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13th Annual Conference on

Materials Science, Metal and Manufacturing

November 16-17, 2017 Paris, France

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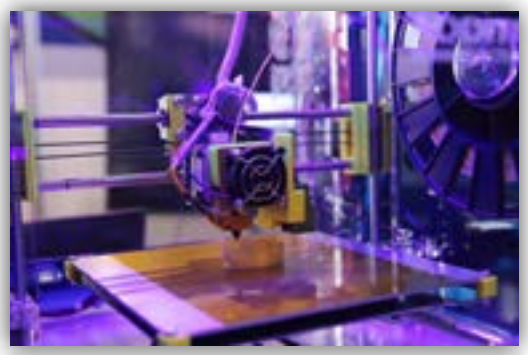
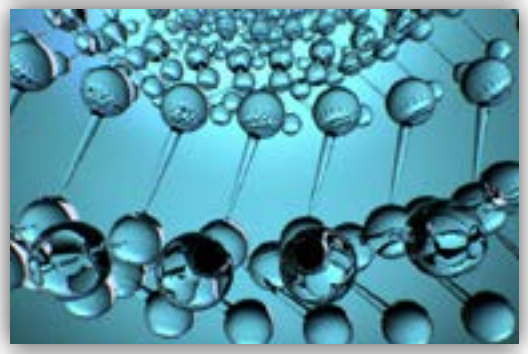



Materials-Metals 2017

Xiangxin Xue et al., Mater Sci Nanotechnol 2017, 1:2

Electrodeposition of tin on copper from choline chloride based ionic liquids

Xiangxin Xue[1,2], Xiaozhou Cao[1,2], Lulu Xu[1,2], Xiaoyu Zhang[1,2], Qiuyue Li[1,2], Yuanyuan Shi[3], He Yang[1,2] and **Tao Jiang[1,2]**

[1]Northeastern University, China

[2]Key Laboratory of Recycling Science for Metallurgical Resource, China

[3]Chinalco Shenyang Non-ferrous Metal Processing Co., Ltd, China

Tin and its alloys are widely used in various industrial applications including electronics, light engineering, automotive and building materials due to their non-toxic, corrosion resistant and ductile properties. The electrodeposition of Sn and Sn alloys is widely practiced in aqueous electrolytes including sulphuric acid, methanesulronic acid, phenolsufonic acid and citric acid. However, electrodeposition of Sn presents the low current efficiency from aqueous solutions due to a narrow electrochemical window of water. Ionic liquid has wide potential window, high thermal stability, good ionic conductivity and negligible vapor pressure as electrolyte for various electrochemical process. The electrodeposition of Sn on copper substrate was investigated using 0.2mol/L $SnCl_2 \cdot 2H_2O$ dissolved in the eutectic mixture of choline chloride and urea (1:2 molar ratio). A typical voltamperogram at different scan rate is shown in. The curve displays a couple of well-define cathodic and anodic peaks which is a typical metal deposition-stripping process. The reduction peak potential shifts to negative potentialsi with the increase of scan rates, which was associated with quasi-reversible electrochemical reactions. The cathodic peak current versus the square root of the sweep rate for the cyclic voltammograms are shown in Figure 2. It can be seen that the plot displays a liner relationship, indicating that the reduction reaction was a diffusion-controlled process. The microstructure of Sn electrodeposits at different temperatures was analyzed by scanning electron microscopy (SEM) in Figure 3. The results showed that the deposits are compact, and the particles began to grow with the increase of temperature.

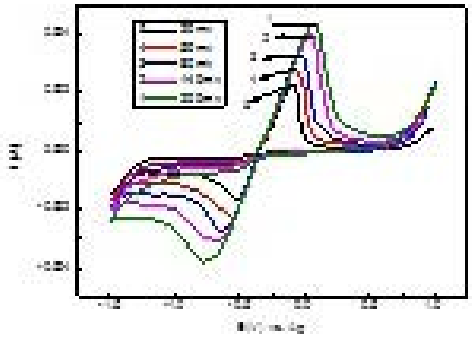

Figure: Cyclic voltammograms of 0.2mol/L $SnCl_2 \cdot 2H_2O$ on Mo electrode in urea-choline chloride at 343K under different scan rates.

Recent Publications

- Anicai L, Petica A, Costovici S, Prioteasa P, Visas T (2013) Electrodepostion of Sn and NiSn alloys coating using choline chloride based ionic liquids-evaluation of corrosion behavior. Electrochimica Acta 114:868-877.
- Walsh F C, Low C T J (2016) A review of developments in the electrodeposition of tin. Surface & Coatings Technology. 288:79-94.
- Anicai L, Costovici S, Cojocare A, Manea A, Visan T (2015) Electrodeposition of Co and CoMo alloys coatings using choline chloride based ionic liquids-evaluation of corrosion behavior. Transactions of the IMF. 93(6):302-312.
- Sakita A M P, Noce R D, Fugibara C S, Benedetti A V (2016) On the cobalt and cobalt oxide electrodeposition from a glyceline deep eutectic solvent. Physical Chemistry Chemical Physics. 18(36):25048-25057.
- Maltanava H M, Vorobyova T N, Vrublevskaya O N (2014) Electrodeposition of tin coatings from ethylene glycol and propylene glycol electrolytes. Surface & Coatings Technology. 254:388-397.

