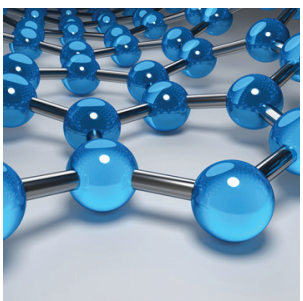
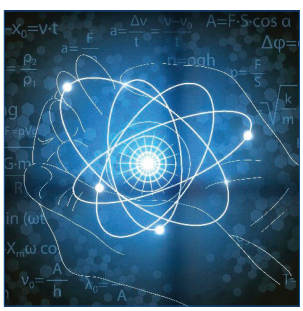
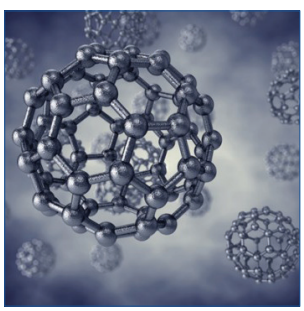
Scientific Tracks & Sessions
May 20, 2019

Biomaterials & Materials Physics 2019



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Biomaterials and Nanomaterials & Materials Physics and Materials Science

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Mechanics and microstructure of [100] oriented FeNiCoAlTi single crystals

Li Wei Tseng[1], C H Chang[1], Y L Tsai[1], I Karaman[2], and **Y I Chumlyakov[3]**

[1]National Changhua University of Education, Taiwan

[2]Texas A&M University, USA

[3]Tomsk State University, Russia

The super elastic response of $Fe_{43.5}Ni_{28}Co_{17}Al_{11.5}Ti_{2.5}$ single crystal shape memory alloy with the [100] orientation aged at 600°C for 4 hours was investigated under both tension and compression. A fully recoverable super elastic strain was observed under both tension and compression within the temperature range of -80 to 0°C. The fully recoverable super elastic strain was achieved in tension however the recoverability of super elasticity deteriorates in compression. The tension-compression asymmetric response is likely caused by different numbers of activated martensite variants in tension and compression. Increasing the aging times decrease the super elastic temperature window and increase the transformation temperature.

Speaker Biography

Li Wei Tseng has completed his PhD at Texas A&M University, USA. He is the assistant professor of National Changhua University of Education, Taiwan. He has 7 publications, 2 paper in Acta Materialia and 5 paper in Scripta Materialia. His research interests are in shape memory alloys, metallurgy, solid mechanism.

e: lwtseng@cc.ncue.edu.tw

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A heat capacitive PCB

Jonathan Silvano de Sousa, Maria Prutti, Bernd Schuscha and **Qi Tao**
Austria Technologie & Systemtechnik (AT&S AG), Austria

The paper describes a new concept for cooling electronic applications where the heat capacity of the PCB is enhanced. This is done by the utilization of commercial phase change material (PCM) embedded in an epoxy resin matrix in the PCB construction.

The basic idea of the concept is described in Fig.1 which depicts the schematics of a PCB structure with a component (device) installed on its surface and a PCM epoxy matrix as heat reservoir installed in its inner part ("a"). During phase change, part of the dissipated heat is absorbed by the PCB which results into a lower operational temperature for the component and longer time for the system to reach steady state ("b"). When the device is turned off, the stored energy is released to the environment ("c").

Benchmark measurements between conventional and heat capacitive PCBs as well as basic reliability tests will be shown. Further possibilities for technology development and applications will also be discussed.

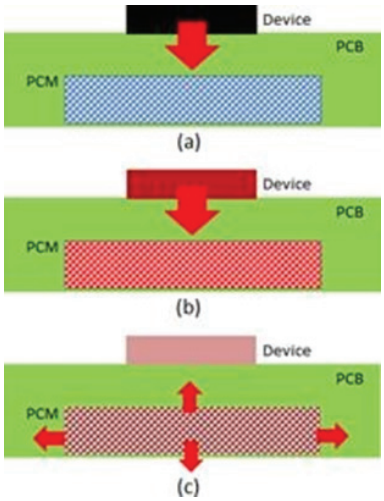

Figure 1: Heat capacitive PCB

Speaker Biography

Jonathan Silvano de Sousa studied physics at the Technical University of Vienna, Austria. He has extensive experience in the printed circuit board and semiconductor industries. Since 2014, he has been heading the research in heat management in the R&D department at AT&S.

