in particle distribution and excellent bonding with substrate was observed when sample processed with 20 mm shoulder diameter tool. Findings of this investigation are important and provide knowledge for better tool design and effective tool selection to bring out better distribution in single pass.

Bioactive Grafting on Passive Metals: Interaction with Protein Solutions

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We focus on the chemical and structural control of the surface reactivity of passive metals at a nanometric scale, as regards properties such as corrosion, nanostructuration and biocompatibility. We propose here to investigate on the biomolecule adsorption on metallic substrates for medical applications (dental implants, vascular stents, other prosthesis…).
Recently, in collaboration, a new methodology for controlling protein adhesion at surfaces has proved its interest for oxide surfaces (Si, Ti) in view of drug delivery or cell adhesion: the thiolene chemistry to design passive metallic surfaces [1]. In addition, we apply an original approach to get *in-situ* real time information (Quartz Cristal Microbalance and electrochemical techniques, see for example ref [2], associated with chemical and morphology surface analyses (X-Ray Photoelectron Spectroscopy, Time of Flight- Secondary Ions Mass Spectrometry and Atomic Force Microscopy). Other grafting techniques adapted for metal oxides have been tested [3]-[4] where surface science tools have proved their interest in addition to multidisciplinary approaches, a rapid view on 3 systems interacting with Ti surfaces will be presented.
Subfields: Biomaterials, Biointerfaces Surface functionalization

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Corrosion of Steel in Alkali-Activated Materials

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Cement is one of the most used materials worldwide. During the production of ordinary Portland cement (OPC) high amounts of emitted greenhouse gases are released. To achieve more sustainable development, the OPC should be gradually replaced by more sustainable binders [1]. One of the potential alternatives to OPC are alkali-activated materials [2,3]. The alkali-activation is a reaction of a solid aluminosilicate ("precursor", e.g. blast furnace slag, coal fly ash, etc.) under alkaline conditions (induced by the "alkali-activator"), forming a products similar to cement paste or ceramics [4,5].

The main cause for reduced service life of reinforced concrete structures is the corrosion of steel reinforcement. Although quite protective towards carbon steel reinforcement due to high alkalinity, corrosion in concretes and mortars from alkali-activated binders exposed to aggressive environments remains relatively unknown and rarely studied process [6].

The aim of this study was to investigate the corrosion of steel reinforcement in alkali-activated mortar (AAM) exposed to chlorides, and to find specifics of AAM (compared to OPC mortar) which have the influence on corrosion initiation of embedded steel.

Small laboratory specimens were prepared using alkali-activated mortar made with fly-ash and ribbed carbon steel reinforcement. For reference, the same types of specimens were prepared from standard mortar (CEM I cement). The specimens are exposed to wet/dry cycles in order to simulate Cl^- contaminated environment. Specimens are periodically tested by means of electrochemical impedance spectroscopy (EIS). The small size of the specimens enables the use of micro X-ray computed tomography (MicroCT) for non-destructive validation of measured corrosion activities. To relate corrosion and physical properties, small specimens made of the same mortar mixtures (without steel reinforcement) were used for testing relevant physical parameters (penetration of chlorides, carbonation depth, porosity).

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Toward the Optimum Spinal Fusion Device

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Lumbar interbody fusion remains a »golden standard« for treatment of spinal instability, deformity, degenerative disc disease, infection and failed decompressive spinal surgery. Substantial effort has been done to optimise surgical technique and even more substantial to develop suitable implants that would address all three major issues of the procedure: stability, restoration of lordosis and osteointegration.

The focus of spinal surgeons is constantly shifting from one material to another. The reason for this might be in the fact that no optimal material currently exists and in the aggressive, commercial drive from the industry, developing and promoting new products.

The era of interbody fusion began with mesh cages, manly produced of titanium. This first generation of cages was met with great expectations but little knowledge of anatomical postulates such as sagittal balance and importance of segmental lordosis. Results were relatively favourable in early post-surgical period, with good interbody fusion but deteriorated with years, because of high grade of subsidence and consequently kyphotic alignment of fused segment. That was followed by rapid degeneration of adjacent segment and clinical deterioration. The other problem with titanium cages were metal artefacts, blurring the radiological interpretation and evaluation of solid bone fusion.

The beginning of 21. century brought up the advent of implants made of polyether ether ketone or popular PEEK. Its biomechanical properties were closer to bone than those of the titanium implants, it was perfectly inert, fully radiolucent. The hopes were high again but again short-lived. PEEK implants have indeed improved possibility of anatomical restauration of diseased segment but failed to persuade with its limited osteointegration.

Currently there is a confusion among spinal surgeons. The industry is bringing back titanium cages which are now more anatomically shaped and have Nano roughened surface modification but still possessing different structural properties to bone and again high risk of subsidence. The compromise would be in titanium coated PEEK cage, emerging out of production in to practice, but many evaluation must be done to answer all these questions.

We propose an animal study to test both titanium and Peek cages with different surface roughening, as well as titanium coated implants.

Annular Laser Beam Based Direct Deposition of Metal

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In the paper, a novel annular i.e. ring shaped laser direct deposition head (LDDH) and related deposition processes are presented. The main components of the head are laser beam shaping and material feeding unit. With minor modification of the material feeding unit the annular LDDH can be used either for deposition of metal droplets generated from a wire, or for deposition i.e. laser cladding of metal powder or wire. The developed head, in contrary to existing LDDHs where a metal powder or a wire material is fed from a side [1], enables axial feeding of the material into the center of the generated melt pool or the focused annular laser beam, respectively. Based on the annular laser beam material interactions [2], several benefits including higher process symmetry, stability and efficiency, as well as improved properties of deposited material are expected. In the paper, the applicability and some benefits direct deposition of metal performed by the annular LDDH are demonstrated by stable deposition of droplets generated on demand and continuous droplet generation from a wire [3, 4], by high powder catchment efficiency and low porosity in metal powder cladding [5,6], and by preliminary results of a wire cladding process.

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Role of Material and Surface Treatment on Premature Failure Mechanism of X37CrMoV5-1 HPDC Tool

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The present paper refers to investigation of the influence of aluminium alloy on the tool used in the process of HPDC, regarding structure, microhardness and the failure mechanism of the used tool. The research involved a hardened and nitrided shot sleeve made from X37CrMoV5-1 steel which was in use. The shot sleeve failed after 30.000 shots (cycles). Before analysing the shot sleeve laboratory tests, thermodynamic calculations and simulations of aluminium-steel surface interactions were made, to predict the properties of the used steel. The material investigation reveals, that the hardening process was made correct, but the nitriding process shows a potential problem in the formed diffusion and compound layer. The depth of the nitrided diffusion layer on the surface, that was not damaged was measured up to 0,2 mm and the thickness of the compound layer up to 18 µm. The compond layer porosity at this point exceeded 75 %. The results show, that the thickness of the compound layer plays a great role in case of premature failure. Another cause is connected with the diffusion zone. The construction of the shot sleeve also had an effect on the lifetime. On the damaged surface of the tool a SEM analysis was made to evaluate the phases formed between aluminium alloy and tool steel. The analysis indicates, that the nitriding process has a positive effect on extending the lifetime of the tool, but it can also cause a premature failure when parameters used in the process are not optimized for the working process of the tool.

Consolidation Of Metal Alloy Powders Into Functional Components Via Laser Based Additive Manufacturing (AM) Technique

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Additive manufacturing (AM), commonly known as 3D printing is fast gaining popularity as a manufacturing technique.

There are currently 7 types of additive manufacturing techniques defined by the ASTM, all share a commonality, that components are produced in fine layers, driven from a CAD (computer aided design) model. Components can be built in various materials including plastics, ceramics and metals depending on the method used.

Laser powder bed fusion (LPBF) falls into the 'powder bed fusion' ASTM category; components are built up by first dosing a thin layer of metal powder, generally in the size range 15 µm – 45 µm, across a build plate of the same material. A high-power laser then melts selected areas of the powder layer, according to the CAD model which has been sliced using process specific software. This process of layering powder and laser melting is repeated hundreds of times until the solid metal component has been built.

Adoption of LPBF AM is largely due to the associated design advantages over more traditional methods, enabling highly complex geometries not possible to manufacture by any other method, allowing for component weight reduction, consolidation of multiple parts in to a single design and customisation of components. These multiple benefits are applicable to a wide range of industries including, medical, aerospace and tooling.

The metallurgical properties of the components produced must be investigated and understood. Unlike production of a billet for machining for example, the AM components may have a very different microstructure due to the processing methodologies as the layers are rapidly melted and cooled. To control and manipulate the microstructure of the metal produced, processes carried out pre-build, whilst, and post building can be applied in order to control the reliability and repeatability of AM as a production method.

Laser Texturing – a Flexible and Efficient Tool for Producing Surfaces with Superior Wetting Properties

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The wettability is an important property of a solid surface that can be characterized by the static contact angle. As shown by many examples in nature [1] the introduction of surface roughness may result in super-hydrophilic (extremely wettable) and super-hydrophobic (extremely water repellent) surfaces. In last 15 years, the surfaces with superior wetting properties gained significant scientific interest since they enable many important technological breakthroughs in different areas, including enhanced heat transfer [2] and corrosion resistance [3].
Artificial surfaces with superior wettability have been successfully fabricated via various chemical and other methods. Nonetheless, in last decade laser surface texturing [3, 4, 5] has proved as a novel and flexible micro/nano-technology for producing surfaces with micro/nano structure due to laser ablation and melting. This contribution reviews two main principles of laser texturing of super-hydrophobic surfaces. The first one is a low-fluence laser ablation with polarized beam resulting in so called laser-induced periodic surface structures (LIPSS) [4, 6], while the second one is a high-fluence laser ablation leading to micro-channels [3, 5]. Both principles can be used to produce surfaces with superior wettability. Recent results of using low-cost, ns-marking-laser texturing for producing surfaces with superior wettability will be also presented. Such a cost-effective approach opens new possibilities for dissemination of this technology into different industrial applications.

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The Influence of Laser Processing Applications for Leather Laminates Comfortability

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The wide range of polymer membranes with different properties gives possibility to manufacture multilayered laminates with unique properties. Membranes used for the production of laminates have increased resistance to water, wind, micro-organisms, and penetration of various chemicals. Improvement of the resistance caused unwanted effects of laminate properties, often make their comfort features worse, such as: water vapour permeability, water vapour absorption, desorption. These features depend on the laminate materials they are made of.

Engravings and the perforations by laser are performed on the surface of various materials: textile, leather, plastic, glass, metal, etc. Laser perforation is widely applied in packaging materials, in the production of airbags, in the cigarette filter paper perforation. Using the laser can be made micro (less than 0.5 μm – 5 μm in diameter) and macro perforations. The application of laser processing technology can improve the comfort features of individual layers as well as laminates. Perforation is done with a very high accuracy, the extraction of various forms of holes, a certain pattern, or dent lines. Herewith perforation is opening the complementary surface of holes, which is able to improve the water vapour penetration and absorption.

Laser treatment modifies the surface, microstructure of materials, and influences physical, mechanical, comfort features such as resistance to water penetration, water vapour permeability and water vapour absorption. The changes of parameters of the treated materials occur mainly due to the created in them thermal fields.

In this paper the investigations of moisture transfer through microporous film laminated leather are presented. Leather lining processed by laser technologies and laminated with micropourous hydrophobic PU membrane. The influence of microporous film and laser perforation parameters on the leather comfort properties has been investigated.

The influence of laser perforation parameters on the laminated leather structure, surface properties and moisture transmission behaviour presented. Increases of laser-processed applications increasing the rate of liquid sorption process and enhanced the wettability of leather. The water vapour permeability and absorption of laminated leather increase as perforation area increase. The mathematical description of the leather water vapour permeability and absorption on the perforation parameters shows high correlation between experimental and theoretical results.

Influence of Heat Treatment Parameters on Mechanical Properties of Aluminum

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Presented work is concerned to evaluate the influence of different heat treatment parameters on mechanical properties of AC75 Aluminum alloy. Eleven group of samples were heat treated at different parameteres to investigate the influence of heat treatment on mechanical properties. The mechanical properties according to standard SIST EN ISO 6892-1 A224 were determined using Instron Universal Tester model 8802, where values of yield strength, tensile strength and elongation were analysed. Beside tensile properties also the hardness after different heat treatments were measured according to the standard SIST EN ISO 6506-1 (HBW2,5/62,5) and according to the standard SIST EN ISO 6508-1 (HRB).

Polyol Synthesis Of Silver Colloidal Nanoparticles With *N*-[3-(trimethoxysilyl)propyl]diethylenetriamine As Capping Agent

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Silver nanoparticles (AgNPs) have unique properties such as excellent conductivity, chemical stability, antimicrobial activity and catalytic activity. Therefore, they have potential applications in various fields of electronics, textiles, sensors, environmental protection and medicine [1,2].
In this study we synthesized AgNPs with chemical reduction of $AgNO_3$ by modified polyol method employing ethylene glycol (EG) as solvent and as reducing agent. Aminosilane *N*-[3-(trimethoxysilyl)propyl]diethylenetriamine (ATS) was added as capping agent. Aminosilanes serve as surface modifiers that prevent particle agglomeration and allow further manipulation of nanoparticles[2]. We studied various aminosilane: $AgNO_3$ molar ratios, as well as influence of pH, temperature and reaction time on size and morphological properties of produced AgNPs. Produced AgNPs were characterized using transmission electron microscopy (TEM), energy dispersive X-ray spectroscopy (EDX), differential scanning calorimetry (DSC), Fourier Transform Infrared Spectroscopy (FT-IR), UV-VIS spectroscopy, X-ray diffraction (XRD) and measuring of zeta potential.

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Rolling Simulation for Finishing Rolling Mills Using a Meshless Method

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A rolling simulation program has been developed to analyze the large deformation processes. The complicated 3D rolling process is reduced to a 2D problem by traveling of a slice assumption [1]. The simulation has two major sub-models, thermal and mechanical. Both of them are solved by a meshless Local Radial Basis Function Collocation Method [2]. The initial computational domain, slice, is discretized by uniformly distributed collocation points. Each slice gets a new position and velocity towards the rolling direction with explicit time stepping. The local system of equations is achieved by considering only a certain number of neighboring nodes for each point. The temperature field is solved locally, however the displacement field is solved globally. This process is repeated at each slice position until the end. The plastic material behavior is implemented by using a predefined effective stress - effective strain relation. Non-linear system of equations is then solved by direct iteration [3].

Completely user defined rolling schedules, including arbitrary groove surfaces, are read and visualized by this rolling simulation program. Symmetric and non-symmetric grooves can be easily considered in the calculations. Cross section of a grooved roll, groove surface line, is drawn for each slice position. Traction boundary condition with friction is considered during the contact with roll surface. The user is able to run multiple simulations by adjusting any user defined parameter such as roll gap, groove type, material properties, and then recalculate. This specific rolling simulation program is created in C# with .NET framework for industrial use.

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Simulation of Macrosegregation in Direct Chill and Low-Frequency Electromagnetic Casting by a Meshless Method

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A comprehensive meshless numerical model was developed for the simulation of macrosegregation in direct chill casting and low-frequency electromagnetic casting. The model uses mass, momentum, energy and species conservation equations to simulate the solidification of aluminium alloy billets. Electromagnetic field equations are coupled with the fluid flow and used to calculate the Lorentz force. Volume-averaging formulation of transport equations is used to handle the two-phase solidifying flow. The effect of floating grains and solidification shrinkage on melt flow and macrosegregation is neglected. The microsegregation is determined from the linearized phase diagram with the lever rule. All time-dependent partial-differential equations are solved with the meshless diffuse approximate method. An explicit time stepping scheme is used. Three different types of boundary conditions for the heat transfer are incorporated, therefore the effects of hot-top, mould chill and direct chill are all considered in the simulation. The use of meshless method and automatic computational node generation made it possible to investigate complex inflow conditions, including sharp and curved edges in a straightforward way. A time dependent adaptive grid is used to decrease the calculation time. The macroscopic transport model results are used in two other independent models to solve the solid mechanics and microscopic grain growth equations. A casting case of an aluminium alloy billet with the radius of 50 mm and Al-4.5wt%Cu alloy is simulated as an example. The effect of low frequency electromagnetic force on macrosegregation is investigated.

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Surface Modification of Polymers by Reaction of Alkyl Radicals

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There are a number of applications of polymers where their surface must be chemically modified for improving the attachment of bioactive compounds[1,2] for releasing drugs,[3,4] for tissue engineering,[5,6] and for their adhesion to other materials.[7,8] Plasma irradiation is the dominant method in this field,[1,9,10] nevertheless other methods can be of interest to provide more chemically complex surfaces.

Herein, we present a mild and versatile method that permits the reaction of an alkyl radical to the surface of two typical polymers: high density polyethylene (PE) and poly-(methyl methacrylate) (PMMA) to give functionalized surfaces.[10] These polymers are widely used for their characteristics such as elasticity, strength, and optical clarity. The grafting of alkyl groups is achieved by homolytic cleavage of the C-Br bond under mild conditions: a bromine atom transfer from the alkylbromide to the 2.6-dimethylphenyl radical derived from a diazonium precursor furnishes an alkyl radical that reacts with the surface of the polymer. Such modification is achieved either in one step starting from a bromo derivative of the molecule to be grafted or in two consecutive steps by post-functionalization of a grafted 6-bromoalkylcarboxylic acid. The grafted films are characterized by ATR IR, XPS and UV spectroscopy. In this way, complex molecules can be bonded to the surface of the polymer.

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Platinum Dissolution - from Fuel Cells Degradation to Recycling

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Platinum, as one of the precious metal, is not only rare and of high economic interest but more importantly, deeply integrated into our society through electrical and electronic equipment and catalysis, which are key enabling technologies for our high life quality. This is due to platinum's very high corrosion resistance. Pt is also one of the most well known and the most studied electrocatalyst. It is used to accelerate numerous important reactions like oxygen reduction, hydrogen and methanol oxidation, etc., utilized in the electrochemical energy conversion reactors like fuel cells and electrolyzers. Also, one-third of platinum supply is consumed for the production of automotive catalytic converters. For this reason development of different kind of nanoparticles as active and stable catalysts is very popular through the materials science community.

Due to increase in Pt consumption, it is predicted that the supply will not be able to meet the demand. It is, thus, likely to assume that the Pt supply will become a bottleneck for catalysts production. It's natural ores concentrations are already at the relatively low-level and to a large extent only found in South Africa. Several states, for example, US, Japan and EU, have already recognized importance of the supply risk and, consequently prepared a so-called critical raw material (CRM) list. For this reason the chemistry of recycling of platinum from end-of-life products, also referred as urban-mining, is becoming essential. However, due to Pt resistance to corrosion, platinum leaching relies on extremely aggressive and hazardous processes, for example, boiling aqua regia; a mixture of concentrated nitric and hydrochloric acid. In this presentation, I will explain how we transferred knowledge from Pt electrocatalysts stability studies to completely new Pt hydrometallurgical recycling [1].

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Assessment of Selected Waste Regarding its Potential for Alkali Activation Process

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Alkali-activated materials present a promising environmentally friendly and technically acceptable alternative to (green) ceramics, mortar and concrete. They are produced through upcycling of various waste materials like ash, slag and clay, making the material highly popular as no natural resources are required in its production and no additional waste is generated while, at the same time, also lowering the carbon footprint associated with the construction industry [1]. To create a solidification matrix from waste materials, the alkali activators are added (NaOH, KOH, K- or Na-silicates etc.). The goal of the present study is to make lightweight insulating alkali-activated materials; therefore foaming agents like Al powder or H_2O_2 are introduced into the mixture to create pores in the final solidified product via a reaction with the matrix and gas release [2].

To find the suitable precursor, a series of inorganic waste materials have been examined: ash produced from burning coal (heating plants), slag, core, foundry sand, ceramics (before and after sintering), refractory materials (furnace lining and insulation materials), water contaminants (gypsum, phenol sludge), sedimentary rocks (clay) and unclassified waste. For the production of alkali-activated materials the most promising precursors contain SiO_2 and Al_2O_3, predominantly in a glassy phase; usually these are found in clay, slag, industrial ash (especially fly ash), paper sludge, and natural pozzolana. Chemical and mineralogical analyses were performed to determine the amount of Si and Al, mineralogical phases; the amounts of glassy phase, free CaO and reactive SiO_2 were also determined. Based on the performed analysis, waste materials suitable for the alkali-activated process were selected for further examination. All potentially suitable waste materials have undergone preliminary testing in combination with alkaline activators to confirm the reaction and solidification process [3].

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Characterization of Chloride Induced Steel Corrosion Processes in Blended Cements

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Concrete does not adequately protect steel against corrosion. Different processes, such as carbonation, chloride penetration, hydration and external loads, change concrete characteristics and, in turn, impact the corrosion behavior of embedded steel. In recent years new cements appeared on the market where clinker is partially substituted with mineral admixtures and additives. Long term impact of these new blended cements on steel corrosion is not yet well understood.

For the study, multiple mortar specimens made of CEM I, CEM II/B-M, CEM III/B and CEM IV/A cements will be designed and investigated. Mineral admixtures used will include blast furnace slag, fly ash, natural pozzolana and limestone. Each specimen will have an embedded Electrical Resistance (ER) probe and two types of carbon steel rebars. Specimens will be exposed to cyclic wetting and drying with sodium chloride solution. Prior to exposure, half the specimens will be subject to accelerated carbonation, while the other half will carbonize naturally. Thickness reduction of steel will be calculated in the case of ER probes, and galvanostatic pulse measurements will be performed on each rebar. After the exposure specimens will be demolished. Optical, SEM, RAMAN and XRD microscopy will be performed on select samples in order to define corrosion products.

Results of the study by using both monitoring techniques will be analyzed, compared and assessed. Correlation will be made between corrosion rates, corrosion initiation times, chloride penetration, level of carbonation and other properties of different blended cements. Intermediary results spanning multiple months will be shown during the presentation. End goal is to rank the tested mortars according to their ability to resist corrosion initiation and reduce corrosion rates once initiation starts.

Local Mechanical Properties of Irradiated Crosslinked HDPE

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High density polyethylene (HDPE) has a melting point of 120±13 °C and latent heat of fusion is as high as 180±21 J/g. It has been reported that the melting point of HDPE is especially suitable for its use as a thermal energy storage material for solar absorption air conditioning.
HDPE can be crosslinked by chemical or irradiation methods. Since crosslinked HDPE has a thermally stable form, it may be utilized as a thermal energy storage material in direct contact with the heat transferred, ethylene glycol. This thermally stable form of HDPE does not require separate packaging which increases the cost of the thermal energy storage system. Thus high density polyethylene (HDPE) has been recommended as an economical thermal energy storage material with its large heat of fusion, relatively low cost and congruent melting behavior [1, 2].
Cross-linking is a process in which polymer chains are associated through chemical bonds. Cross-linking is carried out by chemical reactions or radiation and in most cases the process is irreversible. Ionizing radiation includes high-energy electrons (electron beam - β-rays). These not only are capable of converting monomeric and oligomeric liquids into solids, but also can produce major changes in properties of solid polymers.
The engineering polymers are a very important group of polymers which offer much better properties in comparison with those of standard polymers. Both mechanical and thermal properties are much better than in case of standard polymers. The production of these types of polymers takes less than 1 % of all polymers.
The influence of high doses of beta radiation on the changes in the structure and selected properties (mechanical and thermal) polymers were proved. Using high doses of beta radiation for high density polyethylene (HDPE) and its influence on the changes of mechanical properties of surface layer has not been studied in detail so far. The specimens of high density polyethylene (HDPE) were made by injection moulding technology and irradiated by low doses of beta radiation (0, 33, 66 and 99 kGy). The changes in the microstructure and micromechanical properties of surface layer were evaluated using FTIR, WAXS and instrumented microhardness test. The results of the measurements showed considerable increase in mechanical properties (indentation hardness, indentation elastic modulus) when the high doses of beta radiation are used.