Biography

Xiangxin Xue received his BS, MS and PhD in 1977, 1983 and 1990 from Institute of Metallurgy and Physical Chemistry, Ferrous Metallurgy at Northeastern University. Since June 1998, he became a Professor and Doctoral Tutor. In 2000, he set up the Institute of Metallurgy Resource and Environment Engineering (now department of resource and environment) at Northeastern University. His current research focuses on the comprehensive utilization of metallurgy resource and green metallurgy process flow innovation.

xuexx@mail.neu.edu.cn

Ian C Hsu, Mater Sci Nanotechnol 2017, 1:2

Characterize the mechanical microenvironment of a 3-D hybrid biomatrix by laser trap

Ian C Hsu
National Tsing-Hua University, Taiwan

Hydrogel physical properties were tuned by modulating the type of gelatin and the PEGdA to gel-PEG-Cys concentrations. Bulk viscoelastic properties were highly dependent on PEGdA concentration and total water content; while gel-PEG-Cys concentration was more important to the swelling profiles. Soft materials including the sIPN are viscoelastic in nature. The viscoelastic properties of the material (i.e., the microenvironment) is crucial for understanding the biomaterial-cell interactions at the cellular scale, which may provide insight into the behavior of cells that are entrapped in a 3-D matrix (i.e., sIPN). In this study, we measured the microrheology of a 3-D matrix by laser trap system. We entrapped commercially available polystyrene beads (size: ~1 μ m) in the Gel-PEG-Cys and PEGdA 3400. While trapped by laser trap, the bead position was recorded by a QPD sensor, which has resolution down to nano-meter. The position data was analyzed in frequency domain. The local viscosity was deduced from the corner frequency of the position spectrum. For sample 1 and sample 2 we did see the locational dependent viscosity, especially in the case of sample 2. In sample 3 and sample 4, the viscosity is too high to allow the bead performing measurable Brownian motion.

Biography

Ian C. Hsu received his PhD from the University of Wisconsin-Madison, USA, 1989. He then joined Stanford Linear Accelerator Center, Stanford University as research scientist. He then joined National Tsing Hua University in Taiwan as associated professor in the Department of Biomedical Engineering at 1991, and became full professor and chairman of the department in 1998. He has been a visiting professor of Department of Genetics, Stanford University in 1999 and a visiting professor of Department of Biochemistry, Stanford University in 2007. Dr. Hsu's research was in the beam physics and later in single molecule research as well as in biochip development and its biomedical applications. He has published numerous papers and holds several patents.

ichsu@mx.nthu.edu.tw

Notes:

Electrochemical fabrication of V-4Cr-4Ti alloys from the mixed oxides in a eutectic $CaCl_2$-NaCl melt

Xiaozhou Cao[1,2], Qiuyue Li[1,2], Yuanyuan Shi[3], He Yang[1,2], Tao Jiang[1,2] and **Xiangxin Xue[1,2]**
[1]Northeastern University, China
[2]Key Laboratory of Recycling Science for Metallurgical Resource, China
[3]Chinalco Shenyang Non-ferrous Metal Processing Co., Ltd, China

V-4Cr-4Ti alloys exhibit important advantages as a candidate structural material for fusion reactor first-wall and blanket applications. V-4Cr-4Ti alloys were prepared by direct electrochemical reduction of the solid mixture of V_2O_3, Cr_2O_3 and TiO_2 in molten $CaCl_2$-NaCl melt at 1073K. The influence of cell voltage and electrolysis time on the electrolysis process was reported. The microstructure and phase compositions of the products were analyzed by scanning electron microscopy (SEM) and X-ray diffraction (XRD) during the electrolysis process. The results showed that V-4Cr-4Ti alloys can be obtained at the voltage of 3.1V and the time of 0.5h. The reduction process involved Cr_2O_3 was reduced to Cr metal firstly, thereafter V_2O_3 and TiO_2 was reduced to low-valence oxide of vanadium and titanium. The reduction rate increases with increasing cell voltage, lots of perovskite oxide formed during the electrolysis process. With the increase of the voltage, electrochemical reduction rate increased on the surface of electrode, the current rapidly decreased, and finally reached a stable value at a short time, which is beneficial to accelerate the transferring of oxygen ions. With the increase of time, the particles size of new generated product is less than1μm after 120min of electrolysis it becomes smaller and uniform.

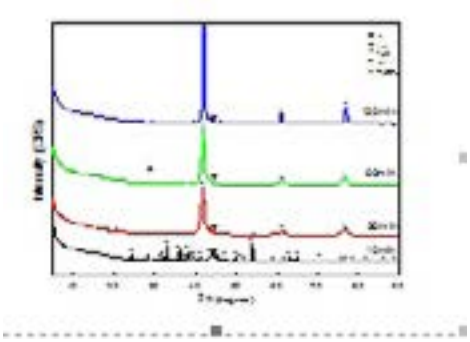

Figure 1: XRD patterns of the products at different electrolysis time.

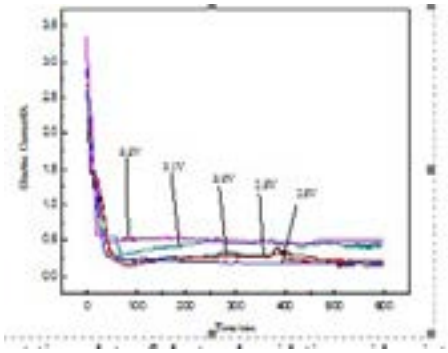

Figure 2: Current-time plots of electro-deoxidation oxide mixture at different electrolytic voltage.

Recent Publications

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- Xiao W, Wang D H (2014) The electrochemical reduction processes of solid compounds in high temperature molten salts. Chemical Social Reviews. 43(10):3215-3228.
- Kar P, Evans J W (2008) A model for the electrochemical reduction of metal oxides in molten salt electrolyte. Electrochimica Acta 54:835-843.
- Juzeliunas E, Cox A, Fray D J (2012) Electro-deoxidation of thin silica layer in molten salt-Globular structures with effective light absorbance. Electrochimica Acta 68:123-127.
- Alexander D T L, Schwandt C, Fray D J (2011) The electro-deoxidation of dense titanium dioxide precursors in molten calcium chloride giving a new reaction pathway. Electrochimica Acta.56:3286-3295.