e: j.silvanodesousa@ats.net

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CALPHAD-assisted synthesis of Hf-free Half Heusler thermoelectrics with high ZT~1.2

Peter Franz Rogl[1,2], M Gürth[1], P Sauerschnig[1], J Vrestal[4], V Romaka[5], A Grytsiv[1,2,3], G Rogl[1,2,3], K Yubuta[6], and **E Bauer[2,3]**

[1]University of Vienna, Austria
[2]Christian Doppler Laboratory for Thermoelectricity, Austria
[3]Institute of Solid-State Physics, Austria
[4]Masaryk University, CR
[5]Lviv Polytechnic National University, Ukraine
[6]Tohoku University, Japan

Besides the well-known skutterudites and Zintl phases, Half Heusler (HH) alloys currently are the most promising candidates for thermoelectric (TE) devices at elevated temperatures: they can be used in a wide temperature range and their starting materials are abundant and cheap. Particularly via nano structuring of TiNiSn-based thermoelectric materials by top-down (ball milling) and bottom-up (spinodal decomposition/precipitation) mechanisms. We have accomplished multicomponent HH alloys with attractive ZTs for n-type TE materials based on (Ti, Zr)-Ni-Sn. These values were achieved on the basis of a profound knowledge not only of isothermal phase relations, temperature dependent solubilities but also of the solidification/annealing behavior.

The detailed experimental investigation of the constitution of both relevant systems Ti-Ni-Sn, Zr-Ni-Sn as well as (Ti, Zr) NiSn - (Ti,Zr)Ni2Sn including liquidus projections and Scheil solidification diagrams, as well as CALPHAD modelling, provided the necessary basis for an elaborate synthesis (annealing/hot-pressing) route in order to reproducibly get a suitable microstructure. Exploiting furthermore the system inherent but coherent binodal/spinodal demixing and precipitation at sub solidus temperatures within the sections TiNiSn-ZrNiSn and ($Ti_{0.5}Zr_{0.5}$) Ni1+xSn we were able to achieve for the n-type half Heusler alloy a ZTmax = 1.2 at 825 K. The demixing is a balanced effect of (i) destabilization of the solid solution by a positive enthalpy of mixing compensated by elastic strain energy (coherent binodal) but also (ii) by the stabilizing effect of the entropy of mixing. The experimental data are backed by SEM/TEM analyses as well as by DFT results.

Speaker Biography

Peter Franz Rogl has completed his PhD at the age of 25 years from University of Vienna, Austria. He is full professor of physical chemistry of materials at University of Vienna, Austria. He has over 700 publications. His publication H-index is 49 and he has been serving as an editorial board member of reputed Journals.

e: peter.franz.rogl@univie.ac.at

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Giant dielectric response and low dielectric loss in $PbTiO_3$ grafted $CaCu_3Ti_4O_{12}$ ceramics evaluated by impedance spectroscopy

Ali Rajabtabar and **Ommeaymen Sheikhnejad**
AC^2T research GmbH, Austria

There is an ever-increasing tendency to employ Electrochemical Impedance Spectroscopy (EIS) as a strong tool to characterize thin films or ceramic layers demonstrating electrical properties in Tribology. In this regard, colossal dielectric materials with reasonable energy storage and dielectric loss are on the core interest of potential applications in sustainable energy industry. In this study, $PbTiO_3$ (PT) was coated on the surface of $CaCu_3Ti_4O_{12}$ (CCTO) particles via sol-gel method to enhance the characteristics of grain boundary and interface towards efficient application in Capacitors and Supercapacitors.