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The Magnetic Properties of the Recycled HDDR Nd-Fe-B Powder Consolidated with the Spark Plasma Sintering

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The dependence of the magnetic properties of the recycled HDDR Nd-Fe-B powders on the particle size fractionation were investigated. Spark plasma sintering technique was utilized to rapidly consolidate the nanograined HDDR powders. The chemical composition of the recycled powder was: $Nd_{13.4}Dy_{0.67}Fe_{78.6}B_{6.19}Nb_{0.43}Al_{0.72}$ with an average 4700 ppm oxygen content. This recycled Nd-Fe-B powder had H_{Ci} = 830 kA/m and B_r = 0.92 T after the HDDR reprocessing. The XRD analysis of the recycled HDDR powder indicates major peaks of the $Nd_2Fe_{14}B$ matrix phase, along with DyNd-$Fe_{14}B$, Nd_2O_3 and NdO_X secondary phases. TG-DSC analysis of the recycled HDDR powder measured a T_C = 309 ^{O}C and Nd-rich phase melting temperature = 790 ^{O}C. The HDDR powder SEM analysis showed a large particle size distribution = 50 – 600 µm. Using this inhomogeneous sized powder, the optimal SPS conditions at 750 ^{O}C for 1 min, yielded fully dense magnets with H_{Ci} > 1100 kA/m. The H_{Ci} further increased to 1200 kA/m via post SPS annealing treatment at 750 ^{O}C for 15 mins. The recycled HDDR powder was sieved from 1 mm sieve and down to < 50 µm to determine the possible variation in the magnetic properties with the particle size. The oxygen content for each fraction was determined and it increased from 4500 ppm in the coarse 630 µm sized particle to > 8700 ppm in the fine < 50 µm sized particles. XRD analysis for fractionated powder indicated an increase in Nd_2O_3 phase peaks in finer sized HDDR powder fractions. Similarly, the H_{Ci} reduced from 820 kA/m in the coarse particles (> 200 µm) to 460 kA/m in the fine sized particles (≤ 50 µm). SPS was done on each HDDR powder fraction under similar optimal conditions to measure the variation in H_{Ci} and density with the particle fractionation. The coercivity (H_{Ci}) for as SPS-ed coarse fraction (> 200 µm) was higher than 930 kA/m and it fell abruptly to just 60 kA/m for the fine sized particles (< 50 µm). Similar post annealing procedure improved H_{Ci} to > 1000 kA/m only up to 90 µm sized fraction with density > 90%. The highest remanence (B_r) = 0.79 T and full densification (> 99%) was observed in the coarse fractions. The loss of coercivity and lack of densification of fine sized particles (< 50 µm) can be attributed to a very high oxygen content. Oxygen scavenges metallic Nd from the Nd-rich phase forming stable NdO_X hindering the sintering with a reduced content of Nd-rich liquid phase for wetting the matrix grains; thereby suggesting a limit to reprocessing the recycled HDDR powders. Microscopical investigation is currently underway to disclose the property microstructure relationship in SPS reprocessed and post SPS annealed Nd-Fe-B nanograined permanent magnets.

Local Mechanical Properties of Irradiated Crosslinked Polypropylene

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Isotactic polypropylene (iPP) is a commodity polymer with the semi-crystalline structure which is very complex and depends strongly on thermal history and processing conditions. Isotactic polypropylene can crystallize in to 3 phases: α–phase is the most stable and the most known. The crystals are monoclinic. Beta phase is metastable and the crystals are hexagonal β–phase is mainly found in block PP copolymers and can be generated by addition of specific nucleating agents. This phase was discovered by Padden and Keith in 1953 and can be improved by crystallization between 130 and 132 °C or by orientation with high shear or through addition of specific nucleating agents. Presence of β-phase in PP homopolymer generally increase ductility in the finished parts. Maximum effect is observed at 65 % of beta-phase. Gamma phase - this phase is also metastable with triclinic crystals. This form is not very familiar but appears mainly in low molecular weight polypropylene by crystallization at very high pressure and very low cooling rate [1,2].
Cross-linking is a process in which polymer chains are associated through chemical bonds. Cross-linking is carried out by chemical reactions or radiation and in most cases the process is irreversible. Ionizing radiation includes high-energy electrons (electron beam - β-rays). These not only are capable of converting monomeric and oligomeric liquids into solids, but also can produce major changes in properties of solid polymers.
The engineering polymers are a very important group of polymers which offer much better properties in comparison to those of standard polymers. Both mechanical and thermal properties are much better than in case of standard polymers. The production of these types of polymers takes less than 1 % of all polymers.
The influence of high doses of beta radiation on the changes in the structure and selected properties (mechanical and thermal) polymers were proved. Using high doses of beta radiation for polypropylene (PP) and its influence on the changes of mechanical properties of surface layer has not been studied in detail so far. The specimens of polypropylene (PP) were made by injection moulding technology and irradiated by low doses of beta radiation (0, 15, and 33 kGy). The changes in the microstructure and micromechanical properties of surface layer were evaluated using FTIR, WAXS and instrumented ultra nano-hardness test. The results of the measurements showed considerable increase in mechanical properties (indentation hardness, indentation elastic modulus) when the high doses of beta radiation are used.

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TEM Studies of Different Ceramics in THR

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Total hip-joint replacement (THR) has been available for many years in orthopedic surgeries. There are many biomaterials available for this purpose but still some drawbacks regarding wear, brakeage, aseptic loosening and implant infections of such biomaterials are present. One of the promising commercially available biomaterials is Biolox ceramic produced by CeramTec AG company from Germany. In our study two samples of different Biolox material were investigated and compared: Bilox forte and Biolox delta.

Thin foils of Biolox ceramic forte and delta were investigated using Transmission Electron Microscopy (TEM). The results showed a difference in sizes and morphologies between Biolox delta and Biolox forte ceramic matrix grains, as well the difference in their chemical composition. Biolox delta had smaller matrix grains with sizes between some tens of nm to around 1 µm. Biolox forte had bigger matrix grains of around 100 nm to around 4 µm. Matrix grains in both samples had different chemical composition and consisted of at least two phases. Biolox forte matrix grains consisted of Al and O in different ratios: one type of grains had composition close to Al_2O_3 and the other type had composition near to 50 atom % of Al and 50 atom % of O. Biolox delta matrix grains consisted in some grains of Al and O with composition close to Al_2O_3 and with additional small concentrations of Zr, Y and Sr, and in some grains mainly of Zr and O, and small concentrations of Y and Al, and also in some grain with Al and O ratios close to 50/50. Both samples had secondary phases present either at the grain boundaries or as small inclusions trapped inside the matrix grains or as bigger prolonged phase in a form of a rod. Rod shaped phase in Biolox delta consisted mainly of Al, O and Sr, and additional small concentrations of Zr and Y with size between 2.5 to 3.5 µm, while in Biolox forte consisted of Al, O and Mg with size around 8 µm.

The Microstructure of Cobalt-Chromium-Molybdenum and Titanium Alloys of Retrieved Implants

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The chemical composition, microstructure, phases and grain orientation of both (new and used) titanium alloys and CoCrMo alloys for knee endoprostheses, were determined using XRF and ICP-OES (chemical composition), SEM (morphology), EDS (chemical analysis), EBSD (phase analysis) and AES and XPS (surface chemistry).
Two used and one new knee endoprosthesis, were studied. The SEM SE and BE images showed their microstructures, EDS provided chemical analysis, while the EBSD provided the phases and grain orientation of the materials.
During the production of the tibial and femoral components of knee endoprostheses, these materials are subject to severe thermomechanical treatments and physicochemical processes that are decisive for CoCrMo alloys.
The AES and XPS results showed that thin oxide films on (a) Ti6Al4V are primarily a mixture of TiO_2 with a small amount of Al_2O_3, while the V is depleted, (b) Ti6Al7Nb is primarily a mixture of TiO_2 with a small amount of Al_2O_3 and Nb_2O_5, and (c) the CoCrMo alloy is primarily a mixture of Cr_2O_3 with small amounts of Co and Mo oxides.

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A Mathematical Model to Correct for Secondary Extinction of Pole Figures of Textured Samples

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There is some evidence that pole figures of textured polycrystals could be affected by extinction[1,2]. Secondary extinction in X-ray or neutron diffraction from a polycrystal is considered here, and it is assumed as a loss of intensity due to a second process of diffraction. The present work is a method to evaluate all possible secondary events taking place in an fcc polycrystal. In this method, as a first approximation it is assumed that the first diffracted beam is the primary beam for a second diffraction process, and the integrated intensity of al Debye-Scherrer rings (D-S) is evaluated. For each point of a D-S an orientation curve is evaluated, and the number of poles is calculated using the ODF, which in turn is evaluated as usual, with the help of three pole figures. Integrated intensity is then evaluated adding the contribution of all D-S. However, if secondary extinction affects pole figures, it is evident that the ODF will likewise be affected by it; therefore the ODF used should be considered also as an approximation.
The method is applied to pole figures of the main reflections of pure silver and copper samples, using a computer program in Dev C++. Only small effects are obtained, which are discussed here.

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Functionalized Nanostructured Surfaces for Medical Applications

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Fabrication of nanostructured polyethylene terephthalate (PET) polymer, which is commonly employed as synthetic vascular graft is presented. Fabrication of PET polymer was done by radiofrequency (RF) oxygen and nitrogen plasma, where the discharge power was set at 200 W and gas pressure was fixed at 75 Pa. The surface of PET polymer was modified to enable improved proliferation of endothelia cells and reduced adhesion of platelets. Chemical modification of plasma treated surfaces was analyzed by X-ray photoelectron spectroscopy (XPS), while the changes in morphology and surface roughness were observed by atomic force microscopy (AFM) and scanning electron microscopy (SEM). *In vitro* studies on interaction of endothelial cells with PET surfaces were determined from MTS assay, while interaction of platelets with PET surfaces was studied from SEM images. Results of our study indicate that both oxygen and nitrogen plasma treatment improved proliferation of endothelia cells, while the lowest adhesion of platelets was obtained on oxygen plasma treated surfaces. Synergistic effects of combined nanostructure and functionalization on the surface of oxygen plasma treated PET enable improved adhesion of endothelial cells as well as reduced adhesion and activation of platelets. Oxygen plasma treatment seems to be a promising way to alter surface properties of blood connecting devices, especially vascular grafts.

A statistical Approach to Size- and Spatial Distribution Analysis of Precipitates

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Analysis of changes in size- and spatial distribution of precipitates in two grades of creep-resistant 9-12% Cr steels, X20 and P91, as a function of ageing at two different conditions was performed. Ageing of both steels was performed at 650 °C lasting up to 2 years and 750 °C lasting up to 6 months, with the aim to study and understand the changes in microstructure that take place at operating conditions of thermal power plants. Prior to the ageing, both steels were heat-treated so that three different microstructures were obtained for each steel, namely parent metal with normal grain size (α), coarse-grained microstructure (γ), and grain-refined microstructure (α+γ). The γ and α+γ are supposed to represent the two characteristic weld heat-affected zone (HAZ) regions from which the grain-refined (α+γ) microstructure is known to be susceptible to type IV cracking. For all three microstructures and two different ageing conditions, metallographic specimens were prepared and SEM imaging was performed. Afterwards, images were digitally analyzed using the FIJI[1] image analyzing software, from where a comprehensive set of statistical data about the precipitates was obtained, including the size, shape, distribution, grayscale level, etc. However, no attempt was made to identify the type of different precipitates that are present in the studied steels whatsoever. Despite the error lever induced by the analysis of 2D images, i.e. random section of precipitates, a good correlation with the results of theoretical particle kinetics for $M_{23}C_6$, VC, and NbC precipitates present in the studied steels was obtained, but only for the specimens aged at 750 °C.
Keywords: Creep-resistant steels, precipitates, automatic image analysis, coarsening kinetics

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Mold Design for Rings of External Fixator

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This paper deals with a structural design of a mold for making a composite ring of external circular fixator used in medical applications. It also focuses on the choice of technology and material for the production of a fixator ring.
Due to the high demands on the quality, appearance, material of the product and higher series production, autoclaving was chosen for this purpose. Thanks to this sophisticated production process, the high quality and accuracy of the ring can be achieved. The starting material for the production of composite components is a layer of resin-saturated fibers, abbreviated prepreg. This blank is cut on a CNC plotter and embedded into a mold for molding. The mold is provided with a separator and a filler of pores. The resulting surface quality of the product then depends on the surface of the mold, the selection and the careful application of the separator (gelcoat), which also affects the life of the mold. For easier machining, aluminum was chosen as the material of the mold.
The result of this contribution is the choice of the material of the product, the appropriate technological process and the design of the mold to obtain the resulting product which meets the required mechanical properties, appearance and functionality requirements.

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Structure and Mechanical Properties of Welded Joints for Nuclear Power Plants of Type MIR 1200

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The paper deals with research, development and verification of production technology of selected welded joints for pressure vessels of primary circuits of nuclear power plants of type MIR 1200. Effect of various welding technology including simulation heat treatment on mechanical and fracture properties have been studied. Four type of homogenous 10GN2MFA – 10GN2MFA type of welded joints and heterogeneous welded joint 10GN2MFA-08Ch18N10T have been prepared for experimental programme. Conventional mechanical properties as well as unconventional mechanical properties (fracture mechanics, low-cycle fatigue and stress corrosion cracking in high temperature water environment) have been studied. Effect of elevated working temperature on structure and material properties has been evaluated. Temperature dependencies of shear fracture have been plotted and effect of welding procedure on transition temperature shift has been evaluated. Experimental data have been compared with numerical simulation using FEM.

Mass-Scale Deacidification and Strengthening of Cellulose-Based Artifacts Using a Prototype Process and Polysaccharide Composite Nanoparticles

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Paper has been used as an important supporting material for preserving mankind's information for many centuries. A large volume of cellulose-based artefacts such as papers, books and graphical works accumulated in libraries and archives since the 1850is are acidified and undergo a rapid deterioration upon aging. The deterioration is mainly caused by acidity generated in the paper during aging since alum was used as sizing agent in the papermaking process. To overcome the above issues, in this work, we developed a new-prototype device and an organic solvent based process using a polysaccharide derivative and alkaline nanoparticles for deacidification and strengthening of old and brittle paper. This approach removed the acidity completely, introduced an alkaline reserve of 60 meq $(OH)^-$/100 g and simultaneously increased the tensile strength of the paper up to 80%.[1] Further it was possible to tune the pH, the alkalinity, the tensile strength and the hydrophobicity of the paper by coating with an appropriate concentration or type of the alkaline nanoparticles and polysaccharide derivative with different molecular weight.

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The Effect of Beta Irradiation on the Structural Changes of Isotactic Polypropylene

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The electron β irradiation of the isotactic polypropylene (iPP) influenced the chemical structure because it caused mostly the crosslinking of the polymer chains beside the macromolecule degradation. This effect led to the corresponding changes of physical and mechanical properties (crystallinity, crystal size, melting and crystallization temperatures). The amount of β phase of iPP in the samples decreased with increasing dose of β irradiation and it was changing into the α phase and amorphous phase. After the irradiation the melting temperature decreased and the spherulitical structure was partially decomposed. The imbibition in Xylene proved, that the highest degree of crosslinking was in the samples irradiated by a dose 33 kGy which showed the highest increase of density, crystallinity, melting temperature and elastic modulus.

Elastomer Testing: The Risk of Using Uniaxial Data Only for Fitting Mooney-Rivlin Hyperelestic Material Model

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Monney-Rivlin constitutive model is often used for characterization of hyper elastic rubber-like materials. To obtain material constants for the model, only a uni-axial tension data set is frequently used. Though it is regularly used for its easiness of getting data though simple practical, the method considered less accurate. To analyze the discrepancy in the method, a detailed examination was done with Monney-Rivlin two parameter model. This paper discusses the variation related to three basic load curves, i.e. uni-axial, equi-biaxial and pure shear. For visual observation of fitted data dispersion, two data fitting cases were considered. First one was with data fitting through only uniaxial data while combination of both uni-axial and pure shear experimental data curve fitting was used in the second case. Detailed one to one comparison of curves was done for accurate estimation of variation. In the later stage of the paper, preliminary investigation was done as to find out a possibility of forecasting equi-biaxial load curve for the available data.

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Amorphous Alloys with Variable Amounts of Immiscible Fe and Cu Metals

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In comparison to crystalline materials, metallic glasses exhibit a structure without any long range order. To obtain such a disordered atomic arrangement in multicomponent glasses, one should combine elements of differing atomic sizes [1], thus enabling a more efficient local packing around the various atomic species [2]. Since amorphous alloys do not possess grain boundaries, their mechanical properties, for example, outweigh those of crystalline materials. Additional benefits include good corrosion resistance, superior magnetic properties and the possibility of thermoplastic forming at adequate temperatures.

Our contribution will describe a series of Al-Ce-Fe-Cu amorphous alloys prepared by melt spinning. Concentrations of Al and Ce are fixed, while Fe is being replaced for Cu. Interaction of the latter two elements is interesting, since they do not mix neither in solid nor in liquid state, hence they are immiscible. Nevertheless, alloying them into a multicomponent alloy often results in an amorphous or complex metallic alloy [3]. X-ray diffraction, magnetic measurements and microstructural observation will be used in a complementary way to provide a better understanding of structure-property relationships in these glassy alloys.

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Anti-adhesive Layers on Stainless Steel Using Thermally Stable Dipodal Perfluoroalkyl Silanes

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The present study aims at anti-adhesive layers on steel, designed for molds and dies employed in polymer processing. Steel surfaces are modified with dipodal perfluoralkyl organosilanes and the resulting wetting properties and surface morphologies are analyzed. Dipodal silane monomers with different fluoroalkyl spacer lengths are synthesized via hydrosilylation reaction. The modification of stainless steel surfaces is performed in a two-step procedure comprising a corona activation of the steel surface and the subsequent reaction of surface hydroxyl groups with the dipodal silanes from the liquid phase. Anti-adhesive behavior on the surface is achieved through the modification. The attachment of the dipodal silanes on the stainless steel surface are validated with infrared reflection absorption spectroscopy and X-ray photoelectron spectroscopy. The wetting properties of the dipodal silane layers are investigated by contact angle measurements and adhesive force measurements. Atomic force microscopy is used to characterize the surface roughness and morphologies. Stainless steel modified with the dipodal perfluoroalkyl silanes exhibits low surface energy and low adhesive force compared to the unmodified steel surface. The thermal stability of coatings based on dipodal silanes is significantly higher when compared to layers based on conventional monopodal organosilanes. It is shown that perflouroalkyl silane coatings exhibit remarkable durability under thermoplast processing conditions, paving the way towards numerous applications in this field.

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Big-Data Analytics for the Modelling of Wrought Aluminium Alloys

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The widespread usability of post-consumer scrap in the production of wrought aluminium alloys for standard or required quality depends on a fundamental ability to be able to formulate new alloys with sufficiently wider concentration intervals.
An industrial tool developed within the Impol Aluminium Group for such a modelling of wrought aluminium alloys is OPTIAl – the algorithm for correlating the properties of wrought aluminium alloys, the chemical composition and the processing parameters. The learning of the algorithm was performed by applying the experimentally confirmed equivalency of different technological paths (the chemical composition of the alloy and the main processing parameters), able to provide the same combination of properties. In the first step, through a process of data mining, a data matrix was created, consisting of the results of standard, room-temperature tensile tests and the corresponding technological paths for different production lots of the AA 6110 alloy. Next, based on the accumulated data, the most probable technological path-property correlations were identified. Finally, various standard and some non-standard alloy compositions, derived from the alloy AA 6110, and the processing parameters were inducted to provide the desired combination of properties.
The validation of the above-described methodology was performed through regular production of a limited number of cognitively computed alloys and their characterization. It was found that by applying the above methodology on proper experimentally determined values, either the chemical composition or the mechanical properties can be predicted with high accuracy, sufficient for most industrial applications.

Improvement in Grain Growth of New-Generation ODS Alloys by Thermomechanical Treatments

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By using a combination of new technologies together with an unconventional use of different types of materials, specific mechanical properties and structures of the material can be achieved. Some possibilities are enabled by combination of powder metallurgy in preparation of a metal matrix with dispersed stable particles achieved by mechanical alloying and hot consolidation. This paper explain the thermomechanical characteristics of new ODS alloys with Fe-Al matrix from the viewpoint of changes in grain size distribution.
Recrystallization and grain growth were investigated in different ranges of temperatures and deformations. The results show that microstructural changes in new ODS alloys are significantly affected by the thermomechanical treatment. Their analysis is performed using different analytical methods such as optical microscopy, scanning electron microscopy and Xray diffraction analysis.

Overview and Trends in Wire Arc Additive Manufacturing Of Metals

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A paper presents an overview of wire arc additive manufacturing technologies for production of metal parts in comparison with laser beam technologies and electron beam technologies. A wire arc additive manufacturing (WAAM) technologies include MIG/MAG welding, TIG welding, and plasma welding. Their advantage compared to laser or electron beam technologies are lower investment and operational costs, good material efficiency, higher productivity and the possibility to produce multi-material components of bigger parts. A smaller disadvantage could be a lower part resolution. The products are made of titanium alloys, aluminum alloys, tool steels, stainless steels, constructional steels, nickel alloys and also refractory materials while it enables production of multi-material components using dissimilar welding. A special attention is set on post deposition treatments, which include machining to obtain the final product shape, different mechanical treatments, heat treatments and surfacing. After selection of arc surfacing technology a selected set technological parameters is crucial to obtain stable product build-up, while maintaining part temperature inside the desired limits. In order to achieve this, a WAAM system typically include welding device, positioning and cooling systems, online monitoring and process control. The R&D on the field of WAAM at our institution is presented. We demonstrate initial results of testing the different welding technologies, like CMT and low spatter MIG/MAG welding. We compare the advantages of robotic and CNC motion systems, discuss cooling problems, temperature monitoring issues and control of the system.

Inhibition of W Grain Growth in W-based Material for Fusion Application (CM)

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In the last decades we see global climate changes, such as rise of temperature due to excessive emissions of greenhouse gases. Nuclear fusion presents a possible way to produce clean and safe energy for the future. The main task in Eurofusion project is development of demonstration fusion power plant (DEMO)[1]. The inner walls of the reaction chamber will be exposed to high heat flows and erosion by hot plasma, especially in the lower part, called the divertor. High thermal loads of 10-20 MW/m^2, presents a challenge for researchers to develop material that will withstand this harsh conditions.[2]

Tungsten is a possible candidate material for divetor, but is inherently brittle at moderate temperatures and it losses good mechanical properties at high temperatures (~1200 °C) due to excessive grain growth and recrystallization process.[3,4] Current endeavors of fusion programs are focused on development of W-based composites. It has been shown, that the grain growth and recrystallization at high temperatures can be suppressed with inclusion of oxide or carbide particles.[5]

Research at the Jožef Stefan Institute has shown, that one of options is the incorporation of W_2C particles in W-matrix by high-temperature reaction of W-matrix with a carbon precursor, such as graphene or WC. Spark plasma sintering (SPS) was used to densify the powder mixtures (1900 °C, 5 min, 60 MPa). All used precursors with concentration above 5 vol. % reacted with W to form W-W_2C composites.

The results also show that presence of small W_2C grains enhance densification of tungsten and inhibit the growth of tungsten grains at high temperature up to 1600 °C. After ageing on 1250 and 1600 °C the density of W-W_2C samples remain the same, but the density of pure W decreased. Flexural strength of the samples containing ~30 wt.% of W_2C remains unchanged after anealing, while the strength of the samples with low content of carbide phase decreased. Further microstructural analysis will be performed to confirm the inhibition of grain growth in W-W_2C composites.

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Electrodeposition of Hydroxyapatite Coating on Biocompatible NiTi alloy

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The electrodeposition method was used to apply hydroxyapatite coating (HAP) on the surface of biocompatible NiTi alloy with the aim to enhance the corrosion resistance and decrease the release of nickel ions from the substrate. The surface morphology, wetting and structural properties were evaluated by using scanning electron microscopy (SEM), contact-angle measurements and X-ray diffraction (XRD). The barrier properties of the coating were studied by potentiodynamic measurements in simulated physiological solution. The coating surface exhibited different morphological characteristics from flake-like to spherical structures on the top of the compact hydroxyapatite layer. Both types of investigated surfaces exhibited hydrophilic characteristics. However, the electrodeposition of hydroxyapatite coating and further alkaline treatment significantly reduced the water contact angles towards the complete wettability limit. Corrosion study showed that hydroxyapatite coating significantly enhanced corrosion resistance of NiTi alloy and confirmed the effective barrier properties of the applied coating, which is critical for biomedical applications.

Comparison of Surface and Anticorrosion Properties of SiO_2 and TiO_2 Nanoparticle Epoxy Coatings

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We compare the morphology, wetting and corrosion properties of fluorosilane modified TiO_2, FAS-TiO_2/epoxy and SiO_2, FAS-SiO_2/epoxy coatings. 30-nm TiO_2 and SiO_2 nanoparticles were spin coated onto the steel substrate AISI 316L and covered with a thin epoxy layer for nanoparticle fixation. The morphology of coatings was analyzed with SEM imaging and average surface roughness (S_a) showing a homogeneous FAS-TiO_2 nanoparticle distribution in the coating whereas FAS-SiO_2 nanoparticles tend to agglomerate. Static water contact angles were measured to evaluate the wetting properties indicating highly hydrophobic nature of both coatings. Potentiodynamic measurements showed that the addition of nanoparticles to the epoxy coating significantly improved corrosion resistance of AISI 316L stainless steel.

