21st International Conference on

Advanced Materials & Nanotechnology

September 04-06, 2018 | Zürich, Switzerland

Special Session

Day 1

Gerd Kaupp, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-020

Gerd Kaupp
University of Oldenburg, Germany

On the way to physically correct indentation analyses

Common indentation analyses (ISO and ASTM standardized) suffer from iterations, polynomials and approximations. However, correct physics on the basis of elementary mathematics avoids iterations and violations of the energy law for hardness and modulus. The new physically founded laws F_N=0.8 k $h^{3/2}$ and $W_{applied}/W_{indent}$ =5/4 apply to nano, micro and macro depth sensing indentations. Importantly, they detect phase changes under load and allow for the arithmetic treatment for single or successive phase transformations, surface layer effects and correct adsorption energies. Thus, the first physical hardness H, stiffness/indentation moduli (these are not "Young's moduli"), indentation works, activation energies and phase transformation energies are directly obtained, simply by application of the basic physically founded equations that avoid the unfortunate common energy law violations. Non-steadiness kinks (in the linear $h^{3/2}$ plots) and any deviations from the precise 5/4 ratio (integration of the smooth appearing loading curves over one or more phase transition onsets is not allowed) prove phase change (s) under load. For example, five successive phase changes to reveal six different polymorphs of NaCl up to 50 N load (corresponding to HV5) from depth-sensing indentations will be presented and analysed. In addition to fcc and bcc, theoretical predictions published three new polymorph structures and there is the possibility of twins and amorphous phases. The undeniable half-page physical deductions of the two basic formulas will be presented and discussed as the derived formulas for the mentioned and further mechanical applications. This is not only of academic interest, but materials' properties must be correctly and reliably described, and technical materials must withstand pressure upon use without failing. The latter are at risk when phase change onset pressures remain undetected, because of the formed interfaces between different polymorphs as sites for nucleation of cracks. Highly resolved (5000X) 3D-microscopy reveals details of crack nucleation. The non-detection of of phase changes is the main objection against the reliability of non-depth-sensing Vickers, Brinell, Rockwell, etc. hardness characterizations of daily life technical materials (not withstanding their always similar standard plates that equally undergo the undetected phase changes). The neglecting of always several undetected phase changes misses the most relevant properties with creation of high common risks. Furthermore, indentation measurements gain enormously in precision, because invalid single measurements can be directly excluded when they do not concur with the undeniable physical $F_N \propto h^{3/2}$ law's linear correlation with >3 or >4 nines, due to local imperfections, or skew, or too close to interface or to borderline indentations. The safety issues also for all the numerous applications that derive from ISO H and E_r are evident and largely unexplored.

Biograpy

Gerd Kaupp has completed his PhD at Würzburg University and Postdoctoral studies from Iowa State University, Lausanne University and Freiburg University. He held a Full-Professorship till 2005 in Oldenburg, Germany and he privately continues his research on wasteless solid-state chemistry temperature-controlled with 100% yield since 1984, AFM on rough surfaces since 1988, the non-stochastic but versatile and better resolving sub-diffraction limit microscopy for unstained non-fluorescing materials of all types (resolution <10 nm, since 1995), and (nano) indentations (since 2000). In the latter field, he is still urging ISO (NIST) to correct their 50 years old standards for conformity with physics. He has published more than 300 papers in renowned journals and has been serving as an Editorial Board Member of several scientific journals.

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21st International Conference on

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Scientific Tracks & Abstracts

Day 1

Day-1

SESSIONS

Advanced Materials Engineering | Emerging Areas of Materials Science | Environmental and Green Materials | Carbon Based Materials | Advanced Bio-Materials and Bio-devices | Energy Materials and Harvesting

Chair: Roger Amade, Universitat de Barcelona, Spain
Chair: Toshihiro Miyata, Kanazawa Institute of Technology, Japan

SESSION INTRODUCTION

Title: Adsorbent materials for desulfurization processes under supercritical water conditions
Florentina Maxim, Paul Scherrer Institut, Swizerland

Title: Realization of conductive aluminum nitride epitaxial layer on silicon substrate by forming spontaneous nano size via-holes
Noriko Kurose, Ritsumeikan University, Japan

Title: A new laser induced local material engineering to convert from n-type to p-type nitride semiconductor to fabricate high power vertical AlGaN/GaN devices on Si substrate
Yoshinobu Aoyagi, Ritsumeikan University, Japan

Title: Restoration of perovskite phase in the top layer of thin BTO film by plasma treatment and annealing
Ankita Ghatak, S.N. Bose National Centre For Basic Sciences, India

Title: Hybrid perovskite halide for detection of environmental pollutant in atmosphere
Barnali Ghosh (Saha), S.N. Bose National Centre For Basic Sciences, India

Title: Comparative analysis on monolithic DeNOx catalysts
Giovanni Perillo, Wessex Institute of Technology, UK

Title: Growth and electrochemical characterization of graphene nano walls and carbon nanotubes
Roger Amade, Universitat de Barcelona, Spain

Title: Fine-controlled sub-nano metal particles in a dendrimer reactor
Kimihisa Yamamoto, Tokyo Institute of Technology, Japan

Title: Thermoelectricity enhanced catalysis
Tiva Sharifi, Rice University, USA

Title: P-type Cu2O-based heterojunction solar cells fabricated with n-type ZnO thin film prepared by electrochemical deposition method
Toshihiro Miyata, Kanazawa Institute of Technology, Japan

Title: **Growth control of vertical nano graphene network in plasma enhanced chemical vapor deposition and its emerging applications**
Keigo Takeda, Meijo University, Japan

Title: **In silico study of the self-assembly and gelation of sugar derivatives**
Dafna Knani, ORT Braude College, Israel

Title: **Design and development of nanomaterials using induction plasma system and its application**
Vignesh Nagarajan, Matrix Nano, India

Florentina Maxim et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Adsorbent materials for desulfurization processes under supercritical water conditions

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Paul Scherrer Institut, Switzerland

Statement of the Problem: It is recognized that the great technological potential of the catalytic super critical water (SCW) gasification of biomass for biofuel production. However, an important issue related to the poisoning of the catalyst by sulfur (S) compounds remaining in the SCW phase is still to be solved. To design efficient S adsorbents at SCW conditions is a challenge since, the sorbent material, which is sought as metal oxide (Me_xO_y), must be structurally stable and in the same time to be able to capture S from both inorganic and organic sources under SCW conditions. The purpose of this work is to design and obtain supported nano Me_xO_y adsorbent materials for efficient desulfurization in SCW. Our previous results reported on the impact of sorbent geometry on the S adsorption in SCW.

Materials & Methodology: SCW impregnation of Me_xO_y (ZnO, CuO, Mn_2O_4, Fe_2O_3) on activated carbon was performed in a continuous flow tubular reactor (Figure), also used for S sorption experiments. In situ neutron imaging (NI), molecular dynamics (MD) and computational fluid dynamics (CFD) were the main techniques used to obtain fundamental knowledge on the phenomena taking place when different S species are adsorbed by Me_xO_y in SCW.

Findings: The NI results, reporting on the S in SCW density profiles and flow patterns through the adsorbent were used for the validation of models applied in MD and CFD. The SCW desulfurization efficiency of different Me_xO_y was established.

Conclusion & Significance: The findings of the present study are of great importance when the goal is to mitigate the deactivation of the catalyst by S from the foregoing biomass gasification by SCW.

Figure: Dedicated experimental setup for desulfurization under SCW conditions.