The X-ray diffraction (XRD) pattern of CCTO/PT ceramics represents the PT phase exists mainly at the interface between the CCTO grains. The field-emission scanning electron microscopy (SEM) images captured from the fracture surfaces confirm the grains were formed in cuboid-like taking regular form with an increase in sintering time. The line scan Energy-Dispersive X-ray Spectrometry (EDS) result demonstrates that PT are slightly substituted in Cu site of CCTO structure. EIS data demonstrates an enhanced dielectric constant in low frequency with low dielectric loss in high frequency for the grafted CCTO composite ceramics (CCTO/PT composite ceramics with the PT weight concentration of 10%) over the entire frequency range. The dielectric loss for the CCTO-30% and -50% PT samples is abruptly decreased to a value of ~0.0013 at 100 kHz. These observations were attributed to the change in characteristics of grains and grain boundaries where the insulating properties of the grain boundaries are improved following the addition of PT.

Speaker Biography

Ali Rajabtabar is Scientist in AC^2T research GmbH where is responsible for data analysis as an experimental materials physicist in the pool of advanced chemical analysis. He graduated in applied physics (B.Sc./M. Sc., Iran) and after 5+years of doing research and teaching physics, he joined Harbin Institute of Technology to pursue his PhD degree in materials physics and chemistry, while he enhanced the characteristics of interface and grain boundary of CCTO based composite ceramics. After a postdoctoral research in China, he moved to Austria as a guest researcher working in ZONA-JKU Linz to learn and employ spectroscopic ellipsometry. Then, as a senior research fellow he was doing EIS measurement, modeling and data analysis on Li-ion battery project of Keysight Technologies GmbH. He could publish even with diverse research background in materials physics. Since his PhD, his focus was placed on energy storage device and materials with growing challenges towards industrial application.

e: ali.rajabtabar@ac2t.at

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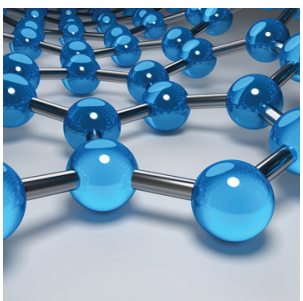


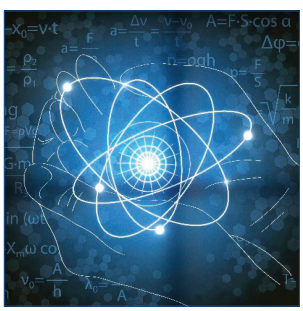
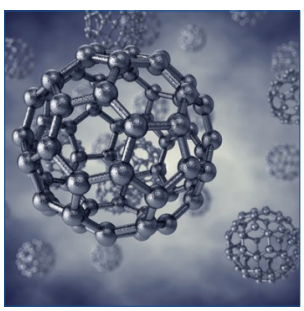

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Highly sensitive and selective gas sensor utilising tips pentacene based organic thin film transistor

Amjad Al Shawi
Bangor University, UK

Organic sensing technology has been widely investigated in the last few years. The low fabrication cost, high sensitivity, short response and recovery time allowed this type of sensors to dominate the research activities in academia and industry. In this work, solution processed organic thin film transistors (OTFTs) based on 6,13-bis(triisopropylsilylethynyl) (TIPS) pentacene were fabricated and characterized using the bottom-gate, top-contact (B-G, T-C) configuration. After preparing clean glass substrate, a 50nm aluminium was thermally evaporated as the gate electrode. The insulating layer was spin coated (2000 rpm) from a cross-linked polymethyl methacrylate (cPMMA) 5% anisole solution by using [1,6-bis(trichlorosilyl) hexane (C6-Si) (10µ/1ml) as a cross-linking agent to produce 330nm layer thick. Tips-pentacene semiconductor (2% toluene solution) was drop coasted on the cPMMA layer as the active layer. Finally, gold electrodes of 50nm thickness were thermally evaporated on the TIPS-pentacene active layer to provide the drain and source. After exposing the OTFTs to different concentrations of ethanol vapour, the current-voltage characteristics of the OTFT sensor and the response to different concentrations of ethanol (from 1ppm to 8ppm) were investigated. The output characteristics (VDS = 0 – (-60) V) with different gate voltages (VGS= 0 – (-50) V) and different ethanol concentration were investigated. It was found that the drain source current in the saturation region decreases rapidly when the OTFT was exposed to ethanol vapour at room temperature (~25 Co). Furthermore, the transfer characteristics with different ethanol concentrations showed a clear shift in the threshold voltage, which increased (from -2V to -18 V) with increasing the ethanol concentration.