Complications with tTotal Hip Arthroplasty

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Total hip arthroplasty (THA) is one of the most successful orthopedic procedures performed today. For patients with hip pain due to a variety of conditions, THA can relieve pain, can restore function, and can improve the quality of life. The complications during total hip arthroplasty can be categorized as intra-operative or post-operative. Most complications in total hip arthroplasty are infrequent and can be prevented or treated readily if anticipated and recognized. Complications associated with any major surgical procedure, including those related to anesthesia, comorbid medical conditions, medications, and allergic reactions, can also occur.

The major potential intra-operative complications are fractures, nerve injury and blood vessels. Fractures: Most intra-operative fractures occur on the femoral side during stem insertion. Nerves: Injury to the sciatic nerve is the most common, but the femoral, obturator, and superior gluteal nerves can also be injured. The peroneal division of the sciatic nerve is more susceptible to injury than the tibial division. Blood vessels: Injuries to blood vessels are infrequent, the main blood vessels can be affected.

The major potential post-operative complications are: Thromboembolism, which is the largest risk of perioperative mortality after total hip arthroplasty. Using thromboprofilaxy procedure the complication rate is 0.1 percent. Infection following hip replacement is uncommon (between 0.4 and 1.5 percent of patients). Antibiotics are routinely given (during the first 24 hours only) to help prevent infection.

Aseptic loosening of the joint implant is most often caused by wear of the prosthetic components. It is the most common long-term problem associated with total hip replacement, although the number of people who develop loosening is decreasing as prosthetic materials and surfaces are improved. Osteolysis and wear are the most common complication for implant failure. It is usually asymptomatic until aseptic loosening is reached. Dislocation of the artificial hip joint is a very painful and unpleasant complication and occurs in less than 2 percent of patients. Breakage of the implant itself can occur as a result of wear and tear of the prosthesis, often over a period of years. Older implants are more likely to break, while newer prostheses are stronger and more durable. This is a rare occurrence, with less than 1.0 percent of people experiencing breakage. Change in leg length — for the patient often an unpleasant complication. Generally wearing a lift in one's shoe is helpful.

Corrosion Degradation of Inert Anode Material in Molten Low-Melting Electrolyte

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The scope of this work was the study of corrosion degradation on advanced metallic materials considered as inert anode in electrolytic production of aluminum. During recent years, non-ferrous and ferrous metal alloys were tested as inert anodes in laboratory scale electrolysis cells [1]. Many nickel-based alloys were also tested for inert anode material: Ni-Cu-Al, Ni-Cu-Cr, Ni-Fe-Cu, Ni-Fe-Co, Ni-Fe-Cu-Al-Nb, Ni-Fe-Co-Al-Nb etc. [2-10]. Corrosion resistance of Cu_{82}-Al_8-Ni_5-Fe_5 material was carried out by static corrosion tests up to 800°C with duration 24 hours. As corrosion medium the low-melting system KF–NaF–AlF_3–Al_2O_3 with cryolite ratio 1.7 ($CR = n_{KF+NaF}/n_{AlF_3}$) and with 5 wt% of alumina was chosen. The initial material was prepared by casting and characterized by scanning electron microscopy, X-ray powder diffraction and DTA-TG analysis. The DTA-TG analysis didn't prove any phase changes up to 1000°C. The alloy has presented a two-phase microstructure (a Cu-rich phase and a Fe-Ni-rich phase). The corrosion degradation of the alloy resulted into weight loss about 0.7 %. The XRD analysis of corrosion products revealed the formation of potassium ferrate as product of the reaction between the melt and the alloy.

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Ceramic Shell Molds Hot Gas Permeability Investigation

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Ceramic shell molds are multilayer structures made of ceramic material. They are fabricate by dip and stucco method and contains of five or eight layers. Molds should be characterized by heat resistance appropriate modulus of rupture factor etc[1,2]. Rare known but significant property from vacuum die cast process is hot permeability factor. Permeability coefficient defines the ability to gas migration by the wall of the shell mold.
The paper presents the results of research of the hot permeability of the SiC-based ceramic shell mold. The raw materials used in mold manufacturing process were investigated using scanning electron microscope (SEM), particle size, chemical and phase composition (XRF, XRD). The hot gas permeability measurements were carried out using self-made measuring system. Calculations were carried out based on Darcy's filtration law.

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Extrusion of PPS-bonded Nd-Fe-B Magnetic Material

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The applications for polymer-bonded magnets became increasingly important in our lives [1]. Conventionally, thermosets as well as thermoplastics and elastomer binders are used in the production of polymer-bonded Nd-Fe-B magnets. Polyphenylene-sulfide (PPS) and polyamide (PA12) are two commonly used polymer binders [2].

In this study PPS binder with the commercial Nd-Fe-B ribbons (MQP, Magnequench Co.) were investigated. The MQP-B+ and MQP-14/12 are both isotropic magnetic ribbons used for the production of polymer-bonded magnets. Both MQP ribbons were ground to an average particle size of around 106 µm. To produce bonded magnets, the Nd-Fe-B ribbons were with PPS polymer bonded, homogenized and kneaded with extrusion process. Furthermore, bonding the magnetic ribbons together with the polymer protects easily oxidizing rare-earth metal against the corrosion [3]. The important step in the production of bonded magnets is to establish the optimal T/t/p (temperature/time/pressure) characteristics of both kinds of ribbons and polymer in order to obtain the desired magnetic and mechanical properties.

Both MQP ribbons were first premixed in a small container with the additive, an organic siloxane wax, specially designed to improve the processing and flow characteristics. The technique used to fabricate these composites was extrusion with Leistritz extruder ZSE 27. This is a co-rotating twin extruder used for continuous production of thermoplastic-bonded magnetic materials. For the production of PPS-bonded Nd-Fe-B magnets the geometry of screw pair which provides different mixing, kneading and conveying of material inside is extremely important and defined.

After the extrusion, the material was injected into the injection molding tool. Measured material properties were: density 5,12 g/cm^3, remanence (Br) 528 mT, coercivity (Hc_j) 820 kA/m, maximum energy product $(BH)_{max}$ 49 kJ/m^3, and the average flexural force at break 131,8 N. Achieved properties are in the upper range for chosen composition.

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Preparation And Characterization Of New Adsorbent Materials For Oil Spills Removal From Water

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Superparamagnetic nanoparticles (SNPs) are among the most promising adsorption materials for oil spill cleanup as they have a superparamagnetic properties, high specific surface area and can be surface functionalized with molecules which have a high affinity for oil sorption. The use of SNPs as the adsorbent is an advantage, because these nanoparticles can literally remove target pollutants from water under the influence of an applied external magnet field, and once the applied external magnetic field is removed, the SNPs retain no residual magnetism and hence they could be easily regenerated and reused in adsorption cycles[1].

In this work, mono-dispersed superparamagnetic cobalt ferrite ($CoFe_2O_4$) NPs with a narrow particle size distribution of around (11.4 ± 1.5) nm were prepared by the coprecipitation method. The prepared NPs were electrostatically stabilized in an aqueous medium and then functionalized by the sol-gel method using a variety of organo-functional silanes such as methyltrimethoxysilane, propyltrimethoxysilane, trimethoxy(3,3,3-trifluoropropyl)silane, trimethoxy(1H,1H,2H,2H nonafluorohexyl)silane, diphenyldimethoxysilane, etc., at different molar ratios of *TEOS* – to – *organo-functional silane* (P) in the range from 0.25 to 2.0.

The prepared adsorbent materials were characterized using X-ray diffractometry (XRD), transmission electron microscopy (TEM) in combination with energy-dispersive X-ray spectroscopy (EDXS), Fourier transforms infrared spectroscopy (FTIR) and specific surface area (BET) analysis. The specific magnetization of the prepared adsorbents was also measured as a function of the applied magnetic field at room temperature (VSM). Analysis of oil adsorption on the surface of the prepared adsorbents was performed. The maximum adsorption capacity was determined and the regeneration of the adsorbents was evaluated[2].

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Compressive Characteristics of SLS-printed Auxetic Lattices with Strain Rate Sensitive Filling

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In this work, quasi-static compressive testing of auxetic lattices filled with strain rate sensitive material to obtain a detailed understanding of their deformation behaviour at is presented. The research is part of investigation into dynamic characteristics of auxetics using Split Hopkinson Pressure Bar, where the quasi-static testing is necessary to define conditions and parameters of the dynamic experiments. Three types of unit-cell geometries are investigated: 2D missing-rib, 2D re-entrant honeycomb, and 3D re-entrant honeycomb. According to type of filling material, the specimens printed by the selective laser sintering (SLS) method are divided to three testing groups. The specimens filled with ordnance gelatine and low expansion polyurethane foam are complemented by unfilled specimens to evaluate effect of filling on overall deformation properties of the structures. Samples from each group are tested under quasi-static loading conditions. Apart from strain measurement based on cross-head displacement, the digital image correlation is used for assessment of in-plane displacement and strain fields of the material. The stress-strain diagrams are established from the data to evaluate yield stress, plateau stress and densification strain of the structures. Effect of filling on these characteristics together with the energy absorption properties (i.e. plateau energy) is also assessed.

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Modeling of Roll Wear of the First Stand of Continuous Rolling Mill

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The paper identifies main parameters affecting the wear of the working roll in the hot rolling process in Štore Steel ltd. For this purpose the first stand of the continuous roll mill for rolling of diameter from Ø 20 mm to Ø 58 mm was chosen. The data on groove shape, surface, roll diameter, contact time, carbon equivalent, rolling temperature and quantity of the rolled material for 2013 was collected. The linear regression and genetic programming was used for predicting the working roll wear. Based on the linear regression results we can conclude that the most influential parameter is groove surface. On the other hand the genetic programming results show that the most influential parameter is roll diameter and quantity of the rolled material. The genetic programming model outperformed the linear regression model for 161.8 %. The results of modeling are practically applicable.

Emulsion-templated Polyelectrolytes for the Absorption of Water Contaminants

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A series of highly porous poly(3-acrylamidopropyl)-trimethylammonium chloride (PAMPTMA) and poly(2-acrylamido-2-methyl-propansulfonic acid) (PAMPS)-based hydrogel polyHIPEs (HG-PHs)[1] were successfully synthesized by templating within high internal phase emulsions (HIPEs). The AMPTMA and AMPS-based HIPEs could not be stabilized with standard surfactants. We were able to successfully stabilize the AMPS- and AMPTMA-based HIPEs through the unusual use of high molecular weight triblock copolymers (Pluronics) surfactant. One important benefit of the high molecular weight triblock copolymer was that it allowed us to significantly reduce the surfactant content to only 5 % of the external phase, as opposed to the 20 to 30 % commonly used with low molecular weight surfactants. AMPTMA and AMPS-based HG-PH contained 11.9 or 9.9 wt.% of nitrogen or sulphur that corresponds to around 8.5 and 3.1 mmol of quaternary ammonium and sulfonic acid groups per gram of the polymer, respectively. Due to high porosity of the HG-PHs, the ionic groups should be easily accessible. The absorption and adsorption behaviour of the HG-PHs was controlled by varying both the extent of crosslinking and the porosity.

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Influence of Different Casting Conditions and Filtering Process on the Electrical Properties of Different Al-alloys

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There are three primary categories of electric motor used in automotive applications; one of them is induction motor. This motor consist of winded stator and induction rotor. Rotor squirrel cage is made with aluminium high-pressure die casting technology. Material for die casting cage is most commonly aluminium and Al-alloys but also copper. High-pressure die casting technology allows producing of bigger quantities with good repeatability. Beside relatively low motor producing costs, also motor efficiency and torque/speed behaviour is important. One of the loss factors for rotor is also the loss of die casted conductance material. With an aim of obtaining data, how different casting conditions are influencing material electrical conductance, Al99.7 Al-alloy was a subject to investigation. With testing various casting conditions during the solidification, such as the vacuum, air and filtering, temperature and electrical resistivity of the castings were measured. Porosity proportions of the samples were examined with X-ray, as well as with an optical microscopy. Based on obtained results the influence of impurities and porosity on the electrical properties of aluminium was observed. Results are the basis for possible melting and rotor die casting process improvement and, moreover, for achieving better induction rotor performances.

Indukcijski motor je ena izmed treh glavnih vrst električnih motorjev, ki se uporabljajo v avtomobilski industriji. Tak motor je sestavljen iz navitega statorja in indukcijskega rotorja. Prevodna kratkostična kletka indukcijskega rotorja je lahko narejena s postopkom visokotlačnega litja aluminija, aluminijevih zlitin ali tudi bakra. Postopek visokotlačnega litja omogoča visoko produktivnost in ponovljivost ulite kletke rotorja. Poleg relativno nizkih stroškov izdelave, so zelo pomembni učinkovitost in karakteristika (navor/hitrost) takega motorja. Ena izmed izgub motorja je tudi izguba prevodniškega materiala kratkostične kletke rotorja. S ciljem pridobiti bazične podatke o vplivu pogojev litja na električno prevodnost litega materiala, smo uporabili testno aluminijevo zlitino 99.7. Zlitino smo ulivali pri različnih pogojih, na zraku, v vakuumu in prek penjenih keramičnih filtrov. Med strjevanjem ulitka smo spremljali temperaturo in merili električno upornost. Delež poroznosti je bil analiziran z rentgenom in z optično mikroskopijo. Ocenili smo vpliv poroznosti in nečistoč na električne lastnosti aluminijevih zlitin. Rezultati so osnova za izboljšanje talilno livarske prakse za doseganje dobrih električnih lastnosti indukcijskega rotorja.

Effect of Al_2O_3 Nano-particles on the Tribological Properties of Stainless Steel

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Stainless steels, particularly the austenitic grades have superior corrosion resistance, ductility and strength. However, the austenitic stainless steels also suffer a major drawback for use in certain tribological environments. They have relatively poor wear resistance owing to their low hardness. The hardness of stainless steels can be increased by alloying, thermomechanical treatment or the addition of hard ceramic particles [1-3]. Recently, Pagounis and co-workers reported that the wear resistance of stainless steels can be improved dramatically by the incorporation of ceramic particles such as carbides and oxides [4].

Austenitic stainless steel reinforced with aluminium oxide (Al_2O_3) nano-particles added in 0.5, 1.0 and 2.5 wt% concentrations were produced by conventional casting route. Produced composite specimens were analysed in terms of microstructural characterization and wear resistance. Pin-on-disc testing method was carried out to study wear behaviour of the composite at room temperature, including steady-state coefficient of friction, the running-in behaviour and wear resistance. Microstructure observation revealed that the concentration and size of particles has an impact on the distribution of reinforcement within the matrix as well as on the wear behaviour. The Al_2O_3 particles increased the hardness and consequently led to improved tribological properties of the composites.

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Influence of Multiple Electron Beam Remelting on the Characteristics of HVOF and CGDS Sprayed CoNiCrAlY Coatings

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Thermal barrier coatings (TBCs) have proved to be a key technology in thermal stability and their use to achieve surface temperature reduction of the underlying super alloys surpass all other achievements in the high temperature applications field of material technologies [1]. The TBC system typically consists of CoNiCrAlY bond coat (BC) and ceramic top coat, both thermally sprayed. The deposition methods used for the BC coatings are usually high velocity oxygen fuel (HVOF) spraying in order to obtain very dense and good adhesive CoNiCrAlY-coatings, or the cold gas dynamic spray (CGDS) deposition, because of its fast deposition rate and low application temperature, however, other methods can be also applied [2].

In the presented paper, experimental CoNiCrAlY coatings (75 µm thickness) were deposited onto Ni-based alloy (Inconel 718) by both HVOF and CGDS spraying techniques. Subsequently the deposits were remelted by EB up to depth of about 90 µm which resulted in removal of defects on the substrate to the bond coat interface.

The primary objective of this study was the investigation of the influence of the parameters used in EB remelting technique, including the dependence of multiple remelting on the microstructural changes, phase modification and final state of the coatings. The amount of porosity in the coatings and roughness of the surface have been in evaluated. Scanning Electron microscopy, X-Ray Diffraction and nanoindentation measurements were performed in order to characterize the phase morphology and phase modification before and after the applied treatment. The results indicated that multiple remelting process improved the coating properties in terms of porosity, smooth surface, strength and chemical homogeneity and at last but not least, this study demonstrates that CGDS deposition represents an interesting and promising alternative for CoNiCrAlY bond coat manufacturing.

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Organic and Inorganic Nanostructures; Common Concepts and Mutual Interactions

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Advancement in technology has enabled insight into nanostructured materials as well as their manipulation, therefore also physical properties and respective descriptions at meso and nanoscopic scales have become relevant. In particular, elasticity of thin shells which was commonly used to describe the shapes enclosed by biological membranes on the micrometer scale (e.g. cells and giant phospholipid vesicles) proved unable to describe stability of most membranous nanostructures (e.g. tubular and toroidal nanovesicles, thin necks and nonlamellar stacks). These structures can however be described by considering in-plane anisotropy of membrane constituents which leads to so-called deviatoric elasticity. While deviatoric elasticity was originally introduced to describe biological membranes, it proved successful to decribe also some observed phenomena in inorganic nanostructures, e.g. collapse of nanotubes into stripes and spirals. Furthermore, similar local curvatures indicate possibilities of mutual interactions between organic and inorganic nanostructures. We will briefly present theory of deviatoric elasticity subject to membranous and inorganic nanostructures. Also we will present the corresponding experimental observations of nanovesicles derived from blood cells, artificial membranes and cell lines and tubular and globular micro and nanostructures from TiO_2, as well as interactions between nanostructured inorganic surfaces and structures enclosed by biological membranes.

Multi-parameter Surface Quality Analysis

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Recent years have been rich in research in the field of metrology. Firstly, the research focused on contact gauges, especially on contact profilometers. Consequently, with investigation and development of materials, it was revealed that contact Profilers are not sufficient and it is necessary to focus on 3D non-contact optical profilometers and surveyors.
This article describes a new method of surface control. It is a method of surface printing using Siloflex dental silicone and subsequent evaluation. Surface quality control is carried out by profile geometries that are divided into two basic groups. The first group consists of contact devices and the second group consists of non-contact devices. Both of these groups can use the 2D and 3D measurement options. Subsequently, Surface quality is assessed using the amplitude parameters specified in the standards. These parameters have to be evaluated in a complex way and referred to as multi-parameter analysis. This analysis is used today by more and more companies and has become an essential part of the control. It is utilised for all types of materials from the engineering industry to medicine. This article deals with the non-contact measurement method. It also shows possibilities of evaluation using multi-parameter analysis.

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Experimental of Increasing the nitrogen content in high chromium steel melt in pilot plant metallurgical unit

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The work is focused on experimental increasing the content of nitrogen in high chromium steel melt using nitrogen gas in laboratory / pilot plant metallurgical unit (Vacuum-Pressurized Induction Furnace VPIM) in MATERIAL AND METALLURGICAL RESEARCH Ltd. in Ostrava, CZ. (MMR). We present the first part of experiments. In this part was performed using nitrogen blowing through the ceramic porous block installed into the bottom of the casting ladle at VPIM chamber. The special induction melting furnace VPIM that can operate either as vacuum equipment at a low pressure of 10-20 kPa(a) or as pressurized equipment with pressure nitrogen (or argon) atmosphere up to 500 kPa(a). The experiment was realized at low pressure 10 kPa (a).

Detection of macro-cracks on engraving tool steel inserts using acoustic emission method

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In daily industrial production of plastic products often various defects can occur on the mould side primarily as a result of material wear and tear, improper storage and improper settings on the injection molding machine. When testing different plastic materials, we normally use different inserts that are made from standard tool steels, such as OCR12VM. In the case of tool steel inserts, after a few years of usage, first cracks can occur and they can later quickly spread in proportion to the applied loading.

The purpose of this paper is to present experimental results that were obtained using acoustic emission method for the detection of cracks on a tool steel insert during a regular molding production cycle of standard test specimens. We focused exclusively on the acoustic emission signal acquisition with the use of two resonant 150 kHz piezoelectric sensors on those tool steel inserts that were already affected by macro-cracks. The obtained experimental results from such tool steel inserts were compared with those obtained on a brand new tool steel insert. The final experimental results from the crack defected tool steel insert revealed that the energy and intensity of the captured acoustic emission signals are higher compared with the ones that were captured on the brand new engraving insert under the same processing conditions.

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Effective Bone Tissue Engineering Scaffolds Fabricated by Electrospinning and 3D Printing Methods

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We prepared porous poly(glycolic acid) (PGA) scaffolds by 3D printing technology. We combined the silk fibroin (SF) nanofiber membrane with 3D printed PGA framework to produce a new type of composite scaffolds to analyze the growth of bone tissue and the effect of preventing soft tissue invasion as a guided bone regeneration (GBR).
In order to produce a SF nanofibrous membrane, purified SF aqueous solution was electrospun to form nanofiber mat by electrospinning technique. The average diameter of nanofibers was 639 nm. Optimum conditions for 3D printing PGA scaffolds were established by adjusting processing parameters (nozzle, temperature, pressure, speed and path code) of the 3D printer. Biomechanical properties and bone regeneration ability of SF membrane-PGA scaffold composites were analyzed with biodegradability, compressive modulus, in vitro and in vivo animal (rabbit) model experiments. The average PGA strand diameter was 206.8 ± 10.7 μm, the average pore size was 353.2 ± 6.7 μm, and dimension of disc shaped porous PGA scaffold was 8 mm in diameter with 1 mm in thickness. We observed the weight loss of PGA and silk fibroin and the change of microstructure via SEM through in vitro biodegradation experiment. The SF nanofibers showed a weight loss of 0.3 % and the PGA support showed a 40 % weight loss in 6 weeks. Then, in vivo animal experiments of rabbit cranial bone defect model showed that the SF nanofiber membrane-PGA scaffold composite scaffold promotes bone tissue formation and reduces soft tissue invasion.

X-ray-based Microstructural Analysis of Hydrogel-based Composites for Bone Tissue Engineering

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Artificial bone structures implantation becomes a promising treatment procedure in regenerative medicine. To ensure proper function of the scaffold its structural, mechanical and permeability properties have to be investigated and optimized. This study is focused on biodegradable hydrogel gellan gum (GG) reinforced by bioactive glass (BAG) nanoparticles with 0, 50 and 70 wt.%. The samples were subjected to tomografic imaging to obtain detail information about the internal microstructure and BAG particles distribution. As a comparative measurement planar energy-dispersive X-ray spectroscopy using scanning electron microscope and nanoindentation measurement were performed.

The microtomography inspection was performed using the patented (European patent no. EP2835631) in-house designed modular radiographic imaging device equipped with scintillators, large single photon counting and spectroscopic detectors. From reconstructed volumetric data internal microarchitecture, porosity, cell-wall thickness and BAG distribution were derived. The results were compared with the results of the planar analysis of thin scaffold layers prepared by cryosection.

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Formation of Hexagonaly Patterned Nanomoss Derived from TiO_2 Surface Structured by Perpendicular Nanotubes

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Layers of self-aligned titanium dioxide (TiO_2) nanotubes (NTs), have created significant interest due to their anticipated impact in various applications, such as photocatalysis, dye sensitized solar cells, lithium-ion batteries and in biomedicine. Here we report on the formation of novel morphology of TiO_2 nanostructures which we call “nanomoss”. The scanning electron micrographs of the nanomoss reveal tens of nanometers thick and macroscopically laterally extended structure which exhibits undulations on the micrometer scale. The nanomoss is composed of thin-walled hexagon-like rings assembled into a honeycomb array. The nanomoss was a side product of synthesis of nanotubes on the titanium foil surface by electrochemical anodization. We have observed that the morphology of TiO_2 nanotubes highly depends on the synthesis time, applied voltage and electrolyte concentration. The nanomoss was obtained in samples with nanotubes of the length of app. 50 µm and diameter of app. 100 nm. Our observations indicate that it was formed due to the pretreatment of Ti foil surface – first stage of synthesis of TiO_2 NTs. Physicochemical properties of nanomoss are not yet explored, however, isolated and conveniently oriented nanomoss could be used for capture and filtering of nanosized particles.

Dilatometric Study of Phase Transformation in SAE 9254 Spring Steel During Heat Treatment

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The Mn-Si spring steel are widely employed in industry for manufacturing automotive helical springs. The control on the processing routes is necessary to obtain springs with high quality and this involves heat treatment procedures in order to obtain desired microstructure and properties[1]. The heat treatment of these steels usually comprises high temperature annealing to promote the complete austenitization of the steel followed by cooling rates to obtain the desired microstructure[2]. Dilatometric analysis permit monitoring in real time of final and start phase transformation temperature due to the change of the specific volume of a sample[3,4]. In this research samples of the SAE 9254 spring steel were submitted heat treatment in dilatometry tests, being austenitized at 850 °C by 12 minutes and cooled under cooling rates of 0.5, 1.0, 2.5, 5, 10, 20 and 40 °C/s. The microstructures of these samples were characterized by confocal laser microscopy, scanning electron microscopy and microhardness measurements. Dilatometric curves indicated that different cooling rates are influence strongly on the transformation critical temperatures (Ar_1, Ar_3, M_S). The microstructural evolution was mainly determined by continuous cooling, especially under different cooling rates was observed change from pearlitic microstructure to martensitic and your effect on the hardness properties.