Biography

Xiaozhou Cao received his BS in 2003, MS and PhD degrees in 2008 with Professor Zhuxian Qiu from Institute of Nonferrous Metallurgy at Northeastern University. He joined the Institute of Metallurgical Resources and Environmental Engineering at Northeastern University since 2008. His current research focuses on molten salt and ionic liquid electrochemistry to seek a simple and environmentally friendly way to produce the corresponding parent metals and alloys.

caoxz@smm.neu.edu.cn

Jungbin Lee, Mater Sci Nanotechnol 2017, 1:2

3D printing technique using photo-curable ceramic suspension for porous bio-ceramic scaffolds

Jungbin Lee
Korea university, South Korea

In this study, CaP (calcium phosphate) comprising of hydroxyapatite (HA) and β-tricalcium phosphate (β-TCP) was mixed with HDDA (1,6-Hexanediol diacrylate) which is a photo-curable monomer. The suspension contains a high content of ceramic (50 vol% or more) and to have flowability applicable to 3D printing, Decalin (Decahydronaphthalene, diluent) was added. In the case of diluent, as the content increases, the shrinkage decreases and the shape reproducibility increases, but the specific percent of the monomer in ceramic suspension is reduced, the strength of green body is lowered, so the composition was optimized for the green body to have sufficient strength. The ceramic/monomer suspension has a suitable viscosity for 3D printing (Tape-casting principle). The content of photo initiator (P.P.O.) and exposure time were evaluated using photo-DSC, finally, the photo curing behavior was optimized. Porous ceramic scaffolds produced by suspension with ceramic content of 45 vol% and 50 vol% were sintered at 1250^{0}C and evaluated. As a result of observing the microstructure using scanning electron microscope, the sintered body was maintained well without deformation or defects, as the content of ceramic increased, the micro pores was decreased, and it was densified. The result of three point bending test, all group (45 vol% & 50 vol%) had the same porosity (55±0.13 vol%), as the content of ceramic increased, it had high mechanical strength. We produced porous calcium phosphate scaffolds using the uniformly-mixed suspension with high content of ceramic and the problem of precipitation of ceramic particles in the suspension was solved by tape-casting technique. It is expected to be used not only for ceramic scaffold with high quality, but also for various fields (structure, environment and energy) using ceramic materials.

Biography

Jungbin Lee is a PhD candidate in the Department of Bio-convergence engineering from Korea University, South Korea. He is interested in biomedical 3D printing techniques and biomaterials for tissue regeneration.

jungbin15@nate.com

Notes:

Bo Gwang Jung et al., Mater Sci Nanotechnol 2017, 1:2

Fabrication of high quality Ag thin film using ZnO buffer layer

Bo Gwang Jung and **Se Young Jeong**
Pusan National University, Korea

Silver (Ag) is a metal with the highest conductivity. It is the only metal with lower resistance (1.63 μΩ cm) than copper (1.72 μΩ cm). However, when it is used as a thin film, the scattering of electrons at the grain boundary is combined with the effect of surface scattering, so that the decrease of conductivity and the oxidation problem become more serious and the signal of reflectance and plasmonic phenomenon in the visible light region is lost. In this study, we tried to compensate many disadvantages of silver thin film by growing the silver thin film close to the single crystal level. A modified sputtering system was used instead of MBE or ALD to fabricate samples with a large area, and ZnO grown on Al_2O_3 substrate with orientation (001) was grown on the Ag thin film. The crystallinity of the fabricated samples was investigated using XRD, SEM, EBSD, AFM and sheet resistance. The fabricated silver thin films showed a high level of (111) surface orientation and surface roughness of RMS 1 ~ 1.5nm and a sharp decrease in grain boundaries. In addition, by controlling the deposition time of the silver thin film, it is possible to manufacture a silver thin film having a thickness of several tens of nanometers to several hundreds of nanometers, so that it can be applied for various purposes.

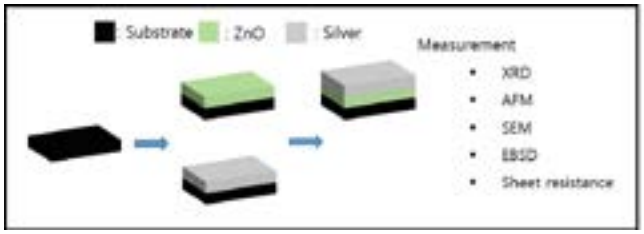

Figure: Experimental schematic diagram

Biography

Bo Gwang Jung graduated from Pusan National University in 2017 with a major in Optical Mechatronics. After that, I am a master student of the major in the Cogno-Mechatronics as a student of Professor Se – young Jeong in Pusan National University. My research area is on the physical properties and application of metal (copper and silver) thin films.

wjdqhrhkd@naver.com

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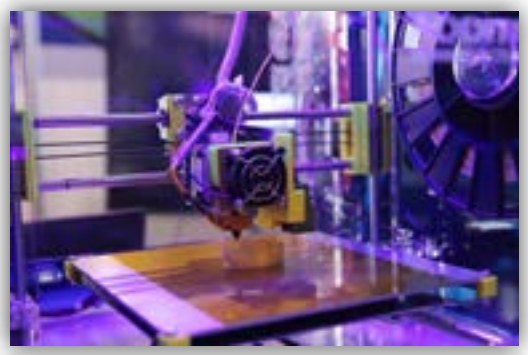
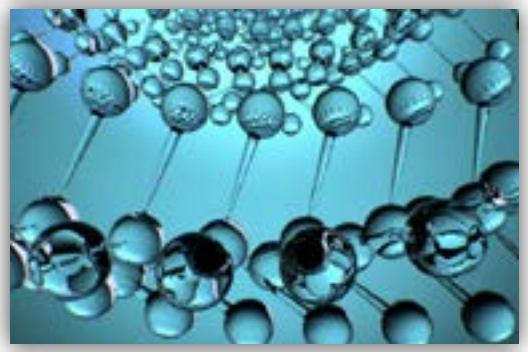