Recent Publications

1. Lachos-Perez D, et al. (2017) Applications of subcritical and supercritical water conditions for extraction, hydrolysis, gasification, and carbonization of biomass: a critical review. Bio fuel Research Journal 4(2):611-626.
2. Stucki S, et al. (2009) Catalytic gasification of algae in supercritical water for biofuel production and carbon capture. Energy & Environmental Science 2(5):535-541.
3. Peng G, C Ludwig and F Vogel (2017) Catalytic supercritical water gasification: Interaction of sulfur with ZnO and the ruthenium catalyst. Applied Catalysis B-Environmental 202:262-268.
4. Ates A, et al. (2014) The role of catalyst in supercritical water desulfurization. Applied Catalysis B: Environmental 147:144-155.

5. Maxim F, et al. (2017) The impact of sorbent geometry on the sulphur adsorption under supercritical water conditions: a numerical study. Biomass Conversion and Biorefinery 7(4):479-485.

Biography

Florentina Maxim has her expertise in the Hydrothermal Synthesis and the Characterization of Nano Metal Oxides. She has completed her Doctorate in the "Morphology control of nano ferroelectric metal oxides" work carried out in the group of Professor Paula Vilarinho at University of Aveiro, Portugal in 2010. After several research fellowships for Electron Microscopy, she was leading the project for Young Independent Research Team funded by the Romanian National Foundation UEFISCDI. Since 2015, she is working as a Postdoctoral Scientist at Paul Scherrer Institute, Switzerland and her major research activities are in the field of advanced materials for energy harvesting from biomass (algae) by supercritical water processes.

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Notes:

Noriko Kurose et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Realization of conductive aluminum nitride epitaxial layer on silicon substrate by forming spontaneous nano size via-holes

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Statement of the Problem: The n-type aluminum gallium nitride (n-AlGaN) vertical field effect transistors on a Si substrate are promising devices for future super high power devices beyond Si, SiC and GaN devices which are currently being developed. The AlN buffer layer is indispensable for the growth of AlGaN epitaxial layer on the Si substrate. However, the AlN is an insulating material and we could not flow current through the buffer layer. We report formation of the conductive AlN buffer layer (hereafter v-AlN) and details of the formation mechanism of the v-AlN.

Methodology: The v-AlN is grown on the Si substrate using metal organic chemical vapor deposition (MOCVD). Al metal dots are grown on the substrate to form Al-Si alloy dots with successive growth of AlN buffer layer. Spontaneous nano size via-holes (hereafter via-holes) are formed in AlN buffer layer due to the surface energy difference of Si and Si-Al alloy. The n-AlGaN is grown on it to fill out the via-holes. The conductive AlN buffer layer with via-holes is formed.

Findings: We have converted the insulating AlN buffer layer to conductive one by forming cluster of via-holes in the buffer layer filled with n-AlGaN during the crystal growth. The size of the cluster and the density are controlled and are 0.2~1μm$^{\Phi}$ and 10^7~10^8/cm^2, respectively. The current flows through these clusters filled with n-AlGaN. The mirror like n-AlGaN epitaxial layer was successfully grown on it. It is confirmed that the vertical resistivity through the conductive AlN buffer layer was 0.2Ω/cm^2 which is about 104 times smaller than that of conventional AlN.

Conclusion & Significance: We have succeeded in growing the conductive AlN buffer layer on the Si substrate. Our technique and findings open a way to make vertical high power AlGaN FETs, UV-LEDs, UV sensors on the Si substrate and to realize Si on chip devices.

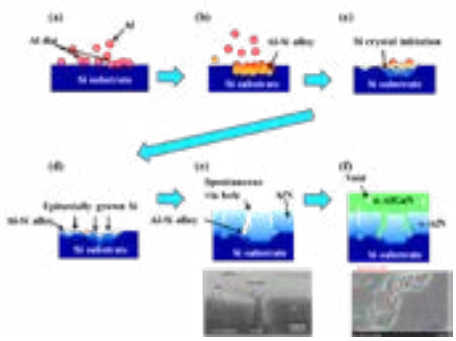

Figure: Steps of the formation of spontaneous via-holes. At the beginning stage of the growth, a small amount of Tri-methyl Aluminum (TMA) is fed on the Si substrate to form small size Al dots (a). The Al embedded on the Si substrate interacts with the Si substrate to generate Al-Si alloy dots (b) during the Al feeding time and during the increase of temperature. At a Si content of approximately 35% β solid phase Si recrystallization is initiated as understood from the phase diagram of Si-Al alloy(c) and Si is epitaxially grown in the Al-Si alloy dots as shown in (d). No AIN growth occurs on the Al-Si alloy surface because of the difference of surface energy of Si and Si-Al alloy. Thus, via-holes of AlN are formed in the area where the Al dots are formed (e). A scanning electron microscope (SEM) image of via-holes is shown underneath of (e). Conductive n-AlGaN is filled in these via-holes by successive growth of n-AlGaN as shown in (f). Nano cluster via-holes observed by SEM are shown underneath of (f)

Recent Publications

1. Kurose N, Matumato K, Yamada F, Roffi T M, Kamiya I, Iwata N and Aoyagi Y (2018) Laser induced local activation of Mg-doped GaN with high lateral resolution for high power vertical devices. AIP Advances 8: 015329-1-015329-5.
2. Kurose N and Aoyagi Y (2016) Development of high power, large area, deep ultraviolet light emitting devices using dynamic microplasma excitation (MIPE) of AlGaN multiple quantum wells. Electronics and Communications in Japan 99:3-11.
3. Kurose N, Iwata N, Kamiya I and Aoyagi Y (2014) Formation of conductive spontaneous via holes in AlN buffer layer on n+Si substrate by filling the vias with n-AlGaN by metal organic chemical vapor deposition and application to vertical deep ultraviolet photo-sensor. AIP Advances 4(12):123007.
4. Kurose N, Shibano K, Araki T and Aoyagi Y (2014) Development of substrate removal free vertical ultraviolet light-emitting diode (RefV-LED). AIP Advances 4:027122.
5. Aoyagi Y and Kurose N (2013) A 2-inch, large-size deep ultraviolet light-emitting device using dynamically controlled micro-plasma-excited AlGaN. Applied Physics Letters 102(4):041114.

Biography

Noriko Kurose has her expertise in "Crystal growth engineering of nitride semiconductor using metal organic chemical vapor deposition to control the material properties". She found an insulating material can be converted to conductive one by introducing nano via-holes spontaneously inside the insulator using a crystal growth technique and she has clarified the conversion mechanism. Her invention opens a way to fabricate various vertical devices on Si substrate and Si on chip devices. Actually, she has succeeded in fabricating a vertical UV-LED and a vertical UV sensor using her technology. In addition, she has succeeded in fabricating large area panel type micro plasma excited DUV light emitting devices with a size of more than two inches. She was invited to present her work in many international conferences.

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Notes:

Yoshinobu Aoyagi et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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A new laser induced local material engineering to convert from n-type to p-type nitride semiconductor to fabricate high power vertical AlGaN/GaN devices on Si substrate

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[2]Toyota Technological Institute, Japan

Statement of the Problem: The n-type aluminum gallium nitride (n-AlGaN) vertical field effect transistors (FETs) are promising devices for future super high power FET electronics beyond Si, SiC and GaN devices. To realize n-AlGaN vertical FETs with carrier blocking layer to concentrate the current flow into the vertical channel region, the local p-type AlGaN formation is indispensable. So far, to realize this local p-type layer, crystal regrowth technique with lithography is carried out but this process is complicated and reduces the crystal quality. To precede local carrier type conversion from n-type to p-type without any crystal regrowth method, the carrier blocking layer can be easily produced without any crystal damages.