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Effects of Fluoride Conversion Time on Properties of Films Formed on AZ31B Magnesium Alloy

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Magnesium alloys have attracted much attention as biodegradable orthopedic and cardiac implants[1]. They can be gradually dissolved, absorbed, consumed or excreted in human body environment. Rapid corrosion is an intrinsic response of magnesium alloys to chloride containing solutions, including the human body fluid or blood plasma[1,2]. The fast degradation always leads to hydrogen evolution and alkalinization of the solution[3]. Chemical conversion is an effective treatment which has been developed to reduce the corrosion rate and also beneficial to improve the bioactivity of Mg and its alloys[4]. Investigations have been performed to study the effects of the temperature and the electrolyte composition on the film properties. However, the effect of the conversion time associated to a constant temperature was scarcely studied. Fluoride is one of the few known agents that can stimulate osteoblast proliferation, increase new mineral deposition in bones and also is required for skeletal growths[4,5]. Thus, films were grown on AZ31B magnesium alloy by chemical conversion treatment varying the conversion time. The corrosion protection ability of the films was investigated by using potentiodynamic polarization (PDP) and electrochemical impedance spectroscopy (EIS). Film morphology was examined by scanning electron microscopy and confocal laser scanning microscopy. The chemical composition of the coatings was determined x-ray photoelectron spectroscopy (XPS). The results revealed that the corrosion resistance was dependent of the conversion time. An optimum time was identified, above which pores formation was enhanced in the coating layer. The films became enriched in fluorine as the conversion time was increased.

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Development of a Metal Matrix Composite Reinforced with Quasicrystalline Particles

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With composite materials, we usually name those materials that contain a continuous matrix constituent that binds together and provides form to an array of a stronger, stiffer reinforcement constituent. Nowadays modern composite materials usually are optimised to achieve a particular balance of properties for a given range of applications. The improved structural properties generally result from a load-sharing mechanism. Between constituents, a good cohesion has to be established so that the composite material has a balance of structural properties that is superior to either constituent material alone.[1] In this light, we attend to design novel metal matrix composite reinforced with icosahedral quasicrystal (iQc) phase. In our case, this was in-situ grown metal matrix compound, where the amount of reinforcing iQc phase can be controlled. Several alloy systems have been chosen for this task and three alloys from Al-Mn based system will be presented. Controlling amount of (iQc) phase requires accuracy in chemical composition and processing parameters. Using analytical methods such as LOM, SEM, XRD and TEM we could confirm a successful synthesis of in-situ grown composite denoted as aluminium matrix/iQc composite. Preliminary assessment of mechanical properties shows us that compressive strength over 350 MPa, yield strength over 750 MPa and compressive fracture strain over 30 % are achievable in our alloys.

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Steel Artefacts from Soča Front

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The western part of the Slovenian territory was the site of the Isonzo (Soča) front from May 1915 to October 1917. The front line was 90 km long reaching from Mt. Rombon to the Trieste bay. Both sides suffered heavy casualties and wounded soldiers in numerous offensives. There are still numerous battle remains throughout the front line. Memorials and burial sites remind us of the suffering of the men that fought there.
Nowadays, rusty remains of different exploded bomb shells, used by both sides to bombard trenches and forts, are still found on the mountain trails. Before and during the First World War steel was produced in Thomas or Bessemer convertor by the Siemens Martin (SM) process.
Results of microstructural analysis and the composition of different steel artefacts found in the area of the front line are presented. The period and warring manufacturer side can be determined from the results of the artefact analysis.

“RESYNTEX” - A new Circular Economy Concept for Textiles and Chemicals

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RESYNTEX aims to create a new circular economy concept for the textile and chemical industries. Through industrial symbiosis, the project aims to produce secondary raw materials from textile waste. Create a strategic design for a complete value chain from textile waste collection through to the generation of new feedstock for chemicals and textiles**;** improve post-consumer collection approaches and increase public awareness of and social involvement with the issue of textile waste; enable traceability of waste processing using data aggregation; the collected data will evaluate the performance of the new value chains by means of a life cycle assessment (LCA) and life cycle costing (LCC), compared to existing end-of-life scenarios**;** develop innovative business models for the chemical and textile industries; demonstrate a complete reprocessing line for basic textile components, including liquid and solid waste treatment**.** Currently, many of the materials contained in products are discarded as waste after use. The textile industry is no exception. Textile waste has increased steadily and only a fraction of it is collected and recycled. Much of the waste is landfilled or incinerated with a high environmental impact and at great cost. The valuable resources held within the waste are lost. Both citizens and industry stand to benefit from RESYNTEX’s ambitious project goals. While research focuses on European countries, the project offers a global benefit and will help to inform governing bodies on how to move towards a more circular economy for textiles and chemicals. A new demonstration process will be presented, based on a synergistic chemical and biotechnological cascading separation/transformation approach of textile basic components (proteins, cellulose, polyamide and polyester) from textile blends as basic feedstock materials for chemical and textile industries which is under development. Liquid and solid waste treatment and valorisation is foreseen to close the loop. The results will cover PET and PA transformation and their decolourization prior chemical degradation.

The Effect of Acid Pickling Process on the Microstructure of a Nickel-Iron-Chromium Alloy

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Alloy A800H is a nickel-iron-chromium alloy having excellent properties at higher temperatures, i.e. strength, resistance to oxidation, carburization and other types of high temperature corrosion. During the hot forming operations, thermal treatments (such as annealing or hardening), or welding, a scale surface (heavy, tightly adhering oxide films) is formed. To remove the heavy and tightly adhering scale different technological processes are used in practice, the most common practice being chemical cleaning, so called acid pickling. When planning an acid pickling operation, it is necessary to know the type of steel (stainless steel (duplex, 316, 304…), nickel-base alloy) and its metallurgical and physical characterization. Because of different alloy compositions, it is expected to behave differently when exposed to pickling acids[1].

In this study, the effect of pickling process on the microstructure of A800H - nickel-iron-chromium alloy was investigated. Two different mixtures of hydrofluoric (HF(aq)) and nitric acids (HNO_3) were used in the laboratory environment to remove the oxide scale. The samples were removed from acid mixture after different soaking times. The effect of sandblasting on the pickling time was also investigated. Sandblasting is an effective method for the rapid removal of scale, and is usually employed as a prior step to acid cleaning. The microstructures of flat and U-bent pickling samples were analyzed by OM. The aim of the presented work was to determine the optimal pickling time with respect to the acid mixture concentration.

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MER Non-woven - High Performance Thermal and Acoustic Insulation Materials Manufactured According to Innovative MB Technology

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MER, melamine etherified resin, is a new MF resin containing significant lowered formaldehyde amounts. It recombines to the best advantage the melt properties of typical thermoplastics with the final product performance of thermosets. Based on sustainable resources (natural gas) MER could be well handled by common melt-blown equipment. Nevertheless, the processing of MER melts while extrusion and through-flow the spinneret makes great demands on exact and narrow managed process temperature. Furthermore the catalytic cross-linking step (fumigation) requires strong acidic, gaseous media with high causticization potential.

Resulting non-melting, non-dripping and fire-proof non-wovens exhibit typically MB single fibre diameter in the range of 0.5 to 5 μm. The fleeces could be manufactured in grammages from 20 up to 600 g/m^2, which means specific dimensional weights from 50 down to 10 kg/m^3. Finally the thermoset non-woven could be thermal stresses up to 350°C in maximum and up to 270°C in long-term use.

The excellent material immanent thermal stability in connection with low emissions makes MER MB nonwovens ideal lightweight materials for hot-gas filtration, thermal and acoustic insulation fleeces in automotive and aircraft, heat protection layers in personal protective clothes and effective barrier to fire for home textiles (bed mattress cover, upholstery fabric, etc.) as well as fire-proof façade insulation.

The lecture will report on the development of the MER resin, the alternative MB process, the non-woven manufacturing and non-woven assessment. It will present properties and test approaches for the fleeces and will illustrate results of several thermal, acoustic and application tests.

Leakage Cause Analysis of a Flange Joint Designed According to Standards

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The design of flanges is linked to the use of relevant standards; in the chemical, petrochemical and energy industries. The modern standards EN 13445 [1], which are focused on design of unfired pressure vessels, are often used to design flanges.

There is a danger of possible flange joints leakages in operation. Whether the flange connection is designed with standardized parts where the calculation is not necessary or it is designed by strength calculation according to this standard, such procedure does not ensure that the flange joint is sealed, as will be shown in the article.

This situation is, for example, a leak due to insufficient contact pressure on the sealing surfaces. The flange joint undergoes several load-bearing operations. When assembling, the cold flange connection is tightened to the specified pretension. When operating media is introduced, there may be significant changes in stress distribution due to thermal expansion, presenting a transient state between assembly and nominal operation. When temperature stabilizes, the force in the bolts decreases and in this condition, leaks may occur when the flange connection design is inadequate.

The aim of this paper is to perform analyses of industrial flange joint designed according to EN 13445 [1], with the priority to analyze flange joint operational conditions and to identify the most probable cause of the leak. Complex structural behavior of the joint will be thoroughly investigated using FEM (finite element method).

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Design of Experiments as a Basis for Silicon Carbide Ceramics Development

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In past decades design of experiments has been recognised as a powerful tool for resource efficiency improvement for energy-consuming industries such as silicon carbide ceramics production which invokes the use of high temperatures and sintering aids. Candidate sintering aids for SiC embrace metals and alloys, Invar-type precision alloys in particular[1, 2, 3]. The present research discusses the correlation between mechanical behaviour (dependent variable, calculated as single contact strength) and process parameters (independent variables, with only two possible values (maximum and minimum, semi-quantitative in case of X4)), namely[1, 3] green body pressure value (X1; 100 and 150 MPa), ceramics firing temperature (X2; 1500 and 1550 °C), and sintering aid content (X3; 10 and 15 % wt.) and preparation technique (X4; dry or wet ball-milling) for SiC-based compositions with ferrous metal dopants corresponding to NILO and Kovar alloys respectively.

The research was carried out within the framework of a full-factor experiment where the amount of experiments was calculated as $n = 2^m$ (where m – number of independent variables), under given conditions n°=°16. Assuming a complex nature of the studied relationships, experimental data were processed by regression analysis methods, and regression models for SiC-NILO and SiC-Kovar ceramics were constructed ($y = 0{,}403 – 0{,}043X1 – 0{,}121X2$ for SiC-NILO, and $y = 0{,}34 – 0{,}134X2 + 0{,}128X3 + 0{,}04X4$ for SiC-Kovar ceramics). Both models passed F-test goodness check successfully. SiC-NILO ceramics properties were most influenced by firing temperature and green body pressure value while SiC-Kovar turned sensitive towards changes in firing temperature and sintering aid content.

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Tailoring the Conductivity of Lead-Free $BiFeO_3$-based Piezoelectric Ceramics

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Piezoelectric materials are used in numerous electromechanical devices, such as sensors, actuators and ultrasonic transducers. In recent years, much research has been focused on development of high-temperature piezoelectric ceramic materials with high sensitivity which would be especially desired in aerospace, automotive industry and energy production.

Among lead-free candidates, bismuth ferrite, $BiFeO_3$ (BFO), has received a considerable attention due to the extremely high Curie temperature (T_c) of ~820 °C which makes this material a prime candidate for high-temperature applications. However, one of the main reasons that have restricted the use of BFO and its solid solutions in practical applications is the high specific electrical conductivity which may reach room-temperature values as high as 10^{-2} $ohm^{-1}m^{-1}$. [1]

Here, we experimentally demonstrate the possibility to reduce the electrical conductivity of $BiFeO_3$-$SrTiO_3$ (BFO-ST) solid solutions by modest doping with MnO_2. With an addition of 0.1 wt% of MnO_2 to the BFO-ST the DC conductivity (σ_{DC}) has been decreased for more than three orders of magnitude with respect to the unmodified BFO-ST. In these samples, ferroelectric loops with the coercive field E_c ~70 kV cm^{-1} and high remanent polarization P_r ~40 µC cm^{-2} were obtained and a piezoelectric d_{33} coefficient of 69 pC N^{-1}.

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The Microstructural Changes in Turbine Blades of Turbocharger Turbine Wheel

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The microstructure of the turbine wheels for turbocharger made from Inconel 713C is very complex and contains large γ dendrites due to casting. The γ matrix contains cubical γ'-Ni_3(Al,Ti), the interdendritic areas and γ grain boundaries contain MC carbides. Optical and scanning electron microscope with EDS (Energy-Dispersive X-ray Spectroscopy) and EBSD (Electron Backscatter Diffraction) methods were employed to investigate the microstructural changes in turbine blades after operation. The casting microstructure is still observable in the center part of the hub and contains minor changes, like precipitation of the $M_{23}C_6$ carbide and σ phase. While the blades of the turbine wheel are, due to high temperature and mechanical stresses during vehicle operation, subjected to a number of microstructural changes. These changes include the decomposition of primary MC carbides, rafting of γ'-Ni_3(Al,Ti) and the precipitation of $M_{23}C_6$ carbide and γ'-Ni_3(Al,Ti) with the reaction front on the γ dendrite grain borders.

XPS investigations of Tribofilms formed on CrN Coatings

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Action of lubrication additives in the case of uncoated steel surfaces, including the type and mechanism of tribofilm formation is well known and understood. However, contact type of tribofilms which might form under the tribological contact between CrN coated surfaces, remains more or less unexplored. The aim of this investigation was to study the type of tribofilms formed on the CrN coated steel samples subjected to lubricated reciprocating sliding contact under different contact conditions Contact surface and tribofilms formed were studied by X-ray Photoelectron Spectroscopy (XPS). Sample surfaces were first imaged by Scanning Electron Microscopy (SEM) to determine areas of tribofilm formation as well as areas not affected by tribological contact. In these areas survey and high resolution (HR) XPS measurements were performed to obtain information about surface chemistry and oxidation states of the constituent elements. It was found that differences between different samples, observed by the XPS measurements, may reflect differences in chemistry of tribofilms formed under different contact conditions.

XPS Studies of UHMWPE Tibial Insert of Retrieved Knee Prosthesis

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Knee prosthetic implant that was surgically retrieved after several years of use was investigated. Special attention was paid to the tibial insert of the knee endoprosthesis. Tibial insert was manufactured of Ultra High Molecular Weight Polyethylene (UHMWPE) which is frequently put to this or similar uses. Visual inspection of the tibial insert showed yellow areas inside it that approximately corresponded to the areas of maximum load exerted by the femoral CoCrMo component of the artificial joint. There are several possible explanations for these changes. Some of them have already been proposed, e. g. chromium being transferred from CoCrMo of the femoral component into the polymer tibial insert. Detailed analysis and description of the mechanism which applies in our case will be presented elsewhere. Of paramount importance for that analysis were details of surface chemistry of yellow and white areas of UHMWPE. These were obtained by surface sensitive X-ray Photoelectron Spectroscopy (XPS), that can provide chemical composition of the analyzed surface, but also information about the chemical states of the elements detected. It is results from these XPS measurements and conclusions obtained from them that are topic of the presentation. XPS survey and high resolution spectra were measured on both types of UHMWPE tibial insert using Al K_α at 1486.7 eV. Software for analysis of the measured spectra was used to fit these peaks with components corresponding to different chemical states of the elements. Results obtained from XPS measurements and analysis could be shortly summarized: (1) No Cr was detected on yellow area of the tibial insert neither on the white one. (2) Si corresponding to SiO_2 and Si in organics was detected on both types of surfaces. (3) O corresponding to O in polymers and/or SiO_2 and O corresponding to O in different organics was detected on both types of surfaces. (4) Possible formation of Ca chloride in the yellow area from $CaCO_3$ in the white area.

Monatomic and Cluster Argon Ion XPS Depth Profiling of $SrTiO_3$ and HfO_2

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Metal oxides are employed in a wide variety of functional applications. There is currently strong technological interest in strontium titanate ($SrTiO_3$) and hafnium oxide (HfO_2) due to their specific band gaps and high dielectric constants. $SrTiO_3$ is being studied for use in photocatalysis, energy storage and electronic sensors, whilst HfO_2 is widely employed for optical coatings and optoelectronic device applications. Both materials are regularly deposited as thin films and doped to optimise their properties for the application. An accurate determination of thin film composition is paramount to the understanding and optimisation of device performance.

In this work, thin films of $SrTiO_3$ and HfO_2 have been deposited onto silicon substrates and XPS depth profiles have been performed through the thin films using both monatomic and cluster argon ion bombardment. The monatomic Ar^+ profiles were performed using an incident ion energy of 500 eV and the gas cluster ion beam (MAGCIS) profiles were recorded using 8 keV Ar_{1000}^+ and 8 keV Ar_{150}^+ for $SrTiO_3$ and HfO_2 respectively. For HfO_2 the optimum results were found when the MAGCIS ion beam was incident upon the sample at a glancing angle. These MAGCIS conditions yielded excellent retention of the original $SrTiO_3$ and HfO_2 stoichiometry during the profile, with no evidence of preferential sputtering or ion beam induced reduction. Using 500 eV Ar+, however, resulted in the preferential sputtering of oxygen leading to the presence of sub-oxide states in the XPS spectra of Ti in $SrTiO_3$ and Hf and HfO2. The depth resolution was similar between the monatomic and cluster ion depth profiles for both thin film materials. Using the same incident ion beam angle, the etch rate for 8 keV Ar_{1000}^+ was only 2.5 times lower than that for 500 eV Ar^+. The results will be discussed in the light of known ion beam effects when sputtering metal oxide materials.

Inkjet Printing of Metal-Oxide-Based Electronic Devices

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Direct-writing techniques have due to their unique characteristics a large potential in the production of modern, large-area electronic devices. Inkjet printing offers several attractive features, including additive deposition, direct patterning with micrometre resolution, and easy pattern modifications. Yet, a high complexity of the printing process—extending from the jetting concerns to the issues connected with the morphology of dried deposit—has impaired the fabrication of electronic devices using inkjet printing.

We report on the inkjet printing of functional thin-film structures for applications in transparent electronics. The structures with the thickness in nanometre range are deposited from solution-based inks, which consist of metal oxide precursors dissolved in a suitable solvent. The printed structures commonly dry in a way that the ring-like deposit forms; the phenomenon known as “coffee stain” effect.[1] A standard approach to improve the uniformity of dried deposits is by combining a solvent and a co-solvent with different boiling points and surface tensions. Consequently, these solvents evaporate with different rates, which leads to variations in the solvent composition in the drying feature. Moreover, the composition variations can lead to the changes in the physical properties, and thus produce a rich variety of complex phenomena observed when the printed features are drying.

We highlight the influence of the ink’s solvent composition, wetting of the substrate, and drying temperature on the morphology of wet and dried structures. These parameters appear to be interrelated in the drying process; well-defined structures with the flat thickness profile can be printed only when all three parameters are optimized. We demonstrate such optimization for inkjet printing of transparent thin-film capacitors composed of tantalum oxide-based dielectric and indium-zinc oxide electrodes. The capacitors were uniform and showed good electrical and optical properties

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Newly Developed 3D Printed Material For Treatment Of Chronic Wounds

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Early and late complications connected with wound healing significantly lower the patients' quality of life and present a huge financial burden for healthcare systems around the world. Acute wounds normally heal in three successive phases in a short timeframe. Whereas in chronic wounds healing is hindered, mostly in the inflammation phase, and by which the healing can be prolonged for several months even years. Consequently, chronic wounds have a major negative impact on the patients' wellbeing, while it also affects the life of the relatives. Treatment of larger wounds requires more complex materials, which could ensure the successful renewal/replacement of damaged tissues. In the field of tissue engineering and regenerative medicine a more recent emphasis is on creation of scaffolds using 3D printing technology. 3D printers can produce complex geometric structures, with a very high resolution and manufacturing repeatability using a wide range of biocompatible polymeric materials.

In our research, scaffold was prepared from the currently most promising materials for efficient chronic wound care, exhibiting a proven positive effect on healing; alginate (ALG) and carboxymethyl cellulose (CMC). During the research of material with optimal printable properties, we have developed the combination of 10 % CMC and 2% ALG, which allows us to form stabile 3D scaffold. Through the *in situ* incorporation of human skin derived keratinocytes, another functionality to the new material was provided. Due to Live/Dead assay, no toxic effect of newly developed material on the human keratinocytes was established.

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Evolution of Polyethylene Terephthalate Surface Morphology upon Treatment with Oxygen Plasma

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The surface morphology of polymer materials is often inadequate for further processing such as printing, painting or gluing. As-produced polymer foils are often smooth so the adhesion of various coatings is rather poor. In order to improve it the polymer surface should be modified in such a way to become functionalized with polar functional groups and roughened at sub-micrometer scale. Of particular interest is polyethylene terephthalate (FET) which is a polyester widely used in industry and medicine. As most other polymers it is moderately hydrophobic with water contact angle close to 90^{o}. In order to achieve better wettability both the surface composition and morphology should be modified.

PET foils have been treated with oxygen plasma in a reactor made from Pyrex glass. The reactor was a cylindrical chamber of diameter 27 cm and height 30 cm. The Pyrex cylinder was terminated with two aluminum flanges. A sample was placed in the centre of the reactor where also a catalytic probe was mounted in order to determine the flux of neutral oxygen atoms onto the polymer surface. The reactor was then pumped down to the base pressure (about 2 Pa) what was achieved in a minute of pumping. After achieving the base pressure oxygen of purity 99.99% was introduced into the system through a manually adjustable leak valve. Upon continuous pumping and oxygen inlet a pressure of 60 Pa was established in the reactor. Plasma was sustained in the reactor by an inductively coupled RF generator. The power used in this experiments was adjusted using a variable vacuum capacitor to about 600 W. Under plasma conditions the molecular oxygen was partially dissociated upon electron impact and the O-atom density as determined by the catalytic probe was about $5x10^{21}$ m^{-3}. Samples were exposed to plasma for different periods between 10 and 80 s. The treated samples were characterized by atomic force microscopy (AFM). The AFM images showed gradual nano-structuring of the polymer surface. The average roughness increased from original 0.9 nm to about 5 nm in 40 s of treatment and remained rather unchanged thereafter.

An Easily Accessible Method for DNA Immobilization on Silicon Surfaces

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We present an easily accessible capturing approach based on streptavidin-biotin binding for protein immobilization on silicon surfaces, which was achieved by modifying a Si film with silicon binding peptide-tagged streptavidin (SBPS). Especially, monomeric streptavidin whose affinity to biotin is one order of magnitude higher than previously engineered monomers was chosen, thereby potentially allowing sensitive monovalent detection of biotin-conjugates. With this monomeric streptavidin possessing high biotin affinity, SBPS was produced as a fusion protein tagged with silicon binding peptide using genetic engineering technique. The biggest benefit of using this straightforward method is that the recombinant fusion protein does not require (Si) surface modification to attain desired functionality, thus enabling easier, faster, and more efficient immobilization of ligands on silicon surfaces. Moreover, the versatile silicon binding peptide-tagged streptavidin can be also applicable to a wide variety of capturing molecules such as nucleotides, lipids, and carbohydrates, since these biotinylated ligands are readily available.