Materials-Metals 2017

Pulsed laser deposition of Fe_2TiSn thin films for thermoelectric applications

S Garabagiu[1], D I Bilc[1], D Marconi[1], S Macavei[1], L Barbu[1], S A Porav[1], B Cozar[1], R Gavrea[2], R Hirian[2], D Benea[2], M Coldea[2] and **V Pop[2]**
[1]National Institute for Research and Development of Isotopic and Molecular Technologies, Romania
[2]Babeș -Bolyai University, Romania

Thermoelectrics are promising to address energy issues but full potential exploitation requires improvements in their performance (large power factors and low thermal conductivities). Advanced thermoelectric materials from the class of Fe-based full Heusler semiconductors, Fe_2YZ, have been theoretically predicted to have very large power factors and to possess low-dimensional electronic transport even at bulk level. The aim of the present work was to grow thin films of Fe_2TiSn full Heusler compounds on magnesium oxide (MgO) buffer layers deposited on Si (100) using pulsed laser deposition (PLD). The buffer layer of MgO has been deposited by PLD onto Si (100) substrates, and its structure has been optimized with the preferential orientation along (100). Then, Fe-based Heusler compounds have been deposited onto MgO (100), using bulk targets of Fe_2TiSn. By optimizing the deposition parameters (substrate temperature, laser fluence and frequency), it was possible to control the stoichiometry, crystallinity and morphological properties of Fe_2TiSn thin films. We present the structural and morphological properties of these films investigated by X-ray diffraction, Atomic Force Microscopy and Scanning Electron Microscopy analysis.

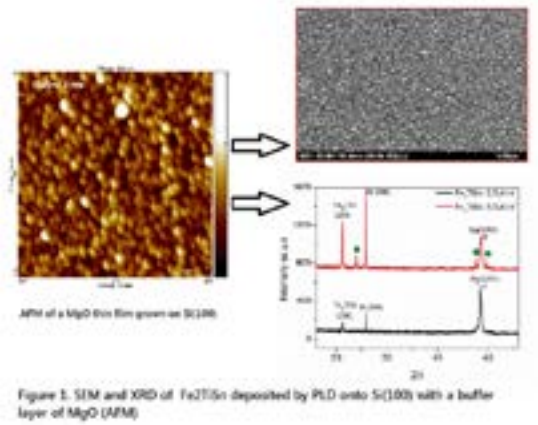

Figure 1. SEM and XRD of Fe2TiSn deposited by PLD onto Si(100) with a buffer layer of MgO (AFM)

Recent Publications

- Bilc DI, Hautier G, Waroquiers D, Rignanese GM, Ghosez Ph (2015) Low-Dimensional Transport and Large Thermoelectric Power Factors in Bulk Semiconductors by Band Engineering of Highly Directional Electronic States. Physical Review Letter 114:136601.
- Cáceres D, Vergara I, and Gonzalez R (2003) Microstructural characterization of MgO thin films grown by radio-frequency sputtering. Target and substrate-temperature effect. J. Appl. Phys. 93:4300.
- Niu F, Meler AL, Wessels BW (2006) Epitaxial growth and strain relaxation of MgO thin films on Si grown by molecular beam epitaxy. J. Vac. Sci. Technol. B 24:2586.
- Kaneko S, Funakubo H, Kadowaki T, Hirabayashi Y, Akiyama K (2008) Cubic-on-cubic growth of a MgO(001) thin film prepared on Si(001) substrate at low ambient pressure by the sputtering method. Europhys. Lett. 81:46001.
- Kaneko S, Ito T, Soga M, Motoizumi Y, Yasui M, Hirabayashi Y, Ozawa T, Yoshimoto M (2013) Growth of nanocubic MgO on silicon substrate by pulsed laser deposition. Jap. J. Applied Physics 52:01AN02.

Biography

Sorina Garabagiu has her expertise in pulsed laser deposition (PLD) of thin films, and their characterization using microscopic techniques (AFM, SEM) and spectroscopy (FTIR, UV-vis, fluorescence). She has performed PLD depositions of oxide materials, as buffer layers for advanced materials depositions, and semiconducting Heusler compounds, as potential thermoelectric materials. She also fabricated thin films of oxide materials by anodization, and arrays of metallic nanowires embedded into oxidic matrices, and 2D arrays of noble metal nanoparticles used for the design of electrochemical bio-sensors.

sorina.garabagiu@itim-cj.ro

Sung-Tag Oh et al., Mater Sci Nanotechnol 2017, 1:2

The effect of powder characteristic on the spark plasma sintering of tungsten

Sung-Tag Oh[1], **Hyunji Kang**[1] and **Young-Keun Jeong**[2]
[1]Seoul National University of Science and Technology, Republic of Korea
[2]Pusan National University, Republic of Korea

Tungsten (W) is an excellent material for many engineering applications such as heating source, aerospace and military uses owing to its attractive properties such as high melting point, high density, low coefficient of thermal expansion and superior mechanical properties at elevated temperatures. However, the densification of micro W powders is very difficult and generally requires a temperature over 2000°C because of its high melting point. To enhance the densification of W powders, there are typically three approaches such as activated sintering by the addition of transition metals, nanosinteing by particle size refinement and pressure sintering by assisted mechanical pressure. Among the above approaches spark plasma sintering is the promising method for fabrication of dense material. However, there are few detailed studies on the effect of particle size and processing parameters available in literature. The aim of this work is, therefore, to investigate the densification behavior and microstructure of W which have a variation in powder characteristic such as particle size and size distribution and sintering condition. To evaluate the effect of processing condition on the densification behavior, different W powder size, sintering temperatures and atmosphere were subject to spark plasma sintering. This will help to optimize the sintering process that should achieve the high density W bulk, and to examine the properties related to their microstructure.