Methodology: We used an excimer laser (193 nm) as an irradiation source for material engineering. The irradiation system has a scanning system of the sample to control the irradiation area and an *in-situ* monitoring system to observe the material surface during the laser irradiation. The material characteristics are observed using Hall effects, Kelvin probe and optical microscope measurement.

Findings: We found the insulating or n-type as grown Mg-doped GaN (Mg: GaN) was converted to p-type GaN (p-GaN) under a proper laser irradiation condition only at the specific local area of the laser irradiation. The lateral resolution for transition from the Mg: GaN to p-type was about 1 μm. The surface has no damage under the irradiation.

Conclusion & Significance: A new technique has been established. This has achieved local activation of Mg: GaN to p-type GaN using the laser irradiation co-operated with *in-situ* observations of the surface during the laser processing. Using this method, local activation of carriers with the lateral resolution of about 1 μm is possible, thus establishing the potential for fabricating local p-GaN carrier blocking layer and vertical high power devices without using any other fabrication techniques such as crystal regrowth.

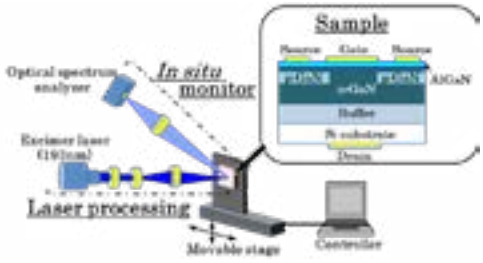

Figure: Experimental set up and sample to be converted locally from n-type to p-type GaN. The sample placed on the X–Y stage was scanned using a controller. The PL and scattered light from the processing region of the GaN were monitored *in-situ* to feed the actual irradiation conditions back to the laser. The inset shows a schematic view of a vertical FET with a p-GaN carrier-blocking layer which is locally converted from n-GaN by our method.

Recent Publications

1. Tanaka S, Iwai S and Aoyagi Y (1996) Self-assembling GaN quantum dots on Al_xGa1-_xN surfaces using a surfactant. Applied Physics Letters 69:4096-4098.
2. Tanaka S, Takeuchi M and Aoyagi Y (2000) Anti-surfactant in III-nitride epitaxy - Quantum dot formation and dislocation termination. Applied Physics Letters 39: L831-L834.

3. Aoki K, Miyazaki H T, Hirayama H, Inoshita K, Baba T, Sakoda K, Shinya N and Aoyagi Y (2003) Micro assembly of semiconductor three-dimensional photonic crystals. Nature Materials 2(2):117-121.
4. Matsuda K, Saiki T, Nomura S, Mihara M, Aoyagi Y, Nair S and Takagahara T (2003) Near-field optical mapping of exciton wave functions in a GaAs quantum dot. Physical *Review Letters* 91:177401-1-177401-4.
5. Aoyagi Y and Kurose N (2013) A 2-inch, large-size deep ultraviolet light-emitting device using dynamically controlled micro-plasma-excited AlGaN. Applied Physics Letters 102:041114.

Biography

Yoshinobu Aoyagi has his expertise in nano technology and creation of advanced materials for developing new devices. His recent work is a discovery of anti-surfactant phenomena to create spontaneously GaN quantum dots even on the lattice matched substrate, for example GaN quantum dots on a GaN substrate which is impossible under common crystal growth condition. He has also succeeded in developing a new technology to fabricate a 3D photonic crystal, DUV LED, a large scale DUV light emitter of more than 2 inches size. Laser processing is also another main work. He also succeeded in pioneer works on laser induced atomic layer deposition and atomic layer etching at the beginning stage of the research. He published more than 500 articles in scientific journals and presented a lot of invited talks.

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Notes:

Ankita Ghatak, Res. Rev. J Mat. Sci. 2018, Volume 6
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Restoration of perovskite phase in the top layer of thin BTO film by plasma treatment and annealing

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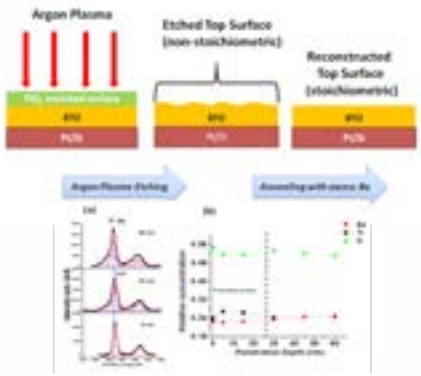
Barium titanate ($BaTiO_3$) is a very attractive material in the field of electroceramics and microelectronics due to its good electrical properties. Its high dielectric constant and low loss characteristics make BTO an excellent choice for many applications, such as capacitors, multilayer capacitors (MLCs) and energy storage devices. In more recent activities, the focus has shifted on growth of thin BTO films with thickness ≤200 nm and preferably even thinner like 100 nm. It is desirable to have thin films of BTO grown on (Pt/Si) that can act as a super capacitor if the relative permittivity is more than 100. However, the growth of thin BTO film (~100 nm) with acceptable dielectric and ferroelectric properties has not been adequately addressed to and the method to grow such a film has not been standardized either. We report a simple method to restore the perovskite phase in the top surface/sub-surface region of a thin film (~100 nm) of barium titanate (BTO) fabricated by pulsed laser deposition on a platinized silicon (Pt/Si) surface and thus enhance its dielectric and ferroelectric properties. Phase evolution, surface morphology with local chemical composition of BTO films have been studied as a function of laser fluence. Investigations using X-ray diffraction (XRD), grazing-angle incidence X-ray diffraction (GIXRD) and depth resolved X-ray photoelectron spectroscopy (XPS) show that even after achieving a good phase formation there can be a presence of non-perovskite TiO_2 phase at the surface and subsurface in such films that degrades its dielectric and ferroelectric response. The restoration of the degraded top layer was done by a combination of low energy Ar plasma treatment followed by an annealing process that enhances Ba content.



Biography

Ankita Ghatak is a Post-doctoral Fellow and has her expertise in growth of nanostructured binary as well as complex oxides. She has grown aligned 1-D nanostructured binary oxide which has a strong influence in the field of applications. She also has her on expertise on microstructural analysis of complex oxide nanostructures that has provided up a new field of research from technological point of view. Her interface analysis of complex materials with substrates has opened a challenging field in the device fabrication process. She in her publications has tremendously contributed about the benefit of creating atomically sharp interfaces that will enhance the future device performances.

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Barnali Ghosh (Saha), Res. Rev. J Mat. Sci. 2018, Volume 6
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Hybrid perovskite halide for detection of environmental pollutant in atmosphere

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In recent years, the organic/inorganic halide perovskites are emerging material and have attracted significant attention because of its various important application potentials like solar cells and other optoelectronic applications. Sensors based on thin films of different materials are widely used for various hazardous gas detection. These sensors with proper electrical readout, if made sensitive enough can even be used for non-invasive diagnosis of disease using the technique of breath analysis. While there are many electrical readout sensors that can detect hazardous gas typically with concentration ≥10 ppm, there are not too many visual (color change type) sensors that can easily detect hazardous gas with comparable sensitivity. Very recent developments of a visual color change-based sensor made using hybrid perovskite halide as working material led to detection of hazardous gas like ammonia with concentration <5 ppm with very high selectivity in room temperature. The low cost of the synthesis and the fact that it is made on a paper makes the sensor disposable. It is a low cost portable sensor for rapid, easy and selective detection of the atmospheric ammonia in open or closed environment by a simple color change effect, without the need for any other instruments. This visual sensor will be useful in places that can produce and emit ammonia gas in the environment such as food grain storage facilities, waste disposal sites and perishable materials storage facilities.