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Contributions to the Understanding of Chloride Induced Stress Corrosion Cracking of Stainless Steels

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Stress corrosion cracks have been induced in various stainless steels in different chloride solutions, at different temperatures, and potentials. Surface of specimens and stress corrosion crack flanks have been investigated by high resolution scanning electron microscopy. Dislocation structure and crack tips were prepared and investigated by transmission electron microscopy. Mechanically strained flat tensile specimens were analysed by use of an atomic force microscope. Passive layer chemical composition has been investigated by X-ray photoelectron spectroscopy.
Results underline localized dissolution of steels at slip steps as rate determining step for SCC followed by slipping processes. Mechanical and chemical part of SCC is discussed. A sequence of (electro)chemical reactions in the crack and at the crack tip is presented.
Keywords: Stress corrosion cracking, stainless steel, mechanism

Surface Functionalization and Nanostructuring of Polymers Using Non-equilibrium Gaseous Plasma

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Surface properties of polymers and polymer composites are rarely adequate so they should be modified prior any further treatment such as painting, printing, gluing or grafting. A suitable technique for tailoring surface properties of such materials is a brief treatment with non-equilibrium gaseous plasma. Reactive gaseous species readily interact with the polymer surface even at room temperature causing functionalization, etching and sometimes also modification of sub-surface layers. Surface properties of practically all polymers can be tailored in a broad span from super-hydrophilic to super-hydrophobic surface finish but the suitable plasma parameters vary enormously for different materials. Nano-structuring is a spontaneous process that takes place upon treatment of a polymer with rather aggressive plasma whose reactive gaseous species cause etching. Typically, oxygen plasma or a mixture of oxygen and another gas is used to tailor surface morphology. The required treatment time is often as low as a second, but many authors prefer prolonged treatment times up to several minutes. The rich surface morphology of plasma-treated polymers that may be original almost perfectly smooth allows for superior surface finish. In the case super-hydrophilicity is the desired surface finish, the nano-rough polymer surfaces should be functionalized with polar functional groups what is often accomplished by a brief treatment with oxygen reactive species. Preferred are neutral O-atoms in the ground state because they allow for a very high concentration of polar functional groups on the polymer surface. In the opposite case when super-hydrophobic surface finish is desired, the final functionalization is performed using reactive gaseous species formed in CF_4 plasma. In many cases, the surface of polymer is saturated with desired functional groups after achieving the fluence of 10^{21} m^{-2}, what happens upon plasma treatment in a fraction of a second providing the plasma properties are optimized. Several practical examples suitable for industrial application will be presented.

Microstructure evolution in the Recycled Anisotropic HDDR NdFeB powders with Spark Plasma Sintering Treatment Magnets

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The transition toward new and better technologies, which are relying on hard magnets are unavoidably linked to a stable supply of HREs, in the recent past already hindered due to the various geo-political and economic reasons. One promising way to tackle this problem is to develop an efficient recycling route for permanent magnets at the end of life cycle, by a proper reprocessing of used scrap magnets into new functional magnets with only little or negligible loss of overall magnetic performance*. The application of different magnet recycling routes inevitably influences the resulting microstructure of the recycled product and hence the overall magnetic performance of the final magnet. Thus, the reliable characterization of the microstructural features by the use of different high spatial resolution techniques of transmission electron microscopy (TEM) is important for the overall development of a successful process to recycle magnet assemblies. In the present study Recycled HDDR powder was investigated under HR-SEM. The recycled HDDR powder was optimally SPSed at 750 ^{o}C for 1 minute and 50 MPa pressure. The SPS-ed samples have H_{Ci} > 1100 kA/m, B_r = 0.75 T and the nearly full density (7.54 g/cm^3). The recycled powder was etched to remove the grain boundary phase and identify the $Nd_2Fe_{14}B$ phase in morphology and composition. Similarly, this HDDR powder was SPS treated to form bulk magnets and utilizing the same microstructural exposition conditions to determine the success of reprocessing route. 3M Cyphos based ionic Electrolyte was used as Etchant for 5 minutes. The average grain size of Recycled powder was < 500 nm with proper stoichiometry of Matrix phase. While the SPS treated bulk magnets had an average grain size of 520 nm approximately. The post SPS annealed samples was observed having average grain size of 535 nm. The grain boundary phase separating the matrix grains was more uniform and thicker in the annealed samples as compared to the SPSed samples. This in effect is the reason behind superior coercivity (30% higher) of the annealed samples starting from Recycled HDDR powder. Further HRTEM and analytical STEM investigation is underway to study the effect of SPS reprocessing, annealing effect and property relationship with the Nanostructure of HDDR powders.

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Influence of Steam-Side Oxid Scales on Creep Life of Boiler Superheater Tube

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Creep life is a limiting factor in case of boiler tubes operating above creep temperature, and, for a given material, it generally is determined by the actual operating temperature and stress. Standard approaches to calculation of tube creep life take into account mainly the stress caused by pressure loading and mean temperature in the tube wall. However, estimation of the temperature and stress may be difficult in water tube boilers, because oxide scales tend to form on inner surfaces of the tubes exposed to steam and indirectly affect the resulting creep life. Because scales increase thermal resistance of a tube wall and, consequently, also wall temperature, creep life is reduced. Moreover, presence of oxide scales leads to higher hydraulic resistance of the tube, which can cause further increase in temperature in some tubes of the bundle if the oxide scale growth rate is not uniform. Additionally, elements increasing creep strength may leach out of the surface should the scales be porous, thus inducing even more pronounced decrease in creep life.
This paper investigates effects of oxide scales on creep life of boiler tubes in cross flow. Thermal and stress conditions in tubes are thoroughly investigated using analytical as well as numerical approaches.

Interrelations Between Genotypes, Year of Growth, Biochemical Composition, Histological Structure and Plant-Polymer Composite Mechanical Traits For Maize, Sorghum and Miscanthus

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This presentation will focus on the use of elongated plant fragments directly obtained after grinding plant stems for preparing polymer composites. We developed a robust method able to discriminate stem fragments according to their reinforcing capacity. We studied three genetically related crops: miscanthus, maize and sorghum. Fragments were collected on varied stem positions on 13 miscanthus genotypes of 7 to 9 years old, 10 sorghum genotypes selected among a panel of 396 genotypes and 10 genotypes of maize. This panel offers a very large range of plants from which stem fragments can be prepared. The work focused on the relationships between the composition and histological structures of stem fragments and (1) the mechanical properties of the individual fragments, (2) their thermal stability and (3) the mechanical performances of polymer composites. Based on these analyses, we will be able to assess how the variability of plant structure and composition is influencing the final mechanical properties of polymer composites.

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Wood-Biopolymer Films as Platforms for Functionalization

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Films based on polysaccharides originating from wood are already being used in packaging and sensing as physically and chemically active components. As opposed to the traditionally used paper being an largely inert phase, these film materials demand improved and tunable properties, as well as diverse functionality. In the case of cellulosic materials the exploration of cellulose nanomaterials and their modification has accelerated their progress. Cellulose nanomaterials are mainly top-down constructed particle and fibril-like materials largely consisting of cellulose, the main wood polysaccharide. In addition to cellulose, trees are a source of hemicelluloses which act as matrix materials in wood cells. These hemicelluloses are characterized by varying sugar monomer compositions and their molecular weight is significantly lower than those of celluloses. In addition, solubility and sugar backbone structure /characteristics differ from cellulose. While cellulose is of scientific and industrial interest and a well-established commodity, wood-based hemicelluloses, xylan being the principle type of them, have had rather limited use in industrial applications. So far, hemicelluloses have been mainly considered as a source for the manufacturing of biobased chemicals. In materials technology applications, investigations have been directed towards the modification of wood-based hemicelluloses to tune their water-solubility, functionality, and film formation, among other properties. This contribution will discuss the film-forming properties of cellulose nanomaterials and hemicelluloses in their native and modified state. Modification approaches with respect to enhanced intermolecular interactions and added functionality will be discussed and demonstrated with respect to applicability in packaging and sensing.

Zirconia Ceramics in Dentistry: Structure, Properties and Clinical Applications

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In the past decades, there have been major advances in the application of sintered yttria partially stabilized zirconia (Y-TZP) ceramics for load-bearing applications in restorative dentistry. Superior mechanical properties of Y-TZP, compared to other bioceramics, allow them to be used for the fabrication of multi-unit dental bridges. Additionally, they enable a substantial thickness reduction of those fixed dental prostheses (FDPs) in the visible part of the dental arch that is subjected to lower mechanical stresses. However, the main driving force for the replacement of traditional metal-based ceramic prosthetic crowns and bridges is the improved aesthetics, and excellent tissue compatibility achieved using tooth-colored, metal-free systems. For the same reasons, Y-TZP ceramic post-and-core systems and implant superstructures were introduced to replace traditionally used metals in dentistry.

Clinical use of porcelain veneering Y-TZP FDPs is often connected with chipping or fracturing of the veneering porcelain. Less porcelain delamination from Y-TZP ceramic framework can be attained by the use of veneering porcelains with thermal expansion coefficient adapted to zirconia framework ceramics. Frequent chipping of veneering porcelain and the development of new translucent zirconia ceramics have dictated the introduction of the use of monolithic zirconia ceramic restorations without veneering porcelain.

Under clinical conditions, dental restorations are exposed to cyclic mechanical and thermal loadings in the chemically aggressive environment of the oral cavity, where they are expected to be in service for at least 7-10 years. The strength tends to diminish steadily with time, from stress corrosion and fatigue as well as other mechanisms, e.g., during mechanical surface treatment and enhanced low-temperature degradation (LTD), i.e. aging of Y-TZP ceramics.

The long-term survival rate of zirconia-based dental restorations largely depends also on the adhesive bond between zirconia ceramics and tooth surface. Unfortunately, the establishment of a durable chemical or mechanical bonding to zirconia has been proven to be difficult because of its surface stability. Chemical methods, such as acid-etching or silanization, proved to be ineffective. For this reason, surface roughening by sandblasting, which enhances the mechanical interlocking, remains the most commonly used surface-preparation technique. However, subsurface cracks may be introduced during abrasion; this process represents a potential threat of a premature failure. Therefore, we have recently proposed an alternative solution to the adhesion problem by a non-invasive functionalization of the core ceramic surface, by applying a thin nanostructured alumina coating.

Contemporary clinical applications of zirconia ceramics in dentistry with the CAD (computer aided design)/ CAM (computer aided machining) technology will be presented.

Magnesium Alloys: Concept of Design and Recent Developments

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Magnesium (Mg) is one of the most fascinating metallic materials, which excites many experts in various fields from the moment of its discovery slightly over 200 years ago. It is the lightest structural metal having the density of less than 25% of that in steels, 40% in titanium and 70% in aluminium (Al). The spectrum of Mg applications spans from light-weight mobility, including automotive and aerospace sectors, to bio-degradable implants to hydrogen storage. Recent achievements include the lift of FAA ban from using Mg alloys in aircraft cabins, development of commercial technologies for Mg sheet production, clinical approval of Mg bio-implants, etc. The most recent wave of interest in Mg and its alloys was inspired by the development of new generation of wrought Mg alloys in late 1990-th. These efforts allowed to tackle the problem of low-temperature deformability and design alloys having strength higher than the strongest Al alloys of 7xxx series. Nevertheless, the control of strength, ductility and plastic anisotropy as well as very high chemical reactivity of Mg remain major barriers in the wide proliferation of Mg alloys into real-life products.

In this talk, an overview of the latest concepts in magnesium alloy design principles, parameters affecting the material performance and achievements in commercial applications will be presented along with our efforts and contributions in this area.

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Fast and Simple Method for the Preparation of the Biocompatible Conductive Film Based on Chitosan/conducting Polymer and its Optoelectrochemical Properties

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A novel bio-composite film that contains chitosan and N1,N4-bis(2,5-di(thiophen-2-yl)-1H-pyrrol-1-yl)terephthalamide (BTPA)[1] was produced on indium tin oxide glass electrode surface. BTPA deposited electrochemically on chitosan modified indium tin oxide electrode. To use chitosan, as a biodegradable and biocompatible polymer[2], with BTPA, a good conductive polymer which synthesized by our group, makes possible to obtain a new composite material that combines the high conductivity of BTPA with a large number of hydroxyl and amino functional groups of chitosan. Cyclic Voltammetry was used to characterize the electrochemical properties of the modified electrodes. The spectroelectrochemical characterizations of bio-composites have been performed by using UV-vis spectroscopy. The morphological changes of the prepared composite have been characterized with scanning electron microscopy. It was aimed by producing this bio-composite to overcome non-conductive character of chitosan by means of electroactive polymer and to take advantages of biocompatible chitosan. As a result, it has been figured out that the bio-composite have promising feature as a conducting and biocompatible material in different fields such as biosensing, optoelectronic and electrochromic applications.

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Synthetic Polypeptides Prepared by Ring-Opening Polymerization of *N*-Carboxyanhydrides

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Synthetic polypeptides are biodegradable and biocompatible polymers with high potential for the use in broad range of biomedical applications. Ring-opening polymerization (ROP) of *N*-carboxyanhdride monomers, prepared from α-amino acids bearing various hydrophobic or hydrophilic side chains, results in synthetic polypeptides with controlled molar mass characteristics and chain-end fidelity, which enable the preparation of block-copolymers as well as polymers with complex macromolecular architectures. Since the propagation during ROP proceeds through the amine end-groups, the primary amines are most commonly used initiators. In this presentation, a new approach in which the hydroxyl groups act as initiator sites will be presented. For this purpose the initiation and the propagation steps were successively carried out by using an acid/base catalytic system. This approach not only expands the pool of possible initiators, but also significantly facilities the preparation of polypeptide hybrid materials. Some examples on adjusting the properties of synthetic polypeptides for specific biomedical applications using various post-polymerization modifications to prepare amphiphilic anionic or cationic polypeptides will be additionally discussed. Amphiphilic anionic polypeptides based on poly(L-glutamic acid) were used together with the chitosan derivative for polyelectrolyte complexation with protein drug to prepare the protein-polymer nanoparticles as drug-delivery systems, whereas amphiphilic polycationic polypeptides based on poly(L-lysine) showed excellent antibacterial activity versus specific bacterial types.

Different Approaches to the Preparation of Sr Buffered Si (001) Surfaces Using Pulsed Laser Deposition

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A buffer layer based on ½ a monolayer (ML) of strontium (Sr) on silicon (Si) (001) is known to passivate the Si surface, while its surface structure constitutes an ideal template for the integration of various functional oxides with the existing Si technology [1]. While the Sr buffer layer has been conventionally fabricated using Molecular Beam Epitaxy (MBE), the slowness of the deposition process and difficult stoichiometry control of this technique makes it less suitable for the growth of functional oxides [2]. A promising technique that offers tunable growth rates and a well-controlled growth of complex oxides is Pulsed Laser Deposition (PLD), but the preparation and the nanoscale structure of such Sr buffer layers have not been investigated in detail yet.
In this work, we have studied different approaches for the preparation of the Sr buffer layer using the PLD technique. First the native SiO_2 layer was removed by flash annealing to 1200°C, followed by the deposition of ½ ML of Sr on the Si (001) surface in Ultra-High Vacuum (UHV) conditions. Second, to test the influence of soft landing of ablated material on the density of defects in the surface structure, the samples were prepared by Sr deposition in an Ar background gas. In the third case, the native oxide was removed via Sr-induced deoxidation at a lower temperature to decrease the thermal budget of the preparation procedure. The complete removal of the native oxide was confirmed by X-ray Photoelectron Spectroscopy (XPS). The results of unique structural analysis of the surface morphology using Low Energy Electron Diffraction (LEED) and Scanning Tunneling Microscopy (STM) will be presented and discussed. The obtained results will help us to establish an energy efficient procedure to produce well-ordered Sr/Si surfaces with low defect concentration to be used as pseudo-substrates for the epitaxial growth of functional oxides on Si.

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3D natisnjeni modeli za litje prototipov / 3D printed models for prototype casting production

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3D printing is more and more used technology for production of various parts from various materials. This technology can be much faster than conventional technologies but it is not jet appropriate for large scale productions. It is often used for production of prototype parts. There are many 3D technologies known and the most used materials are different polymers. Recently also metal powders can be used for 3D printing but with limited capabilities due to material properties such as contraction factors leading to distortions and stresses, phase transformations, etc.
This work presents the rapid production of prototype parts using 3D technology in combination with investment casting technology. In this way the model of prototype casting was 3D printed by fused deposition modelling (FDM) technology using polylactic acid (PLA) material. In order to produce a casting also running and gating system were produced in the same way and attached to a model of a casting. Whole model was then coated with investment material using ceramic shell slurry and fused silica sand. After drying the investment was burnt in a gas fired furnace to temperatures up to 700 °C to form ceramic shell. During the burning the PLA model was melted and burnt in order to get the investment shell. Afterwards the aluminium alloy was poured into the casting cavity to produce the casting. After solidification the running and gating systems were cut off and the prototype casting was finished.

Isolating Reactions at the Picoliter-scale : Parallel Control of Reaction Kinetics at the Liquid-liquid Interface

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Plasmonic colloidosomes are picoliter water-in-oil droplets constructed from noble metal nanoparticles, typically used as three-dimensional (3D) surface-enhanced Raman spectroscopy (SERS) platforms. Here we utilize plasmonic colloidosomes with Ag octahedra strategically assembled at the water-in-decane emulsion surface as a pico-reactor to perform interfacial protonation of dimethyl yellow at the liquid-liquid interface (Figure 1).[1,2] Our plasmonic colloidosomes can isolate ultrasmall amount of <200 pL solutions, for parallel monitoring of multiple reactions simultaneously.

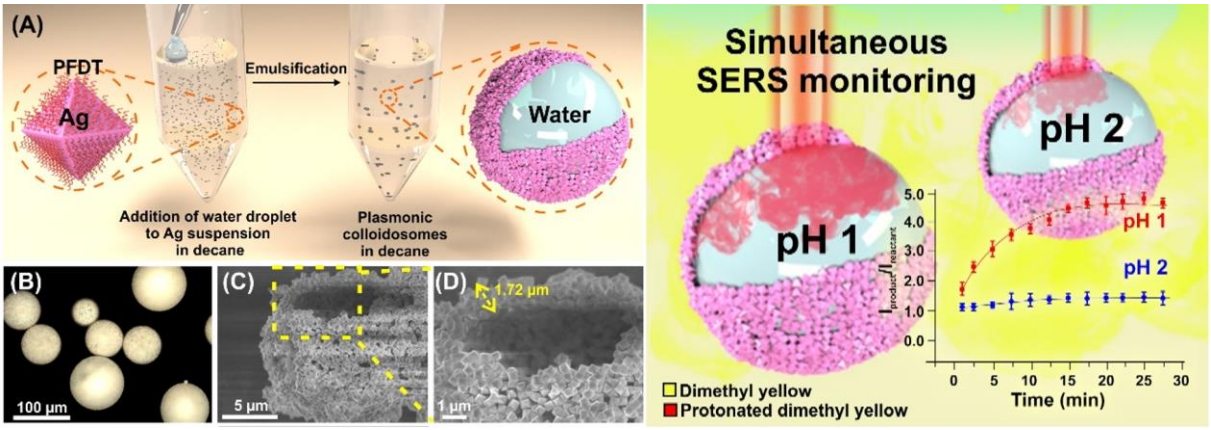

Fig. 1: Plasmonic colloidosomes from Ag nanooctahedra for small-scale reaction monitoring.

Therefore, this dual-phase picoreactor for simultaneous in-situ monitoring of liquid-liquid interfacial reaction feature multiple advantages as a SERS microplatform for small-scale study of interfacial phenomena commonly encounter in the areas of food chemistry, clinical analysis and drug treatment.

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Chemical Structure And Bioactive Properties Of Rutin And Polyrutin

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A flavonoid rutin is a highly potent molecule for wound healing application due to its strong antioxidant, anti-inflammatory and prophylactic activity. A significant limitation of the use of rutin that prevents its widespread application for clinical use, lies in its very low water solubility[1], which could be increased through their enzymatic polymerization.

In this study, enzymatic synthesis of polyrutin was performed in water media, represents a “greener” synthesis of this polymer compare to previous studies dealt only with polymerizations in aqueous organic solvent mixtures. Because the polyrutin properties could be influenced by the reaction media, the chemical structure and bioactive properties of polyrutin synthesized in water media were investigated in detail.

We found that the polymerization of rutin in water media led to a water soluble polymer with a weight-average molecular weight of 14,890 g/mol, where the monomer units are coupled together mostly on the B-rings with the C-O-C bridges without formation of quinones. With the investigation of bioactive properties related to wound healing we found that polyrutin showed only a slightly lower antioxidative activity than rutin together with a beneficial influence on the fibroblast and HaCaT cells proliferation *in vitro* as well as on the wound closure determined *in vitro* with HaCaT cells.

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TiZrNbTaFe High Entropy Alloy for Medical Applications

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The paper considers for the first time a new concept of alloy with high entropy (HEA) for biomedical applications. HEAs are different from the conventional metallic materials by more than five alloying elements, in proportions between 5% and 35% at., which may form simple solid solutions with BCC and/or FCC phases instead of complicated intermetallic ones. These specific features provides HEA with excellent mechanical properties (hardness, strength, malleability), oxidation and corrosion resistance, with potential applications in diverse industrial areas[1-4]. The present tendency in the newest titanium alloys generation is the decrease of elasticity modulus, with the maintaining of high mechanical characteristics[5-7]. M.C.Gao studied TiZrCuNiFe, TiZrCuNiBe, and TiCuNiSnBeZr[4,8] for various technological applications.

Thus, the paper considers the system TiZrNbTaFe for biomedical applications obtained by powder metallurgy (PM) route, because HEAs prepared by PM often show a greater homogeneity in their microstructure compared to the segregated microstructure of melted and cast HEAs. The influence of processing parameters on the microstructure and mechanical properties of the new TiZrNbTaFe alloy were investigated. The final properties of the HEAs could be: modulus of elasticity E < 80GPa, density <7g/cm^3, fracture strength >700 MPA, corrosion resistance < 0,001 mm/an. In addition, the mechanical properties of the high entropy alloy could be improved by sintering at 1250 °C for 2 h. The sintered HEA possesses a lower Young's modulus (about 65 GPa), moderate strength, which shows better mechanical biocompatibility in order to be used as orthopedic implants and to avoid stress shielding and thus prevent bone resorption and implant failure. The mechanical properties of the obtained alloys are better than those of pure Ti and Ti–6Al–4V.

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Plastic Flow at Vicinal Surfaces of Nickel

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Crystalline solids subjected to stresses beyond their elastic limit undergo plastic deformation and subsequently flow. Plastic flow is the continuum description of atomic displacements in a crystalline solid. It involves a wide range of length and time scales, from individual dislocations that move at the nanometer scale to cooperative movement of a large number of dislocations that causes grain boundaries to move at micron scales, ultimately leading to macroscopic response of the solid to applied stresses.

In nanoscale materials, atomic-displacement fields are present to a significant degree already in the elastic regime around discontinuities: grain boundaries, precipitates or surface features, namely steps and islands. Through the displacement fields the presence of the discontinuities is communicated into the surroundings. As the density of the discontinuities is high in nanoscale materials, the emergent displacement fields have an effect on the plastic flow. We show plastic flow in nickel thin films with vicinal surfaces, i.e. consisting of equidistant steps, a system appropriate for studying interplay between dislocations and steps.

Non-Singular Method of Fundamental Solutions for Three-Dimensional Isotropic Linear Elasticity Problems

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The purpose of the work is development of the Non-singular Method of Fundamental Solutions (NMFS) for isotropic linear elasticity problems in 2D and 3D. The NMFS is based on the classical Method of Fundamental Solutions (MFS) with regularization of the singularities. This is achieved by replacement of the concentrated point sources by distributed sources over the sphere around the singularity in 3D instead of the circle in 2D. In case of the displacement boundary conditions, the values of distributed sources are calculated directly and analytically. In case of traction boundary conditions, the respective desingularized values of the derivatives of the fundamental solution in the coordinate directions, as required in the calculations, are calculated indirectly from the considerations of three reference solutions of the linearly varying simple displacement fields. With this, the main drawback of MFS for these types of problems is removed, since the artificial boundary is not present. In order to demonstrate the feasibility and accuracy of the newly developed method, the NMFS solution is compared to the MFS solution and analytical solutions for a spectra of elasticity problems. NMFS turns out to give similar results than the MFS in all spectra of performed tests. The lack of artificial boundary is particularly advantageous for using NMFS in multibody problems. The developments represent a first use of NMFS for 3D solid mechanics problems. They will be used in micromechanics of metal grains in contact.

Cold Atmospheric Plasma Treated Polypropylene Tubes and Their Application in Medical Diagnostics

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Cold atmospheric plasma (CAP) treatment was found indispensable in many fields including medicine. Currently novel diagnostic techniques have been developed, based on detection of microvesicles found in whole blood[1]. Microvesicles can be used as a fingerprint of various diseases including cancer. Currently isolation of microvesicles presents a major drawback due to the fact that the concentration of microvesicles after isolation is very low, as they tend to stick on the surface of medical tools. Improvement of surface properties by CAP treatment was conducted in order to alter surface morphology and chemical structure. Results showed that plasma treatment of Eppendorf tubes (polypropylene) altered surface morphology (Atomic Force Microscopy) and chemistry (X-ray Photoelectron Spectroscopy), while the microvesicle count detected by Flow Cytometer was higher for plasma treated tubes. Thus plasma treatment of medical tools used for isolation could be a prospective method.
Furthermore, it was discovered that tubes from different manufacturers differ greatly and can affect the outcome of microvesicle count detected by Flow Cytometry. Even when untreated, tubes have specific surface morphology and chemistry depending on the manufacturer. Surface finish of tools used to manufacture tubes and fillers added to raw polypropylene all play an important part. Surface etching (nanostructuring) and increase in oxygen functionalities on the surface after CAP treatment by plasma jet was observed and correlated with microvesicle detection.