Biography

Sung-Tag Oh got his Dr. rer. nat. degree in the Faculty of Chemistry, University of Stuttgart, Germany. He worked at Fine Ceramics Research Association in Japan as a NEDO Researcher before he moved to Seoul National University of Science and Technology, Korea. His expertise lies in the area of Porous Materials, Nanocomposite Processing, and High Temperature Materials.

stoh@seoultech.ac.kr

Notes:

Effects of extraction methods on the morphology and chemical properties of kahili ginger (Hedychium gardnerianum) fibres

T Eleutério[1], **A Silva Pinto**[1], **M J Pereira**[2] and **H C Vasconcelos**[2,3]
[1]University of the Azores, Ponta Delgada, Portugal
[2]University of the Azores, Angra do Heroísmo, Portugal
[3]Nova University of Lisbon, Portugal

Hedychium gardnerianum (kahili ginger) stems are the most abundant invasive plant residues in the Azores (Portuguese Isles of the North Atlantic) and has not yet been adequately studied as source of vegetable fibres for different kinds of applications, namely reinforcement materials for composites. This study aims to investigate the extraction method effect on the chemical composition and morphology of those fibres. Three different extraction methods were compared: mechanical, chemical and biological (enzymatic). The fibres chemistry was characterized in terms of structural carbohydrates (cellulose and hemicellulose content), lignin, ash and moisture content. The results showed that enzymatic extraction yielded fibres with higher cellulose and hemicellulose contents than the other two methods; the lignin content decreases if chemical and enzymatic methods are used; the moisture and the water absorption on the fibres were independent of the used method. This study concluded that the enzymatic extraction has potential advantages in comparison to other extractive processes, because it significantly increases the number of possible reaction sites (OH groups) at fibre surface, since the amount of cellulose in those fibres is larger.

Figure: a) Kahili ginger plants; b) fibres extracted from kahili ginger stems.

Recent Publications

- Eleutério T, Pinto AS, Pereira MJ, Vasconcelos HC (2017) Preliminary structural and thermal characterization of Conteira's (Hedychium gardnerianum) fibers for further functionalization with silica colloidal nanoparticles. Procedia Engineering.
- Pereira MJ, Eleutério T, Canhoto J (2015) The influence of cytokinin and auxin types and their concentration on the proliferation and rooting of Viburnum treleasei Gand seedling explants. Acta Horticulturae. 1083: 311-318.

Biography

T Eleutério graduated in Biology and Geology at Azores University (UAC) in June 2013. In February 2016, he got a Master's Degree in Biotechnology and Biodiversity. Throughout his professional career, he has worked as a Volunteer Researcher on three research projects in areas such as micropropagation and biological control; organized four workshops in the field of biology; was the author of five scientific publications in the area of biotechnology and was part of the organizing committee of the third edition of the International Conference on Natural Fibers and the twenty-second meeting of the Portuguese Society of Electrochemistry. He was Speaker at five international conferences including OCTA Innovation - Sustainable Islands' Growth. He is a member of the Center of Biotechnology of the Azores (University of the Azores) since 2016.

telmo.mf.eleuterio@uac.pt

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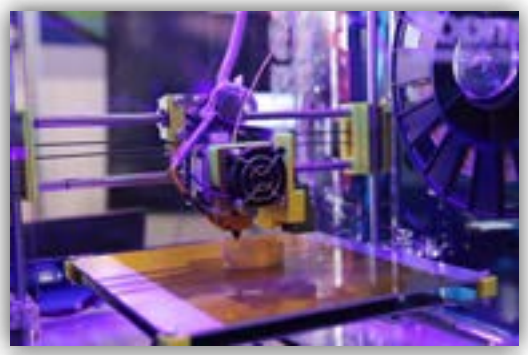
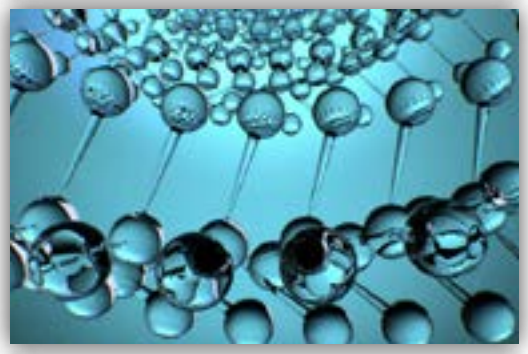



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Mater Sci Nanotechnol 2017, 1:2

Recycling of gel foam rubber waste as filler in natural rubber/styrene butadiene rubber (NR/SBR) blends for mats production

Ahmed A Mousa
Synthomer PLC, Egypt

Gel foam was used on a wide range in carpets backing production to give the tuft strength and to make it compact. The gel foam waste consists of a blend from NR/SBR in addition to amounts of $CaCO_3$. This waste was collected and recycled to work as filler in mats production. It was dried and grinded into particles with a size range from 45 to 75 microns and used as a replacement to parts of $CaCO_3$ filler in different ratios. The mechanical properties of prepared mats using recycled waste were studied and the surface was scanned using SEM. It was found that replacing $CaCO_3$ by waste rubber in ratios up to 5 and 7% has improved the mechanical properties at 3% ammonium acetate gelling agent. Moreover, it has provided better storage stability than $CaCO_3$. Reducing gelling agent to 2.5% has resulted in recycling high amount of this waste; up to 25%.and up to 60% by reducing the gelling agent to 2%. Reducing the ratio of the gelling agent and recycling of such waste are very cost effective. In addition, it helps in decreasing the acetic acid emission and enables the final product to have a good appearance.

ahmed.mousa@synthomer.com

Mater Sci Nanotechnol 2017, 1:2

Microstructure evolution and nitriding behaviors of Sm-Fe alloys in rapid solidification process