Biography

Dr. Barnali Ghosh Saha), is now a Scientist-E, (Associate Professor) in the Department fo Condensed Matter Physics and Material Sciences and Head of the department of Technical Research facility programme. She is a member of Indian Physics Association. She got Ph.D degree in Physic award in 1998. She got a research Award in Woman Scientist programme in 2003 and 2008 from "Department of Science and Technology, Government of India". Currently Dr. Barnali Ghosh (Saha)'s researches focus on experimental condensed matter Physics and Nano Science and nanotechnology, Physics of transition metal oxides mainly perovskite oxides. She is also working on fabrication of single nanowire based devices using different lithographic techniques like, e-beam and focused ion beam techniques and transport measurement on single nanowire. She also does cross sectional transmission electron microscopy related work using focused ion beam based techniques.

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Notes:

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Comparative analysis on monolithic DeNOx catalysts

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Catalysts based on the vanadia-titania system are widely used for the abatement of pollutants, particularly nitrogen oxides (NOx), in the exhaust gases of industrial plants. Their mechanism of operation is based on the catalytic reduction reaction of nitrogen oxides with ammonia (SCR). In this paper, two commercial catalysts based on the V-W-Ti system of very similar nominal composition were compared. The two samples were analyzed in the fresh state and after a period of operation in a waste gas plant of a waste to energy plant. The materials were first characterized from the chemical structural point of view through instrumental techniques such as X-ray fluorescence (XRF), X-ray diffractometry (XRD), IR spectroscopy (FTIR), SEM scanning electron microscopy observations with analysis EDS, measurement of pore size and specific surface area through nitrogen adsorption/desorption and BET techniques. Subsequently, the catalytic properties of the new and used catalysts in the NH_3-SCR reaction were evaluated. The results of the analysis showed that the samples are both made of a titanium matrix in the form of anatase, reinforced with glass fibers used as a support for the active phases based on V and W. The percentages of vanadium are practically the same for both systems, while the tungsten percentage is very different. The specific surface also has very similar values for the two fresh catalysts. The tests of catalytic activity, on the other hand, have given very different results particularly, for one of the two catalysts the performance decays much faster than the other. The kinetic measurements show that the decay is not due to a specific surface decrease but due to the presence of precipitates, but to a difference in initial activity between the two catalysts, linked to the different tungsten content.

Recent Publications

1. M O Guerrero-Perez (2017) Supported, bulk and bulk-supported vanadium oxide catalysts: a short review with an historical perspective. Catalysis Today 285:226–233.
2. Svachula J, Alemany L J, Ferlazzo N, Forzatti P, Tronconi E and Bregani F (1993) Oxidation of SO_2 to SO_3 over honeycomb DeNoxing catalysts. Industrial & Engineering Chemistry Research 32(5):826–834.
3. Xi Y, Ottinger N A and Liu Z G (2014) New insights into sulfur poisoning on a vanadia SCR catalyst under simulated diesel engine operating conditions. Applied Catalysis B: Environmental 160–161(1):1–9.
4. Chen J P and Yang R T (1992) Role of WO_3 in mixed V_2O_5-WO_3/TiO_2 catalysts for selective catalytic reduction of nitric oxide with ammonia. Applied Catalysis A: General 80(1):135-148.
5. Zhang S and Zhong Q (2015) Surface characterization studies on the interaction of V_2O_5–WO_3/TiO_2 catalyst for low temperature SCR of NO with NH_3. Journal of Solid State Chemistry 221:49–56.

Biography

Giovanni Perillo has completed his Graduation in Civil Engineering at the University of Naples Federico II, Italy. He is a Professor at University of Naples Parthenope and Adjunct Professor at Wessex Institute of Technologies, New Forest (UK). He has been involved in several world-wide international research projects and he is an author of more than 100 scientific publications in varied fields of engineering. He is currently a member of several International Advisory and Scientific Committees. He is a Member of Editorial Board of the Journal of Energy Engineering Science and Journal of Hydrology Science from publishing group, New York, USA and Reviewer of Journal China-USA Business Review of Horizon Research Publishing. He also planned many high technical engineering projects. Since 1996, he is a member of National Geographic Society and a member of New York Academy of Sciences. He was also a Chairman of Italian National Environment Commission.

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Growth and electrochemical characterization of graphene nano walls and carbon nanotubes

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[1]Universitat de Barcelona, Spain
[2]Institut de Ciència de Materials de Barcelona, Spain
[3]Escuela Politécnica Nacional, Ecuador

Electrochemical double layer capacitors (EDLC) or supercapacitors exhibit higher specific capacitance than conventional electrolytic capacitors due to their increased surface area and short distance between positive and negative charges at the electrode/electrolyte interface. Because of their high electric conductivity, chemical inertness, thermal and mechanical stability, carbon-based electrodes are the preferred material of choice in supercapacitor applications. In particular, carbon nanostructures such as carbon nanotubes (CNTs), with a high specific surface area may increase the capacitance upto about 100 F/g. Recently, graphene nanowalls (GNWs) are being the focus of research in different areas due to their outstanding properties. GNWs can be described as self-assembled, vertically-standing, few-layered graphene sheet nanostructures. The growth mechanism of these nanostructures is still not clear, but recent results indicate that they grow virtually on every substrate that withstand the synthesis temperature (around 600°C) without the need of a catalyst. Thus, this new material has promising features that may improve performance of energy storage devices like supercapacitors or lithium ion batteries. Surface functionalization of these nanostructures by means of plasma treatments or deposition of metal oxides may further improve their pseudo capacitance and electrochemical performance. This study explores the growth of GNWs and their super capacitive properties grown under different conditions, and compares the results with those obtained for CNTs.

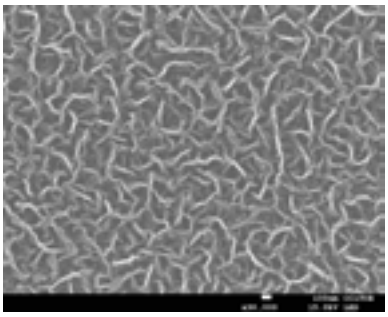

Figure: Top view of Graphene Nanowalls deposited on silicon wafer by means of ICP-CVD (Inductively Coupled Plasma-Chemical Vapor Deposition).

Recent Publications

1. Davami K, Shaygan M, Kheirabi K, Zhao J, Kovalenko D A, Rümmeli M H, Opitz J, Cuniberti G, Lee J S and Meyyappan M (2014) Synthesis and characterization of carbon nanowalls on different substrates by radio frequency plasma enhanced chemical vapor deposition. Carbon Journal 72:372-380.
2. Song X, Liu J, Leyong Y, Yang J, Fang L, Shi H, Du C and Wei D (2014) Direct versatile PECVD growth of graphene nanowalls on multiple substrates. Materials Letters Journal 137:25-28.
3. Bo Z, Yang Y, Chen C, Yu K, Yana J and Cena K (2013) Plasma-enhanced chemical vapor deposition synthesis of vertically oriented graphene nanosheets. Nanoscale 5:5180-5204.
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5. 5. Hussain S, Amade R, Moreno H and Bertran E (2014) RF-PECVD growth and nitrogen plasma functionalization of CNTs on copper foil for electrochemical applications. Diamond and Related Materials 49:55-61.

Biography

Roger Amade has his expertise in the synthesis of carbon nanostructures using chemical vapor deposition (CVD) and plasma enhanced chemical vapor deposition techniques on different substrates and their electrochemical characterization as electrodes for energy storage and production devices. In particular, his research is focused on the development of new nanostructures for supercapacitors, lithium-ion batteries and microbial fuel cells. He is currently an Associate Professor in the Department of Applied Physics from University of Barcelona.