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Ageing of Al-Mg Alloy

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The purpose of our work was to investigate 5xxx series aluminium alloy AlMg8. Al-Mg binary alloy is becoming popular because of its strength and hardness, which are achieved by natural aging without heat treatment. Equilibrium phase diagram has a convex shape solvus curve, which is a prerequisite for precipitation hardening. By heat treatment, the alignment of Al_8Mg_5 can be achieved throughout the entire grain to prevent the formation of stress corrosion. In most cases alloys are not suitable for precipitation hardening, but good strength properties can be achieved by the fact that the magnesium remains in solid solution, with dispersion and strain hardening.
By measuring the electrical conductivity, it was found that with the aging time, of both naturally and artificially aged samples it decreased due to formation of GP zones. The hardness of naturally aged samples was increasing with aging time up to 288 hours, and then started to decrease. The increase can also be attributed to the formation of GP zones, while the decrease is the result of the β´ phase precipitation along the grain boundaries. Based on the results of electrical resistivity measurements and DSC analysis, we have determined the sequence of microstructure changes in the AlMg8 alloy when heated and it is as follows: α → GP zones → β˝ → β´ → β.

Alloy Development Using Modern Tools

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Considering new demands with respect to performance and properties of modern alloys, alloy development is challenging and will be a continuous challenge in the next decades. The phase diagram is the basis for alloy development, processing (leading to a favorable microstructure) is based on the knowledge on phase selection, growth and morphology of the phase diagram. Up to present, the phase diagrams of most binary alloys and a few hundred ternary alloys have been determined consistently. However, most technical alloys contain more than two or three alloying elements, even more so if the impurities that may exert considerable influence are taken into account.

Conventional alloy development based on trial-and-error approaches has been shown to be tedious and may nowadays be too time consuming considering the rapid change in practical applications. For a new generation of a given alloy generally far more than 100 alloys need to be synthesized and characterized. To achieve such a task in a pertinent amount of time, extrapolation methods and high-throughput methods, each with its own strengths, are at present being developed.

In the presentation it is shown how useful sets of data can be generated systematically, how large concentration ranges can be excluded from experimental studies, and how preliminary data on melting range and mechanical properties can be assessed. A new method of annealing in temperature gradients is introduced that yields information on microstructure and properties in targeted concentration ranges (almost) irrespective of the number of alloying elements. Examples are solder alloys and conventional and active brazes.

Electrochemical Mechanism of C-S Composite Cathode in Mg-S Batteries

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Magnesium-sulfur (Mg-S) batteries are of great interest for future energy storage applications due to non-dendritic deposition of magnesium, high theoretical specific capacity of magnesim and sulfur, abundance of active materials and their low price. Due to problems, including compatibility of cathode, electrolyte and anode, the first report on Mg-S batteries was only published in 2011.[1]

Main challenges in research of Mg-S include self-discharge, capacity fade and high polarization. To properly address these issues, fundamental understanding of the system has to be improved.

In work, presented here, different analytical techniques were employed to obtain better understanding of the mechanism of Mg-S battery and cathode-related processes.

In operando XRD measurements of battery were conducted. Disappearance of sulfur peaks in the sample was observed, which is linked to the redox process at higher voltage. *In operando* XANES on sulfur K-edge and RXES measurements were carried out to test the idea of polysulfides formation, known from the Li-S system.[2] Additional information about electrochemically and chemically obtained MgS samples was obtained using ^{25}Mg solid-state NMR.

Use of *in operando* measurements and additional analytical techniques enabled us to draw some parallels with the better understood mechanism of the Li-S battery. Our results give us an important insight into the electrochemical processes in Mg-S system. These advancements in the fundamental understanding of Mg-S mechanism enable us to more systematically and successfully tackle issues including polysulfide diffusion from cathode, high polarization and self-discharge.

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The Practical Use of E-FMEA Method in the Automotive Industry

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The industry plays an important role in the environment protection. This results a continuous increase of requirements for reducing the negative impact of different technological processes on the environment, including limiting the possibility of potential failures and accidents. For this purpose, the new methods for the risk prevention of negative environmental aspects are proposed. E-FMEA is a very useful and practical method. The E-FMEA tool is already used at the beginning of product or process design as well as for improving existing systems. The E-FMEA method takes into account technical problems, deficiencies or irregularities which influence on the environment.
In the article the practical use of the author's E-FMEA methodology for the automotive industry process was presented.

Uniaxial High Pressure Thermocompression of Cellulosic and Lignocellulosic Materials

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All-cellulose materials were prepared by low moisture and high temperature uniaxial high pressure thermocompression of α-cellulose. Among all tested conditions, best results were obtained at 2%MC and 250 °C[1]. These specimens were orthotropic showing better properties in bending than in tension and revealed a very specific morphology with a more porous heart, a dense but very thin skin on the faces (orthogonal to the compression axis) and thick and extremely dense sides. During the process, the pressure increase involves a severe friction between the fibers resulting in a decrease of cellulose molecular weight while temperature allows to get above cellulose glass transition and is responsible for the migration of water towards the heart of the piece. At a temperature around 200°C it accumulates and provokes delamination when pressure is released but, at higher temperature, water, in a subcritical state, may be consumed during the hydrolysis of the amorphous part of cellulose. Regarding cohesion, most of it comes from the small sides of the test samples (parallel to the compression axis) and seemed to be mainly related to the entanglement of amorphized cellulose at the interface between the particles.
The same process was then applied to various lignocellulosic materials and the influence of their composition and morphology on their mechanical and water-resistance properties was statistically analyzed[2]. Cellulose and lignin contents were, as expected, the most important factors.
Finally the possibility of a chemical grafting during the compression was proved while using only green chemicals (i.e. fatty acid and/or fatty anhydride)[3]. Low degrees of substitution were achieved, they were sufficient to greatly improve the water resistance properties of the specimens but were also responsible for a marked decrease of their mechanical properties. This procedure still needs to be improved to produce in a one-step process hydrophobic materials.

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Rheological Properties of Biorenewable PSA Hydrogels

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Biorenewable pressure sensitive adhesive (PSA) hydrogels were made with the ability of swelling and drug release in order to be used as potential patches for transdermal drug delivery.[1,2,3] The biorenewable approach was achieved by the substitution of acrylic monomers in the basic PSA formulation with the glucose-based vinyl surfmer, i.e. butyl polyglucoside maleic acid ester (BGMAH). Thereafter, PSA hydrogels were prepared from the bio-PSA formulation with the addition of hydrophilic monomers acrylamide (AM) and acrylic acid (AA), and N,N'-methylenebisacrylamide as a cross-linking agent.

Often, the high degree of swelling has a negative impact on mechanical properties of hydrogels. For that reason, the important aspect of our research was the influence of each substance on the mechanical properties (determined by rheological measurements) of the prepared PSA hydrogels. The effect of BGMAH content, AM/AA ratio and the concentration of AM and AA at their constant ratio on the final properties of PSA hydrogels was studied. The dependence of storage modulus against the shear strain is an important rheological property of gels and at the same time also a measure of stiffness, brittleness and elasticity of the hydrogel structure. It was concluded that with the increasing content of BGMAH in PSA hydrogels, the prepared copolymer became more rigid and fragile. In addition, higher storage modulus compared to loss modulus till the flow point indicated on the viscoelastic behavior of the prepared PSA hydrogels. In the case of higher AM/AA ratio, higher storage and loss modulus were achieved indicating the increasing stiffness with the increased AM/AA ratio. The mentioned could be related to the increased crystallinity of the prepared copolymer. Again, the increased concentration of AM and AA at their constant ratio (r = 1.33) lead to the increased stiffness of the copolymer. On the basis of rheological measurements, the compromise between swelling and appropriate mechanical properties of PSA hydrogels for further medical applications could be achieved. Finally, the observed experimental phenomena of the system was implemented by mathematical model in order to predict the rheological properties of the studied system.

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Synthesis and Investigation of NQR-Spectroscopic Characteristics of Trivalent Organobismuth Compounds

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Contrast agents (CA) used in magnetic resonance imaging (MRI) are mostly based on Gd^{3+} compounds. In search of novel, 'smart' CAs with high potential for molecular imaging, certain quadrupolar nuclei with a high spin quantum number (I) have become of interest. A particularly favorable element is bismuth due to I = 9/2, the variety of possible chemical reactions and the low toxicity. We describe the synthesis of different known and novel organobismuth compounds showing a suitable quadrupole transition frequency[1]. In further synthetic steps we found that diarylbismuthamides (Ar_2BiNR_2)[2] due to the high reactivity of the Bi-N-bond as well as bismuth alkyne compounds[3] (Figure 1) are perfect reagents for reactions with different functional groups (e.g. R´OH, R´SH, R´COOH, R´´N_3, etc) I-V. This feature is used to investigate if a formation of heterosubstituted-arylbismuth compounds and bismuth-modified polymers is achievable.

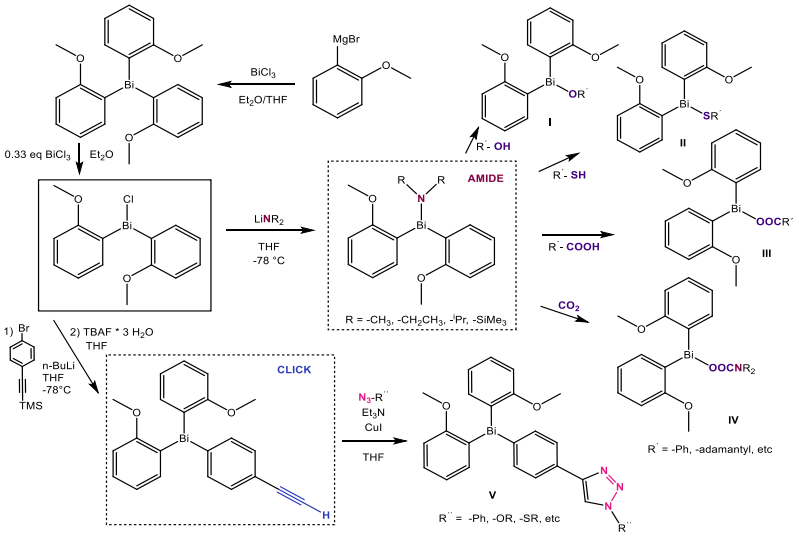

Figure 1 - Triarylbismuth(III)compounds and derivates

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Synthesis of a Bioactive and Degradable 60Poly(35Lactic-co-65Glycoric Acid)/40($85SiO_2$-15CaO) Composite with Dual Pore Structure

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The bone grafting materials must have porous structure because it induces the growth of blood vessels into the material. The salt leaching method is generally used to make porous structure when using the solvent casting method to make ceramic/polymer composites. However, this method is hard to make the connections among the pores. In addition, it cannot be applicable to the process for making nano-composite because the calcium salt, which is inevitable component to produce bioactivity in vivo, is also leached out when washing out the salt after the casting.

Mooney et al. reported the method to produce porous structure in PLGA scaffold by the expansion of CO_2 gas in high pressure chamber. The CO_2 has some solubility in the PLGA. Thus, when the high pressure of CO_2 is applied to the PLGA scaffold and then released quickly, it becomes to expand in the PLGA matrix. Resultantly, the pores are developed at the places where the gas existed. However, the disadvantage of this method is that it is also hard to connect between the pores. Thus, the salt leaching method is combined together to make porous structure. However, there has been no report to apply this method to make a porous bioactive composite material. In this study, we prepared the PLGA/calcium silicate composite by the solvent casting method and then a gradient pore structure was introduced using the expansion of CO_2 gas in a high pressure chamber.

The 60Poly(35Lactic-co-65Glycoric Acid)/40($85SiO_2$-15CaO) composite, which have a gradient pore structure, was newly prepared by the expansion of carbon dioxide gas in the PLGA matrix. The bioactive $85SiO_2$-15CaO (in wt.%) particles were made by a sol-gel method from tetraethyl orthosilicate and calcium nitrate tetrahydrate under acidic condition followed by the heat treatment at 600 ^{o}C for 2 h. The 60Poly(35Lactic-co-65Glycoric Acid)/40($85SiO_2$-15CaO) composite was then prepared by a solvent casting. The composite was loaded into the high pressure chamber and then CO_2 gas was introduced achieving a final pressure of 10 MPa. After 3 days, the gas was released quickly and the gradient pore structure was developed. The samples were observed by FE-SEM and its bioactivity was tested in SBF.

Microstructures and Wetting Behaviour of TMSC and Cellulose Thin Films on Diverse Substrates

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The importance of functional surfaces and microstructures on sustainable bases has risen in the past years. Especially micro-applications as supercapacitors, organic solar cells, filtration materials and protective surface coatings are lately gaining interest. In order to create sustainable bio- and biocomponent thin films the substrate is of a high importance and so far trimethylsilyl cellulose and (TMSC) cellulose layers respectively have so far mostly been investigated on gold slides, glass and/or silicon wafers with a few exceptions.

In this paper other types of substrates which were neglected until now have been under investigation. “Traditional” substrates as glass and silicon; polymeric foils, namely polyamide (PA) and polyethylene terephthalate (PET); metal foils (copper, nickel and aluminium) as well as paper samples (fines and filter) have been successfully coated with TMSC which was later regenerated to cellulose according to the decreasing water contact angles and the vanishing peak of the Si-C vibration at 1250 cm^{-1} in the IR-spectra. The films thicknesses were, if determinable, in the range of 120-140 nm (41-50 nm after regeneration) and had a low roughness. Remarkably even the paper samples were hydrophobized by the silylated compound and the soaking behaviour was lowered drastically. The highest water contact angles of more than 160° were achieved by coating the copper foil which then showed super hydrophobic properties and limited water-oil separation was possible. To investigate the films profilometry and atomic force microscopy (AFM) was done and to follow the regeneration process contact angle measurements as well as IR-spectroscopy were used. Cellulose itself and materials based on it are highly favourable due to their biocompatibility, the easy access, low price and sustainability. The results presented in this paper might open wide fields of new applications for the biopolymer.

Dynamic wear properties of coated tool steel - influence of the substrate hardness and fracture toughness

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Metal processing industry is constantly faced with demands for greater productivity and lower costs, which on the one hand requires better sustainability of working tools and on the other hand the use of cheaper tool materials, elimination of additional processes and cleaning of the products. To achieve these objectives, it is necessary to require the use of less expensive base materials in combination with proper heat treatment and surface modification which provides adequate strength and self-lubricating properties.

Powder Metallurgy steels have a higher toughness but a lower abrasion resistance, which is solved by the use of surface modification techniques. To find an optimal combination of substrate hardness and fracture toughness to be able to carry the protective coating and at the same time withstand the complex stress state is therefore essential.

The aim of this work was to determine the impact of various heat treatment processes and parameters on the substrate hardness and fracture toughness combination and subsequently on the wear properties and subsurface deformation of coated tool steel under dynamic impact loading. Three different cold work tool steels were used as a substrate material and treated with different heat treatment processes with the aim to modify hardness and fracture toughness of steel. TiAlN monolayer with 2 μm thickness was used for all substrates. In order to evaluate impact failure of the coating Ball-on-plate impact fatigue test was designed and used. Rockwell-C adhesion test was used to determine the adhesion of coatings. After the impact tests, wear of the coating was measured and evaluated. Furthermore, using EBSD, effect of impact wear on subsurface deformation was analysed. EBSD was also used to quantify the depth of deformation zone in the subsurface. It was found that hardness and improvement in the fracture toughness have significant influence on the adhesion and impact failure life of the coated tool steel.

Aseptic loosening of hip prosthesis - case report

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Aseptic loosening is the most common long-term problem associated with total hip replacement that can cause pain and instability of the patient. We have investigated the failure of one of the hip endoprosthesis which was retrieved 34 month after the implantation. The patient fell twice on the hip and after that had unpleasant constant pains. X-ray did not show dislocation of femoral head. After revision surgical operation the endoprosthesis was send to sonication and the soft tissue to the histological and microbiological examination. There was no infection detected and it was supposed that the failure was aseptic loosening. Since the most common cause of aseptic loosening can be wear or corrosion it was decided to investigate possible wear and/or taper corrosion.
In order to determine the cause of loosening, taper of the femoral stem and femoral head were investigated. For this purpose chemical composition, hardness, roughness and geometry measurement were performed on the used femoral stem. For comparison new taper of the femoral stem was also investigated. Used stem head was also analysed. The surface microstructure was characterized by SEM/EDS analysis and AES surface analytical techniques. Based on the investigation we can conclude that loosening of the taper didn't result because of the inadequate geometry, hardness or worn material. From the wear marks on the used taper we can conclude that deep scars indicate violent separation of the coupled parts, possibly due to the fall of the patient. Since no material loss was measured on the used taper, we can conclude that after the loosening, movement between the taper and femoral head was not long lasting.

PLA-Crosslinked PVA Porous Microparticles as Carriers of Nisin Bacteriocine

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Novel porous type of core-shell structured microparticles based on polylactide (shell) and poly (vinyl alcohol) cross-linked with glutaric acid (core) prepared by water-in-oil-in-water solvent evaporation technique. The microparticle systems were used as delivery systems for immobilization of model antibacterial agent – nisin. The effect of cross-linking and the initial amount of nisin on their morphology was investigated by using scanning electron microscopy, BET-analysis, zeta potential measurement and Fourier transform infrared spectroscopy. Encapsulation efficiency and release profile of nisin from the microparticles were studied by high performance liquid chromatography. Antibacterial activity of the prepared systems was tested by dilution and spread plate technique. Results showed the microparticles in the size range of 9-16 µm in diameter with spherical multi-hollow core-shell structure. The presence of cross-linking agent glutaric acid influences the release profile of the peptide and has synergistic effect on Listeria monocytogenes growth reduction.

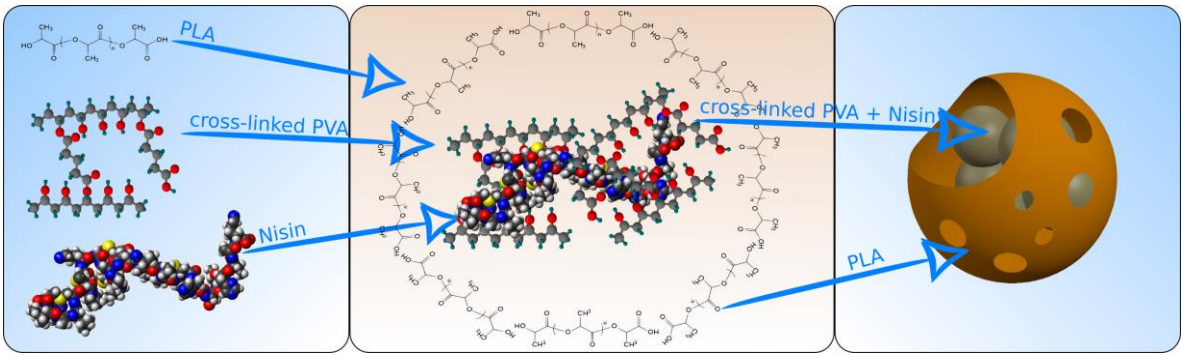

Figure 1. Visualization of the porous microparticles formation and structure.

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Automatic Analysis of Steel Inclusions in Scanning Electron Microscope – Methodological Considerations

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Analysis of inclusions in steels is very important for the technological control of the steel production process. In this contribution, we will present some methodological considerations for automatic particle analysis in the scanning electron microscope.
Particle analysis in the scanning electron microscope, coupled with EDS, can provide a better insight into the distribution, size, shape and chemical composition of the inclusions than the traditional method utilizing an optical microscope. Starting with specimen preparation, the quality of the obtained data is very much dependent on the control of the set-up parameters of the analysis. In this contribution, we will show the effects of surface preparation, microscope set-up and classification of the inclusions for better control of automatic particle analysis in the scanning electron microscope. We will also present some pitfalls and possible solutions to common problems arising with this method.

New Complex Catalysts for Hydrogenation Reactions

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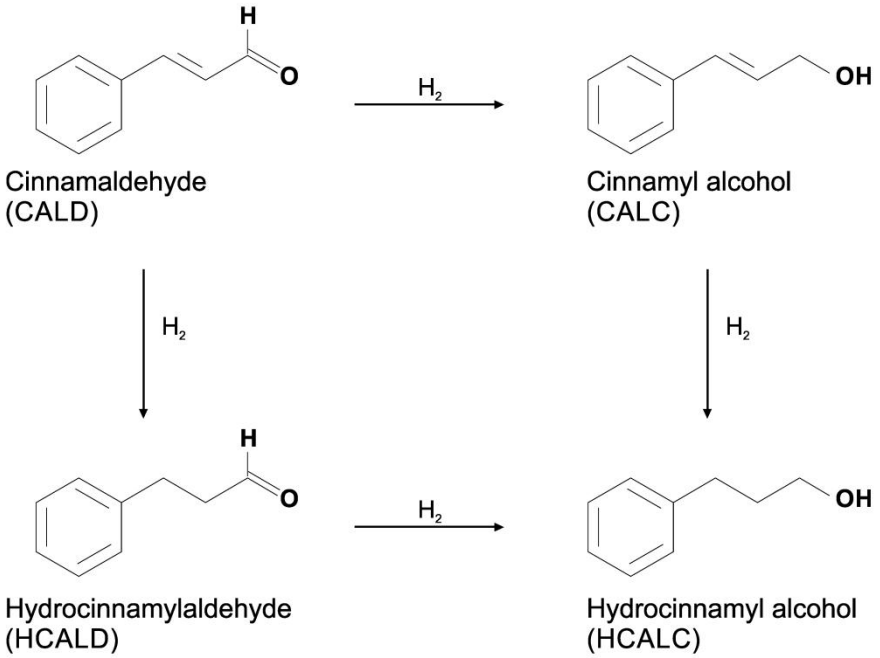
Due to the ever increasing need for new, heterogeneous catalyst, our attention has been directed to the synthesis of the new oxazolidone-isocyanurate matrices based on epoxy resin for metal complex catalysts. The immobilization of homogeneous catalyst $PdCl_2(PhCN)_2$ enable a more accurate and better distribution of the metal complex in a polymer matrix. The morphology, chemical structure of the polymeric supports, the types of binding groups presented in the polymer and condition of immobilization influence on the selectivity of catalytic reactions. The use of these materials provides to obtain low-cost, able to simple separation from the reaction medium and chemically resistant supports which can be used in many areas of chemical technology.



Scheme 1. Hydrogenation of cinnamaldehyde.

Influence of Microstructure and Heat Treatment on Mechanical and Wear Properties of Hot Work Tool Steel

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Hot-work tool steels are used for tools that operate at elevated temperatures and therefore need good mechanical and wear properties to withstand the harsh operating conditions. One of the most important ways to obtain the desired mechanical and wear properties of the steel is applying heat-treatment process, which has a major influence on the microstructure of the material. The steel used is a supreme commercial hot-work tool steel, primarily designed for die casting of light metals and alloys, but it is often used for highly stressed hot-work structural parts where superior toughness is required. It is also recommended for die forging and extrusion.

The investigated hot work tool steel was heat treated at austenitizing temperature of 1030 °C for 15 min in a horizontal vacuum furnace with uniform high-pressure gas quenching using nitrogen gas. After quenching samples were double tempered for 2 h at each temperature. First tempering was at 500 °C for all samples and second was conducted at temperatures 520 °C, 550 °C, 580 °C and 610 °C and 640 °C for each set of samples. Hardness of the samples was measured with a Rockwell hardness machine. Impact toughness tests and tensile tests were performed. Tempering diagram was prepared, plotting hardness and impact toughness as a function of tempering temperature. Different tempering temperatures resulted in different volume fraction and distribution of carbides in the martensitic matrix and consequently in different hardness, impact toughness and tensile strength of tested specimens. In order to correlate microstructure properties with especially abrasive wear resistance, reciprocating sliding wear tests were carried out at room temperature.

Microstructure and wear tracks were investigated by different analysing methods (light optical microscopy, 3D-optical surface profilometry, scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) analysis) and wear test results correlated with the microstructure.

Grain Boundaries of Carbide Particles on Creep Resistant Steels, their Stability and Effect on Creep Rate

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The X20CrMoV12.1 has been widely used for steam pipes in power plants since 1960. It exhibits a good combination of high temperature strength, toughness and creep strength. The microstructure of this steel consists of high tempered martensite with finely dispersed carbide precipitates along the boundaries of ex-austenitic grains and ferritic sub-boundaries. Carbides change their chemical and phase composition as well as their size with time and temperature until equilibrium is reached. During the exploitation the temperature in pipes may locally reach up to 700 °C, while the operating temperature is about 630 °C. At these temperatures the carbide growth occurs which is detrimental for creep resistance. However, this process lasts for thousands of hours. Therefore, we simulated these conditions in the laboratory at higher temperatures to accelerate the process. Using EBSD mapping the carbides' orientational relationships with the matrix grains were determined. The types of the carbides, precipitated during the exploitation, were determined by EBSD technique and confirmed by TEM.