Chunyan Song, Shuhuan Wang, Kaixuan Zhang, Dingguo Zhao and **Yongliang Gui**
North China University of Science and Technology, China

Rapid solidification technology is used widely to fabricate micro-crystalline and amorphous alloys. Compared to the alloys produced under equilibrium solidification conditions, smaller grain size and more grain boundaries in rapidly solidified alloys are undoubtedly beneficial for the diffusion of atoms in heat treatment process. In traditional nitriding process of coarse-grained Sm-Fe alloys, it is hard to further increase the nitrogen content and improve the uniform of nitrogen distribution. Therefore, the nitriding behaviors and microstructure evolution of rapidly-solidified Sm-Fe alloy ribbons with micro-crystalline and amorphous structure were investigated in this work. Several Sm-Fe alloy ribbons with a nominal chemical composition of 30% (wt., %) were manufactured by melt spinning technology at Ar atmosphere. Microstructure of these rapidly solidified Sm-Fe alloys manufactured under different rotating velocities was characterized with OM, SEM and XRD. The nitrogen content penetrated in rapidly solidified Sm-Fe alloys was examined and the morphologies of nitrogen were investigated. Results indicate that with the rotating velocity of wheel increases from 6 m/s to 36.5 m/s, the thickness of Sm-Fe alloy ribbon decreases by one order of magnitude, i.e. from 107.70 μm to 18.93μm, and the cooling rate increases by approximately six times, i.e. from 1.86×105 K/s to 1.08×106 K/s, microstructural characteristics transform from coarse dendrites to cellular crystal, microcrystal, mixture of crystal and amorphous phase. Moreover, Sm and Fe elements in alloy ribbons tends to uniform compare with the as-cast alloys according to the laser ablation inductively coupled plasma mass spectrometry map. The size of all grains is still less than 10μm although the crystalline grains grew during nitriding process of rapidly solidified Sm-Fe alloy at 420^0C. This result suggests that smaller grain size and more grain boundaries of rapidly solidified Sm-Fe alloy could provide more locations for atomic nitrogen absorption in the nitriding process, and then improve the diffusion of nitrogen atoms. However, most nitrogen penetrated in rapidly solidified Sm-Fe alloys are distributed on the boundaries of cellular grains in the forms of nitrogenous compounds. A quickly quenched Sm-Fe alloy ribbon with a stable near-stoichiometric Sm_2Fe_{17} phase and amorphous matrix in microstructure was fabricated successfully when the rotating velocity of wheel was greater than 34 m/s. After nitridation of quickly quenched Sm-Fe alloy ribbons, the constitutional phases are crystalline $Sm_2Fe_{17}Nx$ and α-Fe, and amorphous nitrides. This phenomenon indicates that nitrogen atoms are distributed not only in crystalline phase but also in amorphous matrix. The nitrogen content in Sm-Fe alloy ribbons is up to 4.155%, which indicated the microstructure characteristics of quickly quenched Sm-Fe alloy is helpful for the improvement of nitrogen absorption.

scy7825@163.com

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Mater Sci Nanotechnol 2017, 1:2

Superhydrophobic micro-fibers synthesized from hydrophilic PVAc polymer

C Elif Ozen Cansoy and **Gokhan Acik**
Piri Reis University, Turkey

In this study, super hydrophobic PVAc microfibers were synthesized by utilizing electrospinning process. Various solution flow rates were applied to investigate the effect of flow rate on fiber morphologies and surface wettability. The results showed that, increase in flow rate also caused an increase in fiber diameters and water drop contact angles. Depending on fiber diameters, surface wettability was also changed; increase in diameter caused an increase in contact angle values and especially at 5 ml/h flow rates, super hydrophobic fibers surfaces were successfully synthesized. Contact angle hysteresis (CAH) values of fibers were changing due to the variation in fiber diameters and thus surface roughnesses. CAH values of PVAc fibers showed a decrease with the increase of water contact angles, and these results were in concordance with the literature values.

ecansoy@pirireis.edu.tr

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Iron Oxide-Polymer brush nanocomposites with switchable adsorption properties toward methylene blue

Lee D. Wilson and Asghar Dolatkhah
University of Saskatchewan, Canada

The grafting from approach was used to prepare pH-responsive polyacid brushes using poly(itaconic acid) (PIA) and poly(acrylic acid) (PAA) at the amine functional groups of chitosan. Hybrid materials consisting of polymer brushes and magnetite nanoparticles (MNPs) were also prepared. The products were structurally characterized and displayed reversible pH-responsive behavior and controlled adsorption/desorption of methylene blue (MB). Switchable binding of MB involves cooperative effects due to conformational changes of brushes and swelling phenomena in solution which arise from response to changes in pH. Above the pKa, magnetic nanocomposites (MNCs) are deprotonated and display enhanced electrostatic interactions with high MB removal efficiency (>99%). Below the pKa, MNCs undergo self-assembly and release the cationic dye. The switchable binding of MB and the structure of the polymer brush between collapsed and extended forms relate to changes in osmotic pressure due to reversible ionization of acid groups at variable pH. Reversible adsorption–desorption with variable binding affinity and regeneration ability was demonstrated after five cycles. Additional examples of recent studies on the design and physicochemical properties of polymer-metal composites will be described in this presentation.

lee.wilson@usask.ca

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Metal-nanomaterials, nanocrystallinity, supracrystals