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Notes:

Kimihisa Yamamoto, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-020

Fine-controlled sub-nano metal particle in a dendrimer reactor

Kimihisa Yamamoto
Tokyo Institute of Technology, Japan

We show that tin chlorides, $SnCl_2$ and $FeCl_3$ complexes to the imines groups of a spherical poly (phenyl azomethine) dendrimer in a stepwise fashion according to an electron gradient with complexation in a more peripheral generation proceeding only after complexation in generations closer to the core has been completed. The metal assembly in a discrete molecule can be converted to a size regulated metal cluster with a size smaller than 1 nm as a molecular reactor. Due to the well-defined number of metal clusters in the sub nanometer size region, its property is much different from that of bulk or general metal nanoparticles. Dendrimers are highly branched organic macromolecules with successive layers or generations of branch units surrounding a central core. Organic, inorganic hybrid versions have also been produced by trapping metal ions or metal clusters within the voids of the dendrimers. Their unusual, tree like topology endows these nano meter sized macromolecules with a gradient in branch density from the interior to the exterior, which can be exploited to direct the transfer of charge and energy from the dendrimer periphery to its core. Here, we show that tin ions, Sn^{2+}, complex to the imines groups of a spherical poly (phenyl azomethine) dendrimer in a stepwise fashion according to an electron gradient with complexation in a more peripheral generation proceeding only after complexation in generations closer to the core has been completed. By attaching an electron withdrawing group to the dendrimer core, we are able to change the complexation pattern, so that the core imines are complexed last. By further extending this strategy, it should be possible to control the number and location of metal ions incorporated into dendrimer structures, which might and uses as tailored catalysts or fine controlled clusters for advanced nano catalysts.

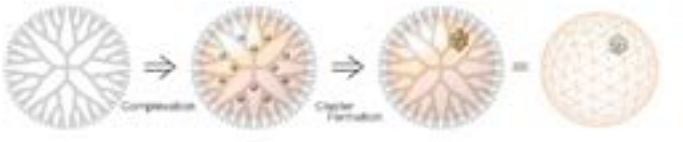

Figure: Precision synthesis of sub nanoparticles using dendrimers.

Biography

Kimihisa Yamamoto has completed his PhD in Polymer Chemistry at Waseda University, 1990. He joined as Professor in Department of Chemistry at Keio University, 1997. Currently, he is a Professor in the Chemical Resources Laboratory at Tokyo Institute of Technology since 2010. His present research interests are in developing supra–metallo molecules for nano synthesizers involving nanoparticles, sub nanoparticles and super atoms..

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Notes:

Tiva Sharifi, Res. Rev. J Mat. Sci. 2018, Volume 6
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Thermo electricity enhanced catalysis

Tiva Sharifi[1, 2]
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The voltage generated in thermoelectric materials can supply energy to any energy demanding system when there is a chance of either existence of temperature gradient or the possibility to generate it if it does not cause any malfunction for the system. Electro/photo catalytic reactions are good example of such systems. Thermoelectric materials can act as mini voltage generators to boost catalytic reactions and hence reduce/eliminate the external bias energy. In this case, thermoelectric material has a function similar to but conceptually different from the catalyst. As recently solar energy has been widely considered as a renewable energy resource to direct or indirectly power up the catalytic reactions, a temperature gradient could be naturally established and be utilized in the system. We have investigated the catalytic performance of nano structured tellurides (e.g., Bi_2Te_3 and Sb_2Te_3) which are among the most known thermoelectric materials. By optimizing the structure, morphology and size of thermoelectric materials, they are utilized in different catalytic reactions. We observe that with the effect of temperature gradient these catalytically inert materials will contribute to and facilitate the catalytic reactions including electrochemical water splitting and photocatalytic hydrogen desorption.

Recent Publications

1. Sharifi T, Zhang X, Costin G, Yazdi S, Woellner C F, Liu Y, Tiwary C S and Ajayan P (2017) Thermoelectricity enhanced electro catalysis. Nano Letters 17(12):7908-7913.
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5. Pham T N, Sharifi T, Sandström R, Siljebo W, Shchukarev A, Kordas K, Wågberg T and Mikkola J P (2017) Robust hierarchical 3D carbon foam electrode for efficient water electrolysis. Scientific Reports 7(1):6112.

Biography

Tiva Sharifi has completed her PhD in Material Science in Physics Department at Umeå University, Sweden. Her research has been mainly focused on the synthesis and understanding of the properties of doped carbon based materials for energy conversion reactions. She then moved to Ajayan Research Group at Rice University, Houston, TX and has completed her Post-doctoral research on the understanding and resolving of the properties of low-dimensional materials.

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Toshihiro Miyata et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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P-type Cu_2O-based heterojunction solar cells fabricated with n-type ZnO thin film prepared by electrochemical deposition method

Toshihiro Miyata, Hiroki Tokunaga and **Tadatsugu Minami**
Kanazawa Institute of Technology, Japan

Recently, substantially improved conversion efficiency has been reported in p-type Cu_2O sheet-based heterojunction solar cells with n-type oxide semiconductor thin films prepared by the pulsed laser deposition (PLD) method. However, PLD has some disadvantages as a practical preparation method, such as low deposition rate, small deposition area and high cost. On the other hand, the electrochemical deposition (ECD) method is a deposition technique that has potential to solve these problems. This paper describes the fabrication of Cu_2O based heterojunction solar cells using n-type ZnO thin film prepared by the ECD method. The n-type ZnO thin film layer was prepared on a p-type Cu_2O: Na sheet using the following ECD process. Initially, a zinc nitrate aqueous solution was prepared with 0.22 M zinc nitrate and de-ionized water; after that, a 0.3 M HCl or 0.1 M KOH aqueous solution was added to adjust the pH. Next, a p-Cu_2O: Na sheet was immersed in the above solution. The photovoltaic properties were strongly dependent on the fabrication conditions of n-type ZnO thin films. For example; the current density-voltage (J-V) characteristics of AZO/n-ZnO/p-Cu_2O: Na solar cells showed strong dependence on the pH of the zinc acetate aqueous solution, obtaining significant improvement with a pH value of 4.9 in Figure 1. Figure 2 shows typical J-V characteristics for AZO/n-ZnO/p-Cu_2O solar cells prepared under optimized deposition conditions, such as film thickness of the n-ZnO thin film. The same structure of a Cu_2O heterojunction solar cell using n-type ZnO thin films was prepared by PLD, and the J-V characteristics are also shown in Figure 2. It should be noted that the J-V characteristics of the AZO/n-ZnO/p-Cu_2O solar cells were the same as those when using the PLD method.

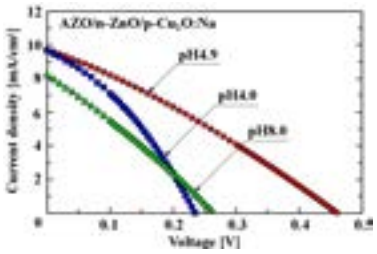

Figure 1: pH dependence of zinc acetate aqueous solution for J-V characteristics of AZO/n-ZnO/p-Cu_2O: Na solar cells

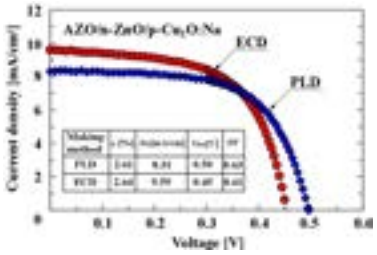

Figure 2: Typical J-V characteristics of AZO/n-ZnO /p-Cu_2O heterojunction solar cell under optimized preparation conditions

Recent Publications

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5. T Minami, T Miyata and Y Nishi (2014) Efficiency improvement of Cu_2O-based heterojunction solar cells fabricated using thermally oxidized copper sheets. Thin Solid Films 559:105-111.