Experimental Investigations Electro-Discharge Mechanical Machining Process of Manganese Cast Steel

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The electrical discharge machining process has been used for more than 60 years. A new type of this method, which employs the tool-electrode in the form of a rotating brush consisting of wires, employed for removing material, has been presented. The electrode is elastically pressed against the machined surface. This modified machining method offers the following possibilities: machining of difficult to cut materials and surfaces of complex shapes, high productivity, easy of process automation. Attention has been given to the statistical relation between the material removal rate and machining conditions. The factors causing the surface roughness of the superficial layer have also been taken into consideration.

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Synthesis of New Aromatic Polyazomethines with Thiophene, Naphthyl and Tetraphenylsilane Moieties in the Main Chain: Thermal, Optical, and Electrical Properties

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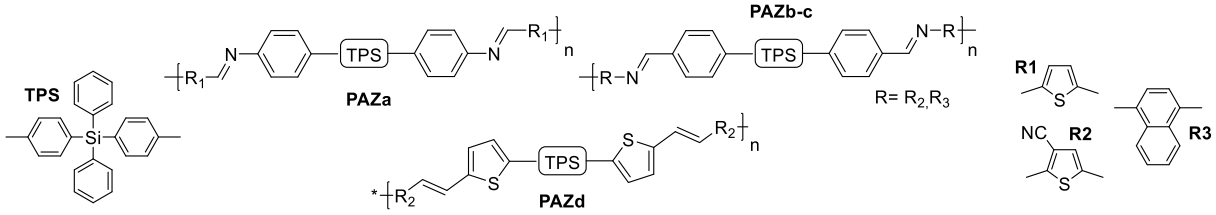
Aromatic Poly(azomethine)s (PAZs) containing thiophene moieties have been investigated in optoelectronic devices like organic solar cells (OSCs) and organic lighting emitting diodes (OLEDs) because their ubiquitous properties like high thermal stability, mechanical strength, and electrical conductivity[1]. Recently, tetraphenylsilane (TPS) has emerged as an ideal group for constructing new active materials for optoelectronic applications[2,3]. In this work is focused on the synthesis of a new aromatic PAZs (PAZa, PAZb-c, and PAZd) containing thiophene, cianotiophene and naphthyl moieties in the main chain. All polymers were synthesized by oxidation of susceptible monomers with ferric (III) chloride under anhydrous conditions[4]. All PAZs show wide UV-Vis absorption range in solution with PAZb showing blue-green solutions at 583 nm (~1.92 eV)[5]. The results suggest that these new polymers with central TPS moieties could be suitable materials for opto-electronic applications like OSCs or OLEDs devices.



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Blend Biopolymer Thin Films

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In this contribution we present our recent findings in the preparation of a variety of different blend thin films composed of biopolymers. In particular, the manufacturing and characterization of amphiphilic bicomponent thin films composed of hydrophilic cellulose and a hydrophobic biopolymer (lignin esters and polyhydroxybuytrates in different ratios is presented. Besides detailed characterizations of the films and mechanisms to explain their formation, non-specific protein adsorption using bovine serum albumin (BSA) onto the films was studied using a quartz crystal microbalance with dissipation (QCM-D) and surface plasmon resonance spectroscopy (SPR). Further for a few examples, their enzymatic degradation using either cellulases or polyhydroxybutyrate depolymerase is studied using video AFM. The enzymes selectively degrade one biopolymer while the other one remains unaffected.

The effect of long-term aging on the degradation of the alloy properties the Inconel 740H alloy

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The Inconel 740H alloy is used in the construction of pressure components of ultra-supercritical operating parameters. The paper presents the results of microstructure and mechanical parameters analysis for 10,000 hours at 700 and 750 °C. Microstructure studies were made using scanning and transmission electron microscopy. Identification of precipitations was made using X-ray analysis of phase composition. The influence of ageing time on changes in microstructure and the precipitation process of the tested alloy, where there are changes in mechanical properties, were described. Presented research results are a materials characteristic of new generation materials, which are used in the design of elements of pressure parts of boilers and diagnostics work during operation.

Microstructure Inhomogeneities of Pulse-Laser-Modified AlSi12CuNiMg Alloy

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An AlSi12CuNiMg alloy substrate was surface modified using pulsed-laser cladding with a ceramics mixture of TiC/TiB_2/Al to increase the hardness of the surface layer. In order to optimize laser cladding using pulsed-laser procedures, especially to prevent failures of the cladding, a systematic metallographic ex-situ characterization can give a lot of valuable information about the effects of the process parameters on the resulting microstructure and hardness. In this study, a TiC/TiB_2 cladded layer was produced by laser scanning over a pre-placed TiC/TiB_2/Al powder mixture on an aluminum alloy using a Nd:YAG pulsed laser. The decreasing of EEDV influences larger scattering of cladded-layer thickness, whereas the increase of EEDV influences the decrease of its surface roughness. The average hardness of the 0.1 mm thick layer was 400 ± 10 $HV_{0.3}$ which confirmed an improvement in surface mechanical properties. Using proper chemical etching and light microscopy, the laser-affected features, i.e., the penetration depth, the melt pool, its boundaries and various inhomogeneities, could clearly be distinguished. The sensitivity of the etchant to the morphological and compositional differences is confirmed by FE-SEM/EDS analyses and microhardness measurements. This additional information suggests that conventional methods are still very well suited to characterizing laser-surface-modified aluminum specimens.

Local Mechanical Properties of Irradiated Crosslinked Filled Poly (butylene terephthalate) (PBT)

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Poly (butylene terephthalate) (PBT) is a versatile engineering thermoplastic that is used for many industrial/commercial applications, and which often is processed by injection molding due to a favored flow characteristics. With a melting temperature around 220 °C and a glass transition temperature near 45 °C, this polymer is often found in electrical and automotive applications. Both the excellent physical properties and the challenging design drawbacks of PBT are due to the inherent semicrystalline microstructure. During injection molding, this semicrystalline microstructure forms under shear and thermal gradients, typically leading to the development of variable morphologies between the skin and core, with subsequent implications on the property profile [1].
Cross-linking is a process in which polymer chains are associated through chemical bonds. Cross-linking is carried out by chemical reactions or radiation and in most cases the process is irreversible. Ionizing radiation includes high-energy electrons (electron beam - β-rays). These not only are capable of converting monomeric and oligomeric liquids into solids, but also can produce major changes in properties of solid polymers.
The engineering polymers are a very important group of polymers which offer much better properties in comparison to those of standard polymers. Both mechanical and thermal properties are much better than in case of standard polymers. The production of these types of polymers takes less than 1 % of all polymers.
The influence of high doses of beta radiation on the changes in the structure and selected properties (mechanical and thermal) polymers were proved. Using high doses of beta radiation for filled Poly (butylene terephthalate) (PBT+25 % GF) and its influence on the changes of mechanical properties of surface layer has not been studied in detail so far. The specimens of Poly (butylene terephthalate) (PBT+25 % GF) were made by injection moulding technology and irradiated by low doses of beta radiation (0, 33, 66 and 99 kGy). The changes in the microstructure and micromechanical properties of surface layer were evaluated using FTIR, WAXS and instrumented ultra nano-hardness test. The results of the measurements showed considerable increase in mechanical properties of Poly (butylene terephthalate) (PBT+25 % GF) (indentation hardness, indentation elastic modulus) when the high doses of beta radiation are used [1,2].

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Photo(electro)catalytic Degradation of Reactive Red 106 Dye

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Reactive Red 106 dye is a red dye often used in textile industry. Since it is an azo dye, it is poorly biodegradable and therefore requires a more advanced treatment method for its successful degradation. The main goal of our study was to determine the efficiency of photocatalytic, electrocatalytic and photoelectrocatalytic processes for discoloration and degradation of this industrial pollutant. For this purpose, we designed and assembled a photoelectrocatalytic microreactor with immobilized TiO_2 photocatalyst. The active part of the microreactor was made of TiO_2 nanotubes grown on titanium coils by anodic oxidation process. The photocatalytic, electrocatalytic and photoelectrocatalytic activity of microreactor was investigated by measuring the discoloration and degradation of Reactive Red 106 dye at different flow rates, initial dye concentrations, UV light intensities, applied external electrical potentials and supporting electrolyte conductivities. All the samples were analyzed with a high-performance liquid chromatography apparatus (HPLC) and with a high-precision UV-Vis-IR spectrophotometer. The results were used to describe the reaction mechanisms and governing phenomena occurring inside the microreactor with the help of a mathematical model. It was found out that the most important parameter influencing the degradation rate was applied electrical potential. Complete discoloration of the dye was only achieved at low enough initial dye concentration and/or at low flow rates through the microreactor.

Simulation of Industrial Solidification Systems Under the Influence of Electromagnetic Fields

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A comprehensive, multiphysics, multiscale, meshless numerical model is developed for the simulation of (I) direct-chill casting under the influence of a low-frequency electromagnetic field, and (II) continuous casting of steel with electromagnetic stirring. The model is capable of solving temperature, velocity, concentration, deformation and stress fields and can predict chemical inhomogeneities, hot tearing and porosity formation. It is based on the mixture-continuum formulation. k-epsilon turbulence model is used to incorporate the turbulence in the melt. The electromagnetic-induction equation used to calculate the Lorentz force, which describes the influence of the electromagnetic field on the fluid flow.

At the micro level, the normal distribution and Kurz-Giovanola-Trivedi model are used to determine temperature dependent nucleation rate and grain growth velocity, respectively. Meshless point-automata algorithm is applied to implement nucleation and grain growth equations.

The involved partial-differential equations are solved with either diffuse approximate or radial basis function collocation method. The boundary conditions for the heat transfer and fluid involve all important phenomena and incorporate the geometrical complexity of the casting device. The use of a meshless method and the automatic node-arrangement generation made it possible to investigate the complicated flow structures in geometrically complex inflow conditions, including sharp and curved edges, in a straightforward way. A time-dependent adaptive computational node arrangement is used to decrease the calculation time.

The model is demonstrated by casting simulation of round aluminium billets for Impol company and square steel billets for Štore-Steel company. The effects of electromagnetic force on the temperature, liquid fraction, fluid flow, macrosegregation, stress and strain fields are investigated along with hot-tearing susceptibility and porosity formation.

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Synthesis and Chemistry of the New Rubidium-oxofluoroaluminate Material

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One important area of solid state ionics is the search of new solid ionic conductors. This has led to the synthesis of a number of solid electrolytes with high conductivity due to various ions, in particular to monovalent alkali-metal cations[1].

Thereof, the scientific objectives of the present work were focused on the synthesis and chemistry of the new rubidium-oxofluoroaluminate compound and on the description of the ionic structure of $RbF–Al_2O_3$ native fluoride system. The part of phase diagram of this system was examined by thermal analysis method. It has been defined as a quasi-binary system, denoted as stable diagonal section of the ternary reciprocal system $RbF–Al_2O_3–Rb_3AlF_6–RbAlO_2$. The demarked individual phase fields were identified by MAS NMR spectroscopy X-ray diffraction methods. Their combination provides a more precise identification of the different phases formed on cooling. The pure reference compounds α-Rb_3AlF_6, $RbAlO_2$, $Rb_2Al_{22}O_{34}$, and $Rb_2Al_2O_3F_2$ were prepared and characterized by X-ray powder diffraction and various solid state NMR techniques, including MQMAS, REDOR and D-HMQC. The formation of a new phase $Rb_2Al_2O_3F_2$ was observed. A ^{85}Rb-^{19}F and ^{27}Al-^{19}F 2D D-HMQC-HETCOR NMR experiment performed on $Rb_2Al_2O_3F_2$ revealed the existence of two distinguishable rubidium sites, one aluminium in fourfold coordination and one fluorine atom.

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Microstructural Changes of ECAP Processed Magnesium Alloy AZ91 During Cyclic Loading at Different Stress Amplitude Levels

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In this paper, the microstructure of extruded and further ECAP processed magnesium alloy AZ91 was analysed. The microstructure was observed before and after cyclic loading at different stress amplitude levels using EBSD analysis. Based on experimental data and the nature of S-N curve, the fatigue limit of 176 MPa was determined for 10^7 cycles. Regarding fatigue limit, samples tested at the levels of stress amplitude of 160, 180, 200 and 220 MPa were selected for further microstructural analysis. Changes of three parameters were compared: average grain size, number fraction of low angle boundaries (LAB) and kernel average misorientation (KAM) parameter, which is connected with local lattice distortion.

According to EBSD analysis results, the changes of grain size were rather insignificant except of samples loaded to 180 MPa, which exhibited slight grain coarsening (Fig. 1a) and certain level of microstructure anisotropy. Compared to that both LAB and KAM changes exhibit some trend, both decreased at 160 MPa but started to increase with higher stress amplitude (Fig. 1b, c).

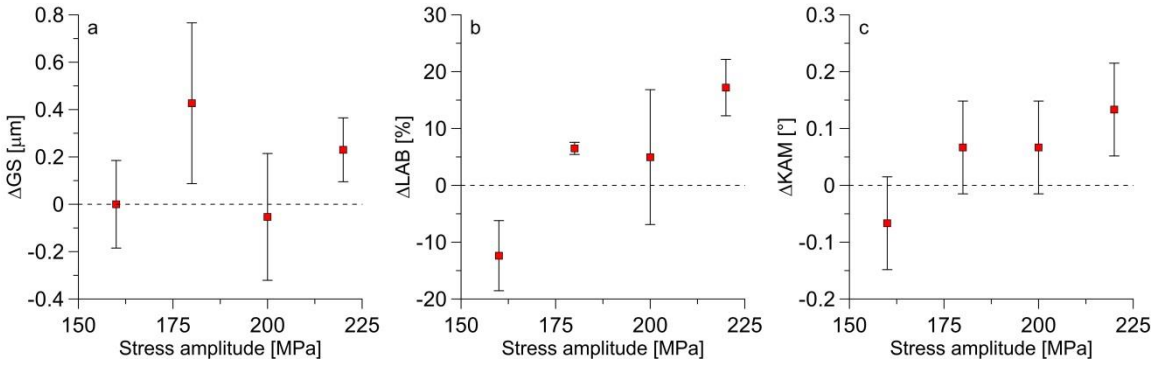

Fig. 1: Average changes of: a) grain size, b) LAB number fraction, c) KAM

The decrease of KAM is strongly connected with the decrease of LAB fraction and could be attributed to dynamic softening processes. These processes could be observed during cyclic loading of a various UFG materials at lower levels of alternating stress. At these conditions, dislocation accumulation, which usually counteracts softening processes, is not probably strong enough. Dislocation accumulation became stronger at higher stress levels and led to overall increase of both KAM and LAB fraction (Fig. 1). This common assumption is supported by performed image quality (IQ) analysis, which indicated increase of IQ with increasing stress amplitude (the value of IQ can be connected to overall dislocation density on the qualitatively level).

Use of Diels–Alder Chemistry for Self-Healing Applications in Epoxy Materials

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One of many principles for self-healing of polymer materials is based on chain mobility. This principle works well within a thermoplastic materials, but is regarded as inadequate for self-healing applications in the thermoset materials, mostly due to restricted chain mobility.
In our study we were interested, how the incorporation of small molecules with potential self-healing abilities into thermoset polymer matrix would affect the mechanical and self-healing properties of the matrix material. For the purpose of a small molecule system with potential self-healing ability furan/maleimide system was used. The polymer matrix was represented by the epoxy-amine system, while the Diels-Alder adduct was incorporated into this polymer matrix.
Samples were prepared according to the procedure: homogenization of 3-(furan-2-ylmethyl)-8-methoxy-3,4-dihydro-2*H*-benzo[e][1,3]oxazine (Gf) and *N*-phenylmaleimide (PMI) in stoichiometric amount was performed in the acetone. Afterwards the mixture was heated at 90 °C for 1 hour, at which point Poly(Bisphenol A-*co*-epichlorohydrin) with molecular mass 377 g/mol (EP-377) and 1,6-hexamethylenediamine (HEDA) in the molar ratio of 2:1 were added. Reaction mixture was once again homogenized with the help of acetone, afterwards acetone was evaporated and the remaining viscous oil was poured into the silicon moulds. The resulting specimens were cured at 70 °C for 17 h
For the purpose of self-healing evaluation, the specimens were processed into compact tension (CT) geometry and fracture toughness analysis was performed, while mechanical properties were evaluated with the help of DMA analysis.

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Modelling of Transient Temperature Field in Plastics During Laser Cutting

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The topic discussed in this article is focused on the thermal transmittance after transition of the laser beam cutting of the polymeric materials. At a small distance from the cutting edge, there can occur various structural and chemical changes due to the heat transfer to the material.
Some influence zone arises, which can play significant role regarding the product capabilities. For intent of the detection of the effected zone width the models of transient temperature field were arranged, representative the distribution of temperature in the vicinity of the cutting edge.
Temperature functions of material properties were considered, with aspect of extensive dependences of mechanical behavior of polymers.

Characteristics and Modification of Nanometric Polycaprolactone/Cellulose Thin Films and its Influence on the Growth and Viability of Human Primary Endothelial Cells

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Biomaterials like polycaprolactone (PCL) and cellulose are the most promising substrates for tissue engineering. The surface chemistry of these materials plays a crucial role since it governs protein adsorption, cell adhesion, viability, degradation, and biocompatibility. Thin films of PCL, cellulose and their blends featuring a smooth topography can preferably be applied to study the protein- or cell-surface interaction *in-situ* by state-of-the-art surface-sensitive analytical methods. The knowledge gained from these methods can lead to the fabrication of tailored cellulose-based interfaces by polymer blending. The interfaces designed in this way yield spatially resolved structures, wettability, charges and chemical composition, which subsequently allow to create a targeted adsorption of proteins and cells, leading to highly functional PCL/cellulosic materials. In this talk, the interaction of newly developed micro- and nano-structured surfaces with blood plasma proteins or extracellular (ECM) proteins and their influence on the viability and growth of human primary endothelial cells will be presented.

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Identification of Cr_2N-type Nitrides and $Cr_{23}C_6$-type Carbides in 2101 Lean Duplex Stainless Steel

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The 2101 lean duplex stainless streel was designed mainly for light-weight constructions and as a more economical substitute for the dominating stainless steel grades. Compared with other duplex stainless steel, the corrosion resistance and cost of processing the 2101 duplex stainless steel are usually worse, as the Ni and Mo contents are lower. It is compensated by higher N and Mn contents to stabilize austenite. At lower test temperatures precipitation of different phases were found, so different annealing experiments were done to further investigate the precipitation occurrence. As the composition of lean duplex stainless steel differs from that of conventional duplex stainless steels, a different aging behaviour is expected. The embrittlement of 2101 lean duplex stainless steel occurs at approximately 700 °C to 750 °C because of the precipitation of the deleterious Cr_2N and $M_{23}C_6$ at δ/γ and δ/ δ interfaces, which begins after a few minutes of aging. The purpose of the research was to work out the qualitative analysis of phases in lean duplex stainless steel after thermal aging. Optical and scanning electron microscopy were used to investigate structural stability and chemical composition of the phases.

Biorefinery Activities In Austria – On The Example Of The Research Initiative Flippr

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Biorefinery is an upcoming issue in several industrial sectors. Producers and converters of products focus on the accessible raw material resources. Biorefinery is expressing the synergy of the activities of a conventional refinery (big scale, screening, purifying), based on a renewable feedstock like wood or agricultural crops and will secure the raw material supply for a bio based industry.
In Austria political and industrial activities are running to address the issue of biorefinery research and development.
This talk will focus on the activities of the Flippr consortium around wood-based biorefineries of pulp and paper mills. In 2013 four company partners and three universities built the Flippr consortium. Flippr stands for *Future Lignin and Pulp Processing Research* and named a nationally funded research project.
Pulp is the main product of the pulping industry at the moment, beside that several side products developed over the recent years. Flippr develops valuable applications[1] for black liquor and it's lignin as well as new applications for fines – small cellulose material which arise during the pulping process and are not obligatory for every pulp based product.
Several scientific competences are required to reach these ambitious targets. In Flippr chemists, chemical engineers, paper & pulp experts, process & particle engineers and economists together defined a work plan. During lab scale trials engineers and company partners already think about industrial implementation. In parallel the economic value and process costs are estimated.

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Use of Composite Materials for External Fixators

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This article focuses on ring (Ilizar) external fixators in traumatology and orthopedics. External fixator is a construction system that is used in the treatment of complicated or infected fractures of long bones, shortening and extension of bones, correction of angular deformations and similar applications. The engineering-biomechanical aspect is a critical perspective, taking into account the recommendations of medical specialists, the design of materials for the fixator components, the development of surface treatment methods, and the optimization of proposed concepts and the implementation of experimental verification.

The frame of the circular fixator consists of outer rings and K-wires. This type of variable-position fixator is frequently used in the management of tibial fractures. It is located outside the human body for several weeks to months. The external fixation method allows continuous treatment of the wound site and the patient is mobile after a few days.

The surgical steel external fixators are found heavy for the patients. By replacing some of the metal components of the fixator composite material, such as e.g. a ring frame can be achieved overall lightening of the entire structure. In addition, carbon or hybrid carbon / aramide reinforcement composites have excellent mechanical properties such as high stiffness, high strength and low density. A suitable matrix selection is to obtain a composite material which has high chemical resistance and resistance to thermal deformation. These have excellent properties and others, such as high impact strength, make the composite a material suitable for orthopedic applications and surgical procedures.

The aim of this paper is to present the practical experience and the results obtained during the cooperation of medical specialists and engineers (overview of used materials, design, laboratory experiments, modeling of finite elements) and to design a metal external fixator using composite materials in combination with a polymeric matrix.

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Multicomponent nanostructured Nd-Fe-B permanent magnets prepared by Spark Plasma Sintering technique

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Rapidly solidified nanostructured Nd-Fe-B melt spun ribbons have unique magnetic properties not obtainable with the conventional powder metallurgy. Due to the grain size that is of the order of the single-domain size, the room temperature coercivity is much higher than the values of sintered magnets with similar composition, where the grains are a couple of orders of magnitude larger. This works even in the case without the addition of the critical heavy rare earth (HRE = Dy or Tb) elements. The temperature coefficient of coercivity is smaller, which effectively increases the performance of the magnet at high temperature.
Some applications (e.g. traction motors for electric vehicles and electric power steering motors) require a high coercive force since the magnets operate at high temperatures and experience large demagnetizing fields. Since some parts of the magnet are more exposed, the local reversal of magnetization leads to the overall reduction of magnetic flux density. To improve performance, HRE elements are added to the alloy to increase the magnetocrystalline anisotropy of the hard magnetic $Nd_2Fe_{14}B$ phase. Since the magnetic moments of the HRE atoms couple antiparallel to the Fe moments, the remanent magnetization is reduced consequently.
We present a new approach to achieve the resource efficiency and to minimize the loss of the magnetic flux density without degrading the performance of the magnet. We used “Spark Plasma Sintering” (SPS) technique to prepare a multicomponent magnet containing regions with different magnetic properties. For this purpose, a Dy-free nanostructured powder was used in combination with a Dy-containing powder. We showed that this type of magnets could be manufactured in a single step by stacking both powders in the desired manner while avoiding mixing or by placing the pre-sintered parts with respective magnetic properties together and applying a short SPS consolidation step. Short processing time and low consolidation temperature of the SPS process limit the grain growth and prevent the diffusion of Dy into the Dy-free part of the magnet. The results indicated that the magnetic properties of the respective starting powders were preserved in a multicomponent magnet. SEM and EDX analysis of the interface revealed that the microstructural characteristics and compositions of the respective parts were comparable to the single component magnets prepared from the individual powders.

Pulsed-Electric-Current-Sintered Ti-CNT Metal-Matrix Composites

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Titanium has the highest strength-to-density ratio of all the metallic elements. When unalloyed, its strength is similar to that of some steels, being twice as strong as aluminium, but only 60 % denser. The excellent corrosion resistance, in addition to the high yield strength of the material, is one of the major reasons for the commercial interest in this metal. This means that titanium and its alloys are used in application areas where either corrosion resistance is important, like the chemical industry, or in aeronautics, where the weight savings and high strength are the key features. Further improvements in these properties can be achieved by utilizing the formation of titanium-based metal-matrix composites with carbon nanostructures, like carbon nanotubes (CNT), since they possess an extremely high thermal conductivity coefficient and have extraordinary electrical and mechanical properties.