Marie Paule Pileni
CEA/IRAMIS, CEA Saclay, Gif-sur-Yvette, France

We will describe some physical and chemical properties metal nanomaterials differing by the crystalline structure called nanocrystallinity: It will be demonstrated that nanocrystallinity play a major role in the final structure when nanocrystals are subjected to oxidation processes (Kinkendall effect). Concerning the optical properties, some processes are markedly affected by the crystalline structure whereas others are negligeable. Nanocrystals, characterized with low size distribution, self assembled in 3D superlattices to produce supracrystals. The final structure of the supracrystals depends on the experimental conditions. By mixing nanocrystals differing by their average diameter, binary supracrystals will be produced. Both one component and binary supracrystals are characterized by specific properties (optical, mechanical, magnetic) opening several research areas. Various water-soluble structures are produced from hydrophobic nanocrystals. With Au supracrystals, the optical properties revealed both photonic modes and localized surface plasmon resonance of the nanocrystals. Furthermore, the fingerprint of nanocrystal was preserved even for large crystalline aggregates demonstrating that the nanocrystal could be used as a probe for investigating the optical properties of such assemblies. These water-soluble supracrystals pave the way towards a large number of potential applications including solar energy and biomedicine.

mppileni@orange.fr

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Tuning gallium concentration to enhance absorption coefficient of $CuIn_{1-x}Ga_xSe_2$ single nanowire

Mourad Rzaizi, A Oueriagli and **D Abouelaoualim**
Cadi Ayyad University, Morocco

Nanowires offer new opportunities for nanoscale quantum optics and cell photovoltaic. These advantages include reduced reflection, extreme light trapping, improved band gap tuning. The I– III–VI_2 family of semiconducting compounds, which includes CIGS has been widely used in photovoltaic because of its many advantages. We present a numerical investigation of effect concentration gallium and size on absorption coefficient of $CuIn_{1-x}Ga_xSe_2$ single nanowire. Within the envelop-function framework, the effect concentration gallium and size on the optical absorption coefficient are studied for the intraband transitions in $CuIn_{1-x}Ga_xSe_2$ single nanowire. Our results show that the parameters of nanostructure and incident optical intensity have a great effect on the optical characteristics of these nanostructures. Thus, the absorption coefficients which can be suitable for great performance optical can be easily obtained by tuning the concentration gallium.

mouradrz1@gmail.com

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13th Annual Conference on
Materials Science, Metal and Manufacturing
November 16-17, 2017 Paris, France

Mater Sci Nanotechnol 2017, 1:2

Chloride removal from the secondary source of zinc

N Dakhili, H Razavizadeh, M T Salehi and **S H Seyedein**
Iran University of Science and Technology, Iran

Zinc containing wastes/secondaries such as zinc ash, dross, flue dusts, sludge, residue etc. are generated in various chemical and metallurgical industries. The materials con-tain different level of impurities depending on the source. If zinc content material, like zinc ash and zinc slag, contains various amounts of chlorides like zinc chloride, zinc oxy-chloride, which comes from ammonium chloride and other chloride fluxes used by galvanizers, the chloride content has to be removed for the evaluation of this secondary resource for recovery as zinc metal or zinc oxide. The results (of the galvanizing slag's treating that left after some pyrometallurgical prosses) indicate that roasting at 800 °C for 30 min, followed by alkali washing treatment, at 70 °C for 45 min by 1/6 solid/liquid ratio and 1.5 times the stochiometric amount, will useful for chloride removal with 94% efficiency.

nafiseh_dakhili@hotmail.com

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13th Annual Conference on
Materials Science, Metal and Manufacturing
November 16-17, 2017 Paris, France

Mater Sci Nanotechnol 2017, 1:2

Applicability of polyisobutylene-based polyurethane structures in biomedical disciplines: some calcification and protein adsorption studies

Nur Cicek Kekec[1], Nihan Nugay[1], Kalman Toth[2], Turgut Nugay[1] and Joseph P Kennedy[2]
[1]Bogazici University, Turkey
[2]The University of Akron, USA

In recent years, polyurethane structures are paving the way for elastomer usage in biology, human medicine and biomedical application areas. Polyurethanes having a combination of high oxidative and hydrolytic stability and excellent mechanical properties are focused due to enhancing the usage of PUs especially for implantable medical device application such as cardiac-assist. Currently, unique polyurethanes consisting of polyisobutylenes as soft segments and conventional hard segments, named as PIB-based PUs, are developed with precise NCO/OH stoichiometry (~1.05) for obtaining PIB-based PUs with enhanced properties (i.e., tensile stress increased from ~11 to ~26 MPa and elongation from ~350 to ~500%). Static and dynamic mechanical properties were optimized by examining stress-strain graphs, self-organization and crystallinity (XRD) traces, rheological (DMA,creep) profiles and thermal (TGA,DSC) responses. Annealing procedure was applied for PIB-based PUs. Annealed PIB-based PU shows ~26 MPa tensile strength, ~500% elongation, and ~77 Microshore hardness with excellent hydrolytic and oxidative stability. The surface characters of them were examined with AFM and contact angle measurements. Annealed PIB-based PU exhibits the higher segregation of individual segments and surface hydrophobicity thus annealing significantly enhances hydrolytic and oxidative stability by shielding carbamate bonds by inert PIB chains. According to improved surface and microstructure characters, greatly efforts are focused on analyzing protein adsorption and calcification profiles. In biomedical applications especially for cardiological implantations, protein adsorption inclination on polymeric heart valves is undesirable hence protein adsorption from blood serum is followed by platelet adhesion and subsequent thrombus formation. The protein adsorption character of PIB-based PU examines by applying Bradford assay in fibrinogen and bovin serum albumin solutions. Like protein adsorption, calcium deposition on heart valves is very harmful because vascular calcification have been proposed activation of osteogenic mechanism in the vascular wall, loss of inhibitory factors, enhance bone turnover and irregularities in mineral metabolism. The calcium deposition on films is characterized by incubating samples in simulated body fluid solution and examining SEM images and XPS profiles. PIB-based PUs are significantly more resistant to hydrolytic-oxidative degradation, protein adsorption and calcium deposition than ElastEonTM E2A, a commercially available PDMS-based PU, widely used for biomedical applications.