Biography

Toshihiro Miyata is a Professor at the Kanazawa Institute of Technology (KIT), Japan and a Researcher of the Optoelectronic Device System R&D Center at KIT. His interests focus on optoelectronic devices, especially solar cells using Cu_2O. He has completed his BE degree in Electronics Engineering at KIT, 1987 and ME and Doctor of Engineering degrees at KIT in 1989 and 1992 respectively. During the period 1992 to 1993, he was a Visiting Scientist at the Micro Systems Technology Laboratory at MIT, USA.

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Notes:

Keigo Takeda et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Growth control of vertical nano graphene network in plasma enhanced chemical vapor deposition and its emerging applications

Keigo Takeda[1], Takuya Suzuki[1], Hitoshi Nozaki[1], Mineo Hiramatsu[1], Hiroki Kondo[2] and **Masaru Hori[2]**
[1]Meijo University, Japan
[2]Nagoya University, Japan

Carbon nanowalls (CNWs) composed of few layer graphenes standing vertically on the substrate have a maze like structure formed by a self-supporting network of wall structures. The 3-dimensional structure of CNWs would be useful as a nano platform for electrochemical applications such as sensing, energy conversion, etc., because of the conductive carbon structure with the large surface and the wide capability of surface modification including decoration with catalysts such as metal nanoparticles. For achieving the CNWs applications to such fields, control of CNWs morphologies including interspace between adjacent nano walls is crucial issue. In this study, we carried out the CNWs growth with plasma enhanced chemical vapor deposition (PECVD) using $CH_4/H_2/Ar$ mixture with emphasis on the surface morphology control of CNWs. The CNWs were grown on a SiO2 film synthesized on a Si substrate by PECVD using inductively coupled $CH_4/H_2/Ar$ plasma. Moreover, emission intensities of CH species (wavelength: 430 nm) and H atom (Balmer α line, wavelength: 656 nm) in the plasma were monitored by optical emission spectroscopy. To estimate the interspace between adjacent nanowalls, the average area surrounded by nanowalls was evaluated from the top view observation of grown CNWs observed by scanning electron microscope. From results, it is found that the behavior of average area change has a correlation with the [H]/[CH] emission intensity ratio in the CVD plasma with $Ar/CH_4/H_2$ mixture. It is considered that the balance between carbon precursors and etching radicals in the CVD plasma affect the nucleation in the initial growth stage of CNWs, therefore, the interspaces between adjacent walls changed as a function of the [H]/[CH] emission intensity which is relative density ratio of gas phase radicals. In our presentation, we report the effects of ion bombardment and catalytic metals on the nucleation of nano walls to achieve the control of space between adjacent walls.

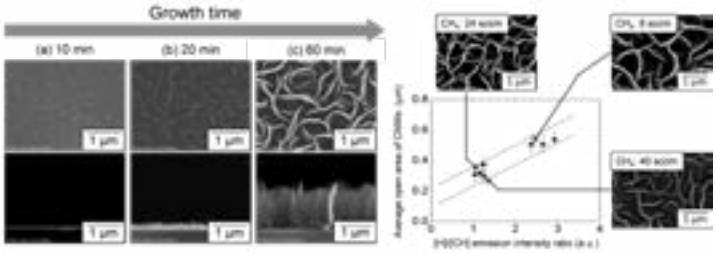

Figure 1: Average area surrounded by the grown nanowalls as a function of [H]/[CH] emission intensity ratio in the plasma

Biography

Keigo Takeda has completed his PhD at Nagoya University and Postdoctoral studies at Graduate School of Engineering, Nagoya University. He is an Associate Professor at Meijo University since 2017. He has published more than 90 papers in reputed journals. His current research interests include Reaction mechanisms of reactive species in plasma processes for advanced materials synthesis, Fine Processing Technology and Biomedical Applications, etc.

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Dafna Knani, Res. Rev. J Mat. Sci. 2018, Volume 6
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In silico study of the self-assembly and gelation of sugar derivatives

Dafna Knani
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Low molecular weight gelators are molecules capable of forming gels in which they are self-assembled into a physical 3D network of fibers, held together by non-covalent interactions like hydrogen bonds, Van der Waals forces and π–π-interactions. The organic gelator 1,3 (R):2,4(S)-dibenzylidene-D-sorbitol (DBS) self-organizes to form a 3-D network at relatively low concentrations in a variety of nonpolar organic solvents and polymer melt. DBS could be transformed into a hydrogelator by introduction of hydrophilic groups, which facilitate its self-assembly in aqueous medium. In this work, the self-assembly of DBS and its derivatives was investigated by molecular modeling. A dynamic molecular simulation was carried out using atomistic and quantum tools included in the Material Studio 8.0 (by Biovia) software. Various properties (cohesive energy density, mixing energy, radial distribution function) were calculated to illustrate the interactions that govern the self-assembly of the examined compounds. The results of the simulation indicate that the interaction between DBS-COOH molecules is stronger than DBS-$CONHNH_2$ and DBS and its water compatibility is highest. Therefore, DBS-COOH seems to be a better hydrogelator than DBS-$CONHNH_2$ and DBS. Intermolecular H-bonding interactions are formed between the three molecules as pure substances and they dramatically decrease in the presence of water. In contrast, the intra-molecular interactions increase in water. This result indicates that in aqueous environment the molecular structure tends to be more rigid and fixed in the preferred conformation. Due to H-bonds, DBS and its derivatives form a rigid structure which might explain their tendency to create nanofibrils. In order to obtain effective hydrogelators, fine-tuning of the balance between the hydrophilic (soluble) and hydrophobic (insoluble) parts is essential.

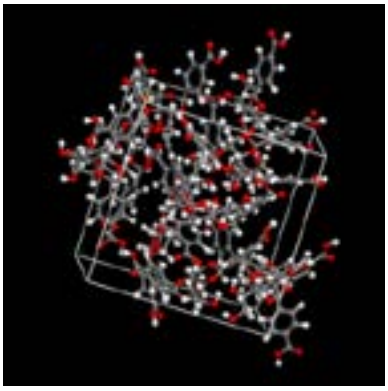

Figure: Periodic cubic cell of DBSCOOH, after 500ps dynamic simulation

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Biography

Dafna Knani is a Senior Lecturer in the Department of Biotechnology Engineering at ORT Braude College. Currently, she is the Head of MSc program in Biotechnology. She is an Organic Polymer Chemist. She has completed her Graduation in the Faculty of Chemistry at Technion-Israel Institute of Technology. In the past, she worked for surgical bio-polymeric materials start-up company (developing adhesives for hard tissues) and as a Research Chemist and Project Leader at Israel Chemicals Ltd. Her current research focuses on "Molecular modeling of materials and biomaterials, especially simulation of systems used for controlled drug release and tissue engineering".