Therefore, the source drain current in the TIPS pentacene based OTFTs can be considered as a significant parameter to monitor chemical species and it can be used as a sensor for chemical gases.

Speaker Biography

Amjad Al Shawi is a PhD student at the school of electronic engineering, Bangor University, UK. He is in his third year of the PhD in the field of organic transistors and organic memory devices. He completed his B.Sc. and M.Sc. study in physics from Basra University, Iraq. He also worked as a researcher in the Polymer Research Centre at Basra University, Iraq.

e: a.alshawi@bangor.ac.uk

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Substrate effect on structural and magnetoresistance properties of amorphous carbon thin films

Awais Siddique Saleemi, Muhammad Saeed and **Shern long Lee**
Shenzhen University, China

The preparation and characterization of amorphous carbon (a-Carbon) thin films continue to be an active topic in contemporary surface materials science. Here, we explore the substrate effect of such thin films fabricated on glass and SiO2 substrates by pulsed laser deposition (PLD) technique through controlling experimental parameters including deposition time/temperature and laser energy/frequency. The structural and magnetoresistance (MR) properties of the as-prepared thin films were studied by means of High-Resolution Transmission Electron Microscopy (HR-TEM), Raman, X-ray Diffraction (XRD) and X-ray Photo Spectrometry (XPS). The D-band and G-band intensity (ID/IG) ratio was 4.0 and 4.7, whereas the percentage of the C(sp2) atomic ratio was 70 % and 74 %, for the sample thin films prepared on glass and SiO_2 substrates, respectively. MR properties were investigated under a magnetic field ranging from -9T to 9T in the temperature range of 2 K to 40 K. A positive MR value of 15% was observed at a low temperature of 2K for the thin films grown on SiO_2 substrate at a growth temperature of 400 with the laser frequency of 300 mJ/pulse. The structural vicissitudes can tune the magnetoresistance properties of such a-Carbon systems. The results designate that such properties are more auspicious for the magnetic sensors and carbon-based spintronics.

Speaker Biography

Awais Siddique Saleemi has completed his PhD at the age of 30 years from Tsinghua University, Beijing, China. He is working as a researcher at Institute for Advanced Studies, Shenzhen University, China. He has over 20 publications that have been cited over 70 times and is working on "Structural and magneto transport properties of amorphous carbon thin films synthesized by Chemical Vapor Deposition and Pulsed Laser Deposition.

e: assaleemi@szu.edu.cn

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Residual strength properties of GFRP composites, using in SARI 250kW wind turbine blade: A practical approach to predict fatigue damages

Pouya Valizadeh
Ferdowsi University of Mashhad, Iran

One of the applications of glass fiber reinforced polymers are in wind turbine blades. These blades are subjected to cyclical loading consequently suffering fatigue damage. In this study, the residual strength in E-glass fiber reinforced epoxy composite with the sequence of [90/0/±45]' made by vacuum infusion process (VIP) has been investigated. By determining the ultimate tensile strength and S-N curve, the residual strength test was performed at a maximum stress level of 163 MPa for three different ratios of nominal fatigue lifetime namely, 20, 50 and 80 percent of nominal fatigue lifetime. The experimental results of residual strength were analysed by linear (BR), nonlinear (REI) and modified (OM) proposed models. The reduction in the residual strength was observed in the experimental and predicted results of the OM model representing a preliminary loss of residual strength, a subsequent decrease with low slope and a sudden drop at later stages of its life. These changes may be attributed to the rapid accumulation of the damage in the first stage, damping at energy in the second stage and delamination in the third stage. The results represent the conservative function of the linear model (BR) and the adaptation of the modified model (OM) to the experimental results.

Speaker Biography

Pouya Valizadeh is a dynamic industrial PhD candidate with more than 7 years of experience in design, manufacturing and testing of wind turbine blade; familiar with related cost analysis and raw materials market. Some of his academic research works are a fatigue and failure mechanisms of GFRP composites and adhesives in wind turbine blades, and industrial projects such as design and implementation of T-Bolts in root joint of wind turbine blades.

e: Pouya.vali85@gmail.com

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