Spherical, commercially pure, titanium particles, with diameters averaging ~ 100 μm, were mixed with carbon nanotubes in accordance with (1-x)Ti–(x)CNT, where x = 0.1, 0.2, 0.5 and 0.75 wt %. The mixing was performed in a planetary ball mill with a rotation speed of 300 rpm for 2 hours and a ball-to-powder ratio of 20. Stearic acid (2 wt %) was added to the mixture in order to promote the mixing of the two phases. The obtained composites were then sintered with a pulsed-electric-current sintering device at a temperature of 850 °C and an applied pressure of 16 kN for a duration of 10 minutes.

The microstructures of the compacts were analyzed with optical and scanning electron microscopes and their Vickers hardness values were measured according to the SIST EN ISO 6507-1 standard. The densities of the compacts were measured using Archimedes' method. The results show that the compacts were fully dense and that the Vickers hardness increased when more binder phase was added.

Electrodeposition and electro-catalytic properties of Ni based nanomaterials for formaldehyde detection in alkaline media

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In this study we used KOH-modified Ni electrodes (films and nanowires) for the electro-oxidation of formaldehyde (HCHO), which are promising to be used as effective electrochemical receptor element. Ni ''films'' were deposited on Au substrates by the electro-deposition from acidic and neutral $NiSO_4$-based solutions with subsequent modification in 1 M KOH. From the SEM results we found out that pH of Ni^{2+} solution affects the morphology of the deposited films. Under acidic conditions homogeneous Ni film was formed, but under neutral conditions porous Ni film was deposited. Ni nanowires (200 nm diameter, ~1 μm length) were prepared with template-assisted electrodeposition into alumina templates. After the electro-deposition of the nanowires, the template was removed in 10 M solution of NaOH in order to get free standing wires.

The modification step with KOH is very important for the further investigations of HCHO oxidation, because $NiO(OH)/Ni(OH)_2$ redox couple exhibits high catalytic activity towards HCHO. The electro-catalytic activity of modified Ni nanowires and Ni films (Ni-OOH) for formaldehyde detection in alkaline media was investigated via a series of electrochemical measurements. The potential range for modification in KOH has to be chosen in the region where oxygen does not form (the maximum potential 0.6V), because molecular oxygen can be adsorbed on the electrode and inhibits further oxidation of HCHO [1].

Experimental results show that the 2D and 1D Ni-based electrode (nanowires and films) displays a remarked electro-catalytic activity for the oxidation of HCHO and exhibit a linear relationship in a concentration range from 1 mM to 0.5 M. An oxidation peak was obtained at potentials around 0.5 V vs. Ag/AgCl for concentrations 1 mM – 0.1 M and around 0.8 V vs. Ag/AgCl for concentrations above 0.1 M. Results showed that the reaction of the electro-oxidation most probably proceeds by a chemical reaction with NiO(OH) as shown on Scheme 1. The experimental data further reveal that Ni nanowires exhibits a higher sensitivity (approximately 7x higher) compared to the homogeneous and porous Ni electrode, because the slope of the curve current signals vs. concentrations reached higher value. The detection limit was 0.1 mM for Ni nanowires, 0.4 mM for porous Ni film and 0.5 mM for homogeneous Ni film. It was concluded from results that Ni nanowires exhibit a higher catalytic activity due to the larger surface to volume ratio and connected higher amounts of adsorbed –OOH groups on the surface that promote the electron transfer between receptor elements and HCHO molecules.

$$NiO(OH) + \text{formaldehyde} \rightarrow \text{oxidised formaldehyde} + Ni(OH)_2$$

Scheme 1: Formaldehyde oxidation on modified Ni electrodes

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Insights into the steel-rubber adhesion

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The performance of many rubber products such as radial tires, handrails, hydraulic hoses etc. strongly depends on the adhesion of the rubber to the reinforcing material i.e. steel wires or cords. Because of the low direct binding of steel to rubber, the adhesion is achieved in most cases by a thin brass or zinc layer. Therefore, rubber-brass adhesion is a critical issue in rubber technology. The adhesion performance is, thereby, strongly influenced by the properties of the rubber mixture as well as the brass surface. Due to the strong adhesive strength of the rubber on the wire, it is very difficult to access the adhesion interface directly.

In this contribution we will give an introduction of the bonding mechanism between brass and rubber and will discuss different methods how to characterize this adhesion interface. For example, using olefin metathesis sulfur crosslinked rubbers can be selectively degraded using modern ruthenium catalysts resulting in the uncovering in the underlying metal surface, which is now accessible for further detailed characterisation.[1] Other appraoches are the filter paper method and the squalene method. In the latter case, a model system using squalene as liquid analogue to natural rubber simulates the formation of the adhesion layer by the reactive sulfur species during vulcanization. Pros and contras for the different methods will be discussed.

A detailed investigation of this adhesion layer is the basis for subsequent optimization of the rubber metal bonding.

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Resolution of EBSD in Light Metals: How good are we?

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Checking and further improving the spatial resolution of electron backscatter diffraction (EBSD) technique is of importance in measuring the minimum size of observed regions in orientation measurements in a scanning electron microscope [1]. However, in case of EBSD, spatial resolution is different for directions along the tilt axis and perpendicular to the tilt axis, since the shape of the electron interaction volume is anisotropic. Spatial resolution is also dependent on the energy of the primary electron beam and the atomic number, and it varies significantly from light metals to heavy metals. The resolution of heavier metals is higher than its lighter counterparts [2,3]. In the present work, we investigated the spatial resolution of EBSD in a wrought magnesium alloy namely WE43 as a function of varying beam energy. Resolution was compared for the grain boundaries parallel and perpendicular to the tilt axis of the specimen. In addition, atomic force measurements were performed along the grain boundaries for checking the grain boundary curvatures and its effect on the final spatial resolution.

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Surface Treatment of Stainless Steel and Its Effect on Gas Flow Conductance

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Knowing the precise value of conductance of elements (e.g., tubes and orifices) in vacuum systems is of great importance in vacuum metrology, as well as in industrial applications. It is defined, at pressure difference Δp, as $C = \frac{q_{pV}}{\Delta p}$, where *pV*-flow rate of gas from the chamber with a volume *V* equals to $q_{pV} = V\frac{dp}{dt}$. Conductance of tubes depends not only on their geometry and dimensions, but on the surface conditions of tube's inner surface as well. Theoretical calculations of tube conductance are based on assumption of cosine law of molecular scattering on the surface. However, surface roughness and coverage with adsorbed molecules cause deviations from the cosine law and consequently influence tube conductance. Currently there are no models to estimate real scattering conditions on technical surfaces. Aim of our work is to evaluate possible deviations of molecular scattering from cosine law caused by different treatments of surface of stainless steel, which are common in vacuum technology. A system for precise measurement of tube conductance with the pressure decay method was built and conductance of a long stainless steel tube of length 77 cm and diameter 0.77 cm was measured at pressures ranging from 0.1 mbar down to 1e-5 mbar (from viscous to molecular flow regime). Conductance was measured for several gases: helium, methane, neon, nitrogen, argon and krypton. A sequence of surface treatment procedures of the tube's inner surface was performed and conductance was measured at every step. First, the tube was heated and exposed to oxygen. Next, the tube was only heated, and finally, it was heated and exposed to hydrogen. Every step was done overnight, where the temperature of the tube was kept at 300 °C. Oxygen and hydrogen pressure was kept at 3e-3 mbar. The largest change in conductance for all gases occurred after oxidation, bigger than 1 %, where the largest was 13 % for helium. All subsequent steps produced changes below 1 %.

Tailoring Surface Properties of Polypropylene Used for Food Packaging

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Commercially available polypropylene foil with acrylic coating was modified by treatment in the afterglow of oxygen plasma created in MW surfatron. A correlation between the fluence of oxygen atoms to the surface and the surface finish was investigated. A density of oxygen atoms was adjusted by changing the effective pumping speed and oxygen leak rate in such a way that the pressure was kept constant at 20 Pa. The microwave power was set to 200 W. The surface wettability of the samples was determined by contact angle measurements and chemical modifications by X-ray photoelectron spectroscopy (XPS). We found that the oxygen concentration determined by XPS increased as a logarithm of the O-atom fluence, whereas the water contact angle at first decreased with increasing fluence but then it stabilized.

A novel mathematical description of hot deformation stress-strain curves for steels

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Hot deformation test carried out on TA Instruments 805 D/A deformation dilatometer were base for an alternative mathematical description of stress-strain curves. Samples are cylindrical 10 mm long and with a 5 mm diameter.

Experimental setup provides dense data of strain stress (ϕ, σ) curve, which enable wide range of numerical model approaches. Laplacian transformation is for decades used in analysis of various dynamical systems (mechanics, electronics) and is therefore tested. Since several phenomena concurrently take place during hot deformation in steel, their interaction and some of them alone exhibit inherently dynamical nature, Laplacian transformation is used for description of (ϕ, σ) relationship in *s* space as transfer function.

Obtained transfer function is of lumped-parameter type and therefore resulting models enable fast computations. Transfer function parameters are determined by numerical optimization technique. Obtained model accuracy is mostly below 1 % and therefore method seems promising.

Interesting Formation and Properties of Some New Dynamic Polymers

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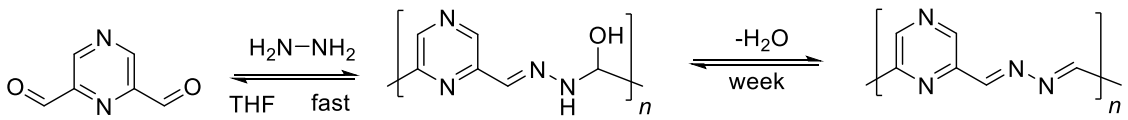
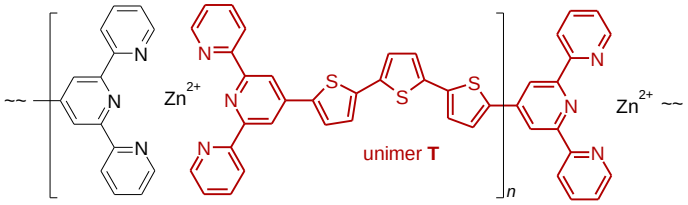
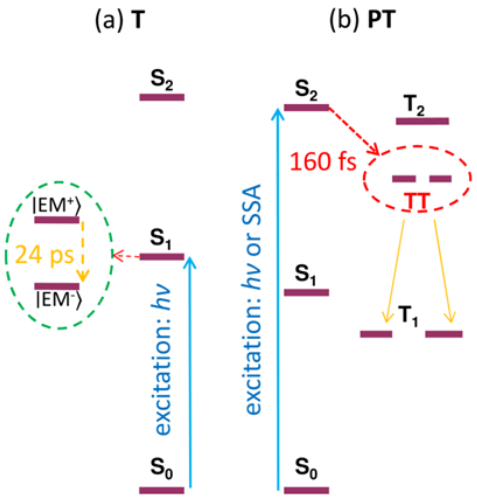
Constitutional dynamic polymers (CDP) are polymeric entities whose chains are composed of units linked together by reversible covalent, coordination or supramolecular bonds.[1] Stability of CDPs is effectively controlled by the thermodynamics of the system. Thus they can reversibly dissociate and re-assemble depending on conditions such as temperature, solvent or pH, which gives them processing advantages, responsiveness to external triggers and possibility of self-healing and post-polymerization tuning the properties.
This presentation will report: *(i)* mechanism of formation of covalent CDPs with alternating pyrazine and hydrazine of diamine units linked via hemiaminal and azomethine linkages:



and *(ii)* preparation and properties of metallo-supramolecular CDPs composed of conjugated blocks comprising thiophene, fluorene and phosphole units[2-5] with and without ionic side groups and chelate end-groups, connected to chains by coordination to various metal ions. A metallo-supramolecular system exhibiting singlet fission will be presented.[6]



metallo-supramolecular polymer **PT**



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Viscose based cellulose thin films, a new model system for studying cellulose surface interactions

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Cellulose thin films with a well-defined chemical composition and morphology are frequently used materials for studying cellulose surface interactions. Therefore these materials contribute to develop a better understanding for processes and reactions taking place on cellulose interfaces. Commonly, there exist several applied techniques for the production of such cellulose model films. On the one hand cellulose thin films can be prepared by dissolving and converting an organo-soluble cellulose derivative like trimethylsilyl cellulose followed by regeneration after processing. Another option to establish cellulose model layers is to disperse cellulose in proper solvents followed by film formation and precipitation. However the production and investigation of cellulose thin films produced via these technologies features some drawbacks[1].
In this contribution we will present a new method for a water based production of smooth cellulose thin films with high storage stability, as well as defined chemical composition and morphology. The cellulose films produced via this method are characterized by ATR-IR spectroscopy, profilometry, atomic force microscopy, contact angle measurements and GI-WAXS studies. Finally protein absorption on the new cellulose model films is investigated by SPR spectroscopy.

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Embedding of lipophilic liquids in a cellulosic fiber ensuring textile refining

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An additional function embedded in cellulosic fibers enhances their outstanding properties compared to fuel-based fibers. Whereas different materials like inorganic particles, organic resins, secondary polysaccharides, etc. were proven to be distributed inside the cellulose skeleton [1] direct incorporation of lipophilic additives into cellulosic fibers [2] exhibits an exceptionally challenge. Thermodynamic incompatibility of hydrophilic cellulose and lipophilic oils or waxes has to be overcome by composites, which allows permanent incorporation. By means of that, a depot can be realized that release functional agents over a long period. Further, harsh stages inside the textile chain demand enduring fiber material with high durability. Especially temperatures over certain time periods, pH value or pressure due to mechanical treatment have impact on textile properties and the incorporated additional function.
Using the example of insecticide *permethrin* as an oily lipophilic substance the anchorage inside cellulose network and homogeneously distribution over the whole cross-section by REM-EDX analysis is demonstrated. Resistance against selected parameters of textile processing will be explained. Long-lasting behavior of that regenerated cellulose composite fiber is compared to insecticidal nets as state-of-the-art vector control.

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Investigation of the properties of SiC-based shell molds with binder containing fibers using thermal imaging camera

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Silicon Carbide is a very perspective material in modern precision casting. SiC is characterized by higher thermal conductivity than commonly used molding materials, ie. Al_2O_3, aluminosilicates and ZrO_2. Also a interesting aspect is the application of a binder containing fibers, that will increase the gas permeability of the molds [1].

The paper presents the results of research of molding materials in the delivery state. Their microstructure was investigated using scanning electron microscope (SEM), particle size, chemical and phase composition (XRF, XRD). The results of investigations of the properties of the ceramic slurry used to obtain samples of shell molds were also presented. Evaluation of the properties of the samples concerned the drying time and cooling time, which were investigated using thermo vision camera. It has been shown that the use of temperature field measurements with thermal imaging camera is an interesting solution for evaluating the drying and cooling processes of the ceramic molds [2].

Acknowledgments
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Electrodeposition of Nd-Fe-based alloy from aqueous solution

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The Nd-Fe-based alloys i.e $NdFe_{12}N_x$[1] are of great interest because of their good intrinsic magnetic properties that lead to extremely high energy products which can be extensively used in many different fields connected to permanent magnetism. In this study binary Nd and Fe were electrochemically co-deposited onto the copper substrate from ionic liquid. The experiments of NdFe-based films deposition were performed in ionic liquid-based 1-ethyl-3-methylimidazolium dicyanamide ([EMIM][DCA]) electrolytes in protective Ar atmosphere. Nd-Fe-based micron thick films were successfully deposited with Nd content up to 7 at.% which is close to the desired $NdFe_{12}$ ratio. The effects of applied potential/current density as well as the deposition temperature on the deposit composition and morphology were investigated by scanning electron microscope (SEM) coupled with energy dispersive X-ray spectroscope (EDS). The development of the crystal phases upon annealing was monitored with the X-ray powder diffraction (XRD) and vibrating sample magnetometer (VSM) measurements. As the EDS spectra did not show a significant oxygen content (below the detection limit of the method) which indicates that these films have the potential to be used as novel permanent magnets.

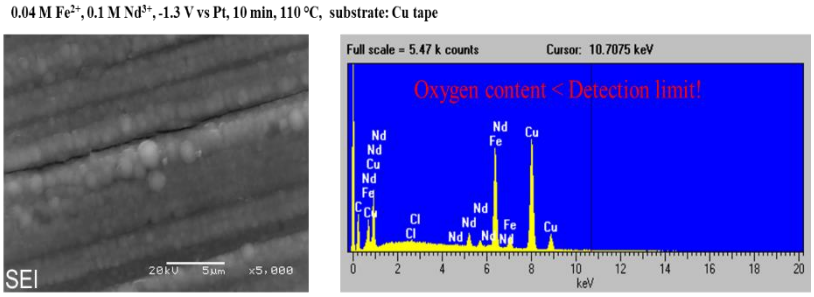

Figure: SEM image of the as-deposited NdFe thin film coupled with EDS spectrum

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Influence on the Electrical and Thermal Conductivities of CNT-Polyamide Composite according to the Varying CNT Diameters and Quantities

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The carbon nanotube (CNT) is superior to the general powder state materials in their thermal and chemical properties(1). Because its ratio of diameter to length (aspect ratio) is very large, it is known to be a type of ideal nano-reinforcement material(2). In this study, We researched the effect of CNT diameters and contents on properties of CNT-polyamide composites were investigated such as electrical conductivity, tensile strength and thermal conductivity. To get different diameter distributions of CNTs, several portions of Mo and Fe in Mo-Fe/MgO catalysts were synthesized by a combustion method at 600 °C. And all CNTs grew at 900 °C with 3 SLM methane and 1 SLM hydrogen for 40 min. Four kinds of CNTs with different diameter distributions, such as 1~3 nm, 3~7 nm, 7~13 nm, and 10~30 nm, were selected to make CNT-polyamide composites. Each composite was manufactured by a solution mixing using bar-type ultra-sonicator in the CNT portions from 1phr to 50 phr. And electrical conductivity, tensile strength, and thermal conductivity were measured. Three properties of CNT-polyamide composite, manufactured with 10 nm diameter, were more excellent compared to other composites, with electrical conductivity 10 Ω at 7 phr, thermal conductivity 2.4 W/mK at 40 phr, tensile strength 60 MPa at 30 phr. CNTs with diameter 10 nm were superior to other diameters for the multi-functional composite such as CNT-polyamide Composites.

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Using orientation microscopy to explore the correlation of materials properties and microstructures

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Understanding the correlation between the microstructure of a material and its corresponding properties is one of the important goals of materials science. A good understanding of this relationship allows tailoring microstructures in order to obtain desired properties. This is the basis of microstructure engineering.

Orientation contrast microscopy based on electron backscatter diffraction (EBSD) in the scanning electron microscope is perhaps the most powerful tool to observe and quantify microstructures on a broad length scale and in 2 and 3 dimensions. It enables to quantify dislocation densities, phase composition, grain- and phase boundary networks, textures and even residual stress distributions. It is, therefore, the method of choice for microstructure engineering.

In this contribution we will show examples on how quantitative microstructure data can be obtained using EBSD-based orientation microscopy and related techniques and how this information is employed to determine and interpret mechanical and other properties of materials: by example of DP steels we show how to understand strength and toughness and how to optimize these properties. An example on CdTe solar cells illustrates how to use the knowledge on boundaries and their optoelectronic properties to optimize solar cell efficiency.

Fast 2D Node Generation for Meshless Simulation of Solidification of Binary Alloys

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Simulation of binary alloys solidification occurring in industrial processes plays an important role in the prediction of microstructure evolution, which strongly affects the mechanical properties (*e.g.* ductility and tensile strength) of the final solid part. The accuracy of such simulations with numerical methods relies on both an appropriate modelisation of the involved phenomena and an accurate resolution of the chosen models (*i.e.* partial differential equations), especially near the interface between the solid and the liquid phases. Meshless approaches for the solution of the latter problem [1] are becoming more and more popular in the field of numerical simulations because of their geometrical and computational flexibility; the spatial node arrangements required by such meshless methods need to be refined in presence of an interface in order to accurately resolve the related physical issues. Furthermore, the interface evolves in time and, consequently, the node distribution must continuously adapt to it.
In this work we propose a fast 2D node generation procedure that allows a very quick node placing phase for the meshless solution of solidification processes; this has been done through local nodal refinement in the interface zone over each time step: this approach can provide high quality node distributions in a very short time.

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Advanced Material Model for Shotcrete – Calibration of Hardening Parameters

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High precision of computational results might be obtained in a design process by using of numerical methods. Choice of an appropriate constitutive model is an important part during the process of mathematical modelling. Advanced material models for soils were developed in geotechnical engineering, but often only elastic constitutive models are used for structural elements.

Process of calibration of input parameters for more advanced elastoplastic material model for structural elements made of shotcrete and concrete [1] is presented in this paper. Various laboratory procedures such as splitting tensile test, displacement controlled uniaxial compression and triaxial compression tests were performed. The last mentioned – triaxial test is not common to carry out for concrete, so the laboratory investigation can be considered as unique in this way. The calibration process is focused on parameters related to strain hardening.

Locality in utility tunnel network in Brno was chosen for obtaining shotcrete samples. The sampling was situated in two particular sections in different geological conditions, soil environment of Neogene clay and hard rocks – Devonian arcoses and shales, and therefore with different tunnel lining. Both sections are considered as problematic according to a previous reconnaissance and a system of geotechnical monitoring is installed there. Thus, the results of calibration process are intended to use in next detailed analysis of the structure.

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Novel Materials Based on $La_{0,75}Sr_xA_{0,25-x}Cr_{0,5}Mn_{0,5}O_3$ (A=Ba, Ca, Mg) as Full Ceramics Anodes in High Temperature Fuel Cells

Novi materiali na osnovi $La_{0,75}Sr_xA_{0,25-x}Cr_{0,5}Mn_{0,5}O_3$ (A=Ba, Ca, Mg) kot keramične anode v visokotemperaturnih gorivnih celicah

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Among alternative anode materials for high temperature fuel cells complex ceramic oxide $La_{0,75}Sr_{0,25}Mn_{0,5}Cr_{0,5}O_3$ (LSCM) has recently shown good catalytic activity toward fuel oxidation and sufficient stability in reductive environment at relatively low steam to carbon ratios. However, electrical and ionic conductivity of LSCM are somehow lower compared to some other perovskite materials. One of the possibilities to improve conductivity of LSCM is in its composition variations, i.e. altering the Sr-content, doping on A-site of the perovskite with other ions (Ba, Ca and Mg), and varying Mn to Cr ratio on B-site of the perovskite. In this paper systems with general formula $La_{0.75}Sr_xA_{0.25-x}Cr_{0.5}Mn_{0.5}O_3$ (A = Ba, Ca, Mg, x varies between 0 and 0.25) are described. Within the investigated system, prepared materials after the synthesis contain the perovskite structure as a main crystallographic phase with relatively low additions of secondary phases. Any secondary phases are undesired, because they may substantially influence electrical properties of final materials. In samples with relatively high Sr-additions a secondary Sr-rich phase Sr_2CrO_4 is also identified. Ca-doping may result in traces of $CaCr_2O_4$ phase in as-synthesized samples, while Ba-doping may lead to $BaCrO_4$ or $BaCO_3$ phases with higher Ba-additions. The amount of secondary phases may be controlled by calcination program or sintering conditions. Secondary phases, which may form additional grains or liquid phase, influence also the development of microstructures during sintering. Within investigated compositions, the most promising materials are $La_{0.75}Sr_xCa_{0.25-x}Cr_{0.5}Mn_{0.5}O_3$ (x = 0.05 – 0.15), because they exhibit single-phase microstructure with fine grains after sintering at 1200 ^oC. Materials with Ba- or Mg-additions form precipitates of secondary phases at 1200 ^oC, which remain present also after sintering at higher temperatures.

Failure Analyses of Nickel Alloy Fan Blade

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Electric energy production in power stations from coal combustion produces large amounts of pollutants, such as NO_x and SO_2.The flue gas desulfurization unit reduces the amount of harmful sulfur compounds in flue gasses. A catastrophic failure of a fan blade from such a flue-gas desulfurization unit was investigated. The expected life time of flue gas desulphurization unit fan blade in a minimum of 20 years, the investigated blade failed after only 5 years of operation.

On the investigated blade the crack initiations were found on the surface of the blade, specifically on the area where the riser was present. This means that the crack initiation sites were already present at installation.

The cracks in the riser area were the result of the melt solidification shrinkage and were exposed to the surface only after riser removal. The crack propagated trough fatigue and crack propagation was accelerated by the presence of non-metallic inclusions and shrinkage porosity. The reason for the blade failure was not inappropriate material selection (mechanical and corrosion properties) or to severe working conditions, but an inappropriate production process and insufficient quality inspection.