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Notes:

Vignesh N et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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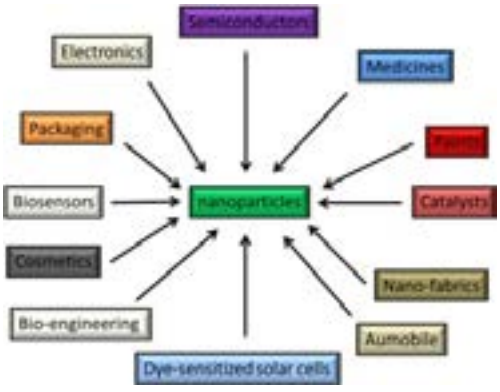
Design and development of nanomaterials using induction plasma system and its application

Vignesh N[1] and **Justin C**[1]
[1]Matrix Nano, India

Induction plasma technology (IPS) is the new way of producing high purity nano-powders at an industrial scale, all this made possible by TEKNA Company, the leading producer of nanomaterial synthesizing machines. Not only being a means of producing high purity powders, IPS is known for having a clean heat source which lacks induced contaminants assuring high grade products. This complex technology is based on utilizing high voltage being passed through a coil with a conductor placed in between the coil to produce high amount of heat at the conductor due to the effect of electromagnetic induction. With flowing gas being used as the conductor, it will reach high temperature extremes due to ionization or the gas into a plasma. The most common gases used in this system include Argon, Hydrogen and Oxygen as carriers. The IPS machine uses micron sized powders as the feed which is then carried carried through the system by a carrier gas commonly being Argon which are then together heated up to extreme temperatures producing ionized metal oxides which are then subjected to a quenching gas which ensures homogenous nucleation. Several parameters are to be closely calculated and followed to ensure the desired nanoparticle size outcome. These include:

- Temperature
- Feed dispersion
- Gas composition
- Quenching gas
- Feed rate
- Carrier gas
- Feed rate
- Carrier gas temperature
- Torch temperature
- Raw material

Extensive research in induction plasma has made the technology better and more efficient than ever before in synthesis of nanomaterials.



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Biography

Vignesh N has majored in the field of nanotechnology specializing in design and development of nanomaterials. Based on this background he is now involved in the research and development work of multiple products which are based on nanotechnology. Backed by dozens of trials, his perseverance finally paid off as he was able to tailor specific experimental parameters for several nanomaterials which have already made their way to the market. With this research work, it is paving the way for a future with nanotechnology in it".

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Notes:

21st International Conference on

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Young Researchers Forum Day 1

Clément Genet et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Development of functionalized coating by sol-gel process on aluminium alloy

Clément Genet[1], Marie-Joëlle Menu[1], Florence Ansart[1], Marie Gressier[1] and **Olivier Gavard[2]**
[1]University of Toulouse, France
[2]Amphenol Socapex, France

The goal of this study is to develop an innovative coating in accordance with the environmental regulations REACH and RoHS. Innovation will consist in an original approach of the sol-gel process implementation. Compared to the current plating's, environmental unfriendly processes due to hazardous chemicals to health and environment, this innovative liquid process is very interesting to work on many different substrates. The formulation is designed according to the required properties of the coating, throughout an appropriate surface structuration. The originality of the approach is to develop a formulation with an adequate choice of precursors and fillers which bring simultaneously anticorrosion and electrical conductivity. The literature provides many sol-gel formulations, and the most suitable for complex shape parts are composed of both organic and inorganic precursors. They are named organic inorganic hybrid (OIH) sol-gel coating-1. Coating flexibility and anticorrosion properties are some of the properties provided by an OIH coating. In our study, organic and inorganic precursors are selected towards anticorrosion properties. Inhibitor is also added to sol-gel matrix-2 to improve the corrosion resistance. Some works have been performed on the influence of different fillers on the electrical properties of the polymer matrix-3, but the innovative study here is to combine the anticorrosion and electrical properties in a coating prepared by sol-gel route. To bring electrical properties to sol-gel coating, different fillers are taking on and studied. Influence of fillers natures, form factors and quantities are evaluated to find an optimum composition. Electrical, viscosity and hydrophobic characterization are accomplished to file fillers in function of their behavior in the sol-gel matrix. Structural and microstructural characterizations are performed by 3D optical microscopy and scanning electron microscopy. The chemical interaction between the sol-gel coating and the substrate is also deeply characterized and specially the durability of materials under corrosive conditions by coupling salt spray test, electrochemical impedance spectroscopy, nano scratch and nano indentation.

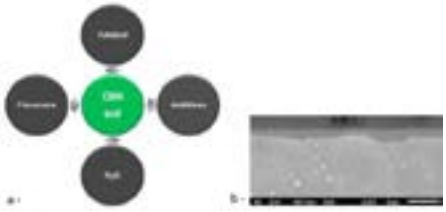

Figure-1: (a) OIH sol composition and (b) SEM micrography of OIH coatings on aluminium alloy substrate.

Recent Publications

1. Figueira R, Fontinha I, Silva C and Pereira E (2016) Hybrid sol-gel coatings: Smart and green materials for corrosion mitigation. Coatings; 6(1): 12.
2. Cambon J B, Esteban J, Ansart F, Bonino J P, Turq V, Santagneli S H, Santilli C V and Pulcinelli S H (2012) Effect of cerium on structure modifications of a hybrid sol-gel coating, its mechanical properties and anti-corrosion behavior. Materials Research Bulletin; 47(11): 3170-3176.
3. Zhang W, Blackburn R S and Dehghani-Sanij A A (2007) Effect of carbon black concentration on electrical conductivity of epoxy resin-carbon black-silica nanocomposites. Journal of Materials Science; 42(18): 7861-7865.

Biography

Clément Genet is a PhD Student at University of Toulouse Paul Sabatier and Research Associate at CIRIMAT laboratory and Amphenol Socapex Company. He has obtained his Engineer's degree in Materials Science at ESIR, France and has a specialization with his Master's degree in Materials Science for Aeronautics and Aerospace at University of Toulouse, France. He has experience in the synthesis and characterization of nanostructured materials and coating for more particularly anticorrosion properties in aeronautic field.

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Tahmineh Forati et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Developing super hydrophobic copper/graphene nano-platelets coatings by plasma spraying

Tahmineh Forati[1], F Ben Ettouil[1], T Kaydanova[2], N Moghimian[2], C Moreau[1], M Pugh1 and **A Dolatabadi[1]**
[1]Concordia University, Canada
[2]Nanoxplore Inc., Canada

Water vapor condensation is frequently used as an effective method of transferring heat using drop-wise condensation on non-wetting surfaces demonstrating enhanced heat transfer when compared to film-wise condensation. The aim of this study is to develop hierarchical surface morphologies on superhydrophobic coatings with high water repellency and mobility using atmospheric plasma spraying (APS). The novelty of this work lies in the processing of the plasma sprayed copper/graphene nano-platelets (GNPs) composite coatings. Retention of the GNPs was made successful by controlling the plasma power and particle injection angle to minimize the temperature and consequently prevent the combustion of GNPs. Several coatings were developed with different surface morphologies. By isolating the effect of surface chemistry using a stearic acid treatment the significance and effect of the achieved morphologies on the wetting behavior of the coatings were investigated. Experimental results demonstrated that coatings produced by the APS process showed excellent water repellency and water mobility: water contact angles as high as 162° as well as water sliding angles less than 1° were achieved due to the hierarchical roughness attributed to the submicron size particles in the feedstock. Moreover, results indicated that Cu/GNPs is a promising surface coating to promote dropwise condensation of water in industrial conditions due to its robust chemical stability with the potential for scalable applications while maintaining low thermal resistance.

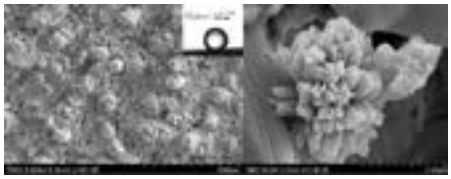

Figure: The SEM micrographs of the Cu-GNPs coating. Inset: a sessile drop of water on this surface

Recent Publications

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Biography

Tahmineh Forati has completed her PhD in Biomaterials Engineering at Islamic Azad University, Sciences and Research Branch, Tehran, Iran in 2014. She has completed her MSc in Biomaterials in 2009, followed by BSc in Material Science and Engineering at the same university. Currently, she is working as a Research Assistant at Concordia University, Canada. Her international experience includes various programs, contributions and participation in different countries for diverse fields of study. Her research interests reflect in her wide range of publications in various national and international journals.