nurcicekkekec@gmail.com

Mater Sci Nanotechnol 2017, 1:2

Local traditional bio based materials as a model for the future

Sanela Klarić
International Burch University, Bosnia and Herzegovina

The materials nowadays have important role in all sectors of human activities. Construction sector, is one of most polluted ones, which is facing several challenges that could be partially resolved by use of local, traditional, bio based construction materials. Good traditional, practical examples still exist in our close surrounding. Those examples very often present sustainable way of living with excellent correlation with nature and location, very good knowledge about local natural materials, renewable energy use as well as sustainable use of all resources on the location. Those traditional houses present affordable, optimal, healthy way of living which we strive for. Unfortunately, most of that local bio based materials today present the waste or their exploration is unsustainable. This paper will present some of the researches about traditional local natural bio based materials (wood, sheep wool, straw, clay, lime) and their properties in comparison with most used ones today in construction sector in Bosnia and Herzegovina (BiH) region. Focus of this research will be on green properties such as CO_2 emission and PGW. Additional to that, paper will present experiences through building of an example and will discuss future needs for sustainable development of construction bio based industry as well as other innovative technology needed to support comprehensive development of bio based construction sector. Discussion will show a lot of potential as well as obstacles and huge needs of strategic approach to this issue in BiH region.

sanela.klaric@ibu.edu.ba

Mater Sci Nanotechnol 2017, 1:2

SiC nanowires/ribbons reinforced high-temperature ceramic coatings

Yanhui Chu
South China University of Technology, China

Carbon/carbon (C/C) composites are prone to oxidize and ablate at elevated temperatures, which limits their applications as high-temperature structural materials. The ceramic coatings are considered to be the effective methods to solve this problem. However, the intrinsic brittleness of these coatings and the mismatch of the poor interfacial bonding between these coatings and C/C substrate often give rise to the cracking of the coatings, which results in the failure of the coatings. To solve these problems, in our work, the ceramic coatings reinforced by the well-dispersion SiC nanowires/ribbons with different morphology and aspect ratios were proposed and prepared by chemical vapor deposition, in-situ synthesis and pack cementation. The as-prepared coatings possessed the excellent oxidation protective ability, which achieved the oxidation protective of silicon-based ceramic coatings for C/C composites between 1500 °C and room temperature. Our study not only revealed the traditional toughening mechanisms of SiC nanowires/ribbons including nanowire/ribbon pull-out, nanowires/ribbon bridging, crack deflection and microcrack toughneing, but also revealed the novel toughening mechanisms of SiC nanowires including the plasticity deformation of the nanowires, the plasticity fracture at the interface of the nanowire-matrix, and the generated special mechanical interlocking. In addition, our study also discovered that the interfacial bonding strength of carbon and ceramic materials with other materials was improved significantly by in-situ synthesizing SiC nanowires/ribbons on their surface, and revealed the novel interface anchoring mechanisms of SiC nanowires/ribbons involving the interfacial bonding anchoring and the mechanical interlocking anchoring.

chuyh@scut.edu.cn

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13th Annual Conference on
Materials Science, Metal and Manufacturing
November 16-17, 2017 Paris, France

Mater Sci Nanotechnol 2017, 1:2

Experimental analysis of low density poly ethylene effect on the mechanical properties of poly ethylene vinyl acetate for prosthetic and orthotic application

Yenealem Yilma
Ethiopia biotechnology institute, Ethiopia

In this comparative study, the effect of low density poly ethylene and ethylene vinyl acetate loading ratio by melt blending with additives and without additives on mechanical properties for prosthetic and orthotic application was analyzed. To carry out this thermoplastic materials such as low density poly ethylene (LDPE), Ethylene vinyl acetate (EVA), color pigment, calcium carbonate, titanium dioxide and black carbon have been used as raw material to produce the sample in sheet form and to achieve comfortable prosthetic and orthotic application. The method used were blending, molding, testing of produced materials. Increasing the content of EVA and decreasing content of LDPE had effect on compatibility, tensile strength and elongation at break vice versa. The blended composite with additives have no significant effect on molding and without additive have significant effect on molding due to molecular mobility which leads shrinkage. The maximum tensile strength reached to 10.5Mpa and minimum tensile strength reached 2.8Mpa and the maximum elongation at break reached 469.8% and minimum elongation at break 40.2%.The other result are in between of these ranges, which have better than existing one has maximum tensile strength of 2.3Mpa and elongation at break have 265%.The mean value of maximum tear load is 74.4N/mm and minimum tear load have 38.9N/mm which have better result than existing one has 10.5N/mm. Scanning electron microscope(SEM) test result showed that specimen with more filler and less content of EVA become poor in its morphology and compatibility.

yenealemy@gmail.com

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Materials Science, Metal and Manufacturing
November 16-17, 2017 Paris, France

Mater Sci Nanotechnol 2017, 1:2

Synthesis and characterizations of (2 × 2) tunnels structured manganese dioxide nanorods with α phase for lithium air batteries

Zafar Khan Ghouri and **Saeed Al Meer**
Qatar University, Qatar

The (2 × 2) tunnels structured manganese dioxide nanorods with α phase (α-MnO_2) are synthesized via simplistic hydrothermal method at low temperature. The obtained tunnels structured α–MnO_2 nanorods are characterized by, Transmission electron microscopy, Scanning electron microscopy, and X-ray diffraction techniques. The oxygen reduction reaction (ORR) activity was studied by cyclic voltammetry and rotating ring-disc electrode voltammetry techniques in alkaline media. Moreover; the highly electrocatalytic tunnels structured α–MnO_2 nanorods were then also applied as cathode in rechargeable Li–O_2 cells. The Li–O_2 cells exhibited initial discharge capacity as high as ~4000 mAh/g with the tunnels structured α–MnO_2 nanorods which was double the original capacity of the cells without any catalyst. Also, we obtained 100% round trip efficiency upon cycling with limited capacity for more than 50 cycles.

zafarkhan.ghouri@qu.edu.qa