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Amir Elsaidy et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Novel carbon nanomaterials coated with CuO particles via electroless plating for nanothermite applications

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Carbon nanomaterials (CNMs), such as carbon nanotubes (CNTs) and carbon nanofibers (CNFs) can be employed as carriers for superthermite particles via coating or encapsulation. This study reports on the synthesis of copper oxide coated CNTs and CNFs via electroless plating which offer metallization with uniform distribution layer of copper. The copper coated CNTs and CNFs were annealed at 250˚C to obtain copper oxide coated CNMs. The developed hybrid CNMs were characterised with TEM which demonstrated uniform coating with CuO particles. XRD diffractograms demonstrated highly crystalline CuO particles superimposed on the surface of CNMs. CuO coating can act as an effective oxidizer for aluminium particles in superthermite applications. The developed CuO-coated CNMs were effectively dispersed in isopropyl alcohol with aluminium particles (100 nm) using ultra sonic probe homogenizer. The developed hybrid nanothermite materials were effectively integrated and dispersed into molten TNT. Whereas CuO-coated CNFs/Al binary mixture demonstrated an increase in shock wave strength by 6.5% using kast test; CuO-coated CNTS/Al binary mixture demonstrated an increase in destructive effect of TNT by 15.5%. The superior performance of CuO-coated CNTs was ascribed to the fact that CNTs can offer extensive interfacial surface area of 700m^2/g. Consequently it could act as an ideal carrier for highly energetic particles.

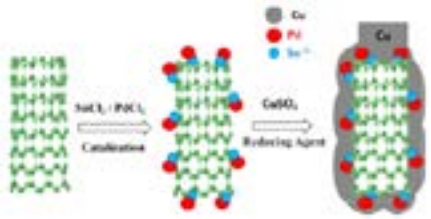

Figure: Schematic diagram of CNMs metallization with Copper

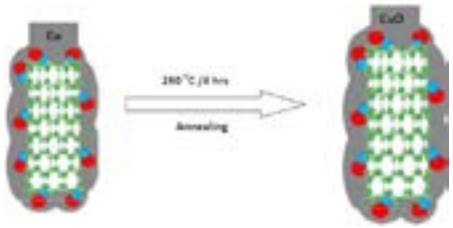

Figure: Schematic diagram of Copper oxide coated CNMs formation by annealing

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Biography

Amir Elsaidy had graduated from military technical college, Egypt (chemical engineering branch). He has experience in preparations and developments in the field of chemical engineering and energetic materials by creating new pathways for improvements .My interesting's are in preparation and spectral performance evaluation of these materials. These materials were developed by granulation and subsequent pressing & their Spectral performance was conducted.

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Uliana Pinaeva et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Functionalized track-etched PVDF membrane electrodes for heavy metal analysis in water

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[2]CIMAP, France
[3]University of Maryland, USA

Being a greatest earth's resource, water should be preserved. Its pollution effects on all living beings due to accumulation of toxic elements. Therefore, the needs of water quality monitoring are necessary to prevent potential contamination disasters. Currently, tolerable limits are in a few µg/L that requires sensitive, environmentally friendly, fast and on site instruments, which are able to analyze heavy metal concentrations in water. To fit the requirements, we are developing a portable electrochemical device based on the functionalized membrane electrodes. These membrane electrodes are made of track-etched functionalized nanoporous poly (vinylidene fluoride) (PVDF) membranes of 9 µm thickness covered with gold layers of 35 nm thickness on each side. To create nanoporous membranes, PVDF films were irradiated by swift heavy ions. Chemical etching reveals ion tracks into nanopores. For sub-micron pore diameters, the reactivity of remaining radicals formed during irradiation was found sufficient to initiate free-radical polymerization of vinyl (or allyl) monomers. This method allows any selective polymer issued from radical polymerization to be grafted onto pore walls of PVDF membranes. For instance, poly (acrylic acid) has shown a high selectivity toward Pb^{2+} and Cu^{2+} ions, poly (4-vinylpyridine) toward Hg^{2+}. Recently developed bis [2-(methacryloyloxy) ethyl] phosphate (B2MP) grafted inside the nanopores of PVDF membranes were found efficient for pre-concentration of UO_2^{2+} from aqueous solutions. EPR, FESEM, FTIR were used to study radical content, morphology of the surface and presence of functional groups inside the nanopores. Voltammetry was used to demonstrate the sensitivity of such functionalized membrane electrodes in trace level. A first generation prototype exhibiting its own potentiostat, software and set of membrane electrode pads have been developed.

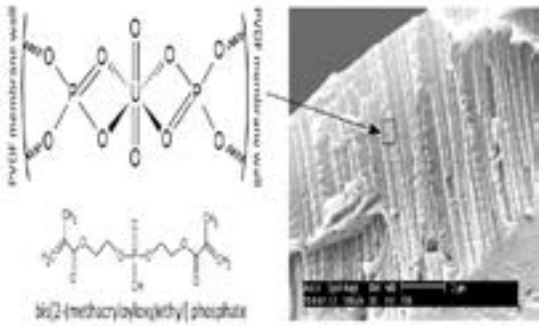

Figure: FESEM photo of cross section of B2MP functionalized track-etched PVDF membrane, fluence 10^9 cm^{-2} (right), and proposed configuration of UO^{2+} trapping by phosphate groups of B2MP (left)

Recent Publications

1. U Pinaeva, M C Clochard, E Balanzat, T L Wade, T C Dietz and M Al–Sheikhly Bis[2-(methacryloyloxy)ethyl] phosphate radiografted onto track-etched PVDF for uranium (VI) determination by means of cathodic stripping voltammetry Haz. Mat. 2018 (submitted) .

Biography

Uliana Pinaeva has completed her Master's degree in Applied Physics at the ENS de Cachan. Currently, she is pursuing her PhD in the Laboratoire des Solides Irradiés at the Ecole Polytechnique. Her research interest focuses on "Functionalization of polymers by means of radiation grafting technique for heavy-metal ions extraction and their following analysis by voltammetry".

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Wolfgang Gräfe, Res. Rev. J Mat. Sci. 2018, Volume 6
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Relation between internal friction and fatigue

Wolfgang Gräfe
Private scholar, Germany

The background of internal friction in solids and their fatigue may be theoretically described by a migration of unspecified items which is caused by the action of mechanical stress gradients. From the two resulting formulae a relation between the fatigue and the background of internal friction has been deduced. With this relation the statistical distribution of the fatigue data can be explained to some extent. Data published by Ravilly in 1938 demonstrates the correctness of this theoretical result. For the case that temperature gradients are the reason for the migration of the unspecified items, a formula results which is similar to the above mentioned one for the fatigue. With the statistical analysis of the data for fatigue and the total internal friction it could be possible to answer the question which physical quantity is the cause of fatigue.

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Biography

Wolfgang Grafe has completed his Degree in Physics at the Humboldt-Universitat in Berlin (GDR) in 1962. In the following years, he worked with semiconductors and semiconductor surfaces at the Akademie der Wissenschaften in Berlin. With the results of those investigations, he also received the degree Dr. rer. nat. (PhD) at the Humboldt-Universität in 1969. From 1971, he worked in the field of mechanical properties of mineral glasses. With the results of these investigations he has completed his Dr. sc. nat. degree at the Akademie der Wissenschaften in Berlin in 1984. He was employed in a Federal Administrative Authority in Berlin from 1991 till his retirement in 2001.

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Anna Boczkowska et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Improvement of CFRP electrical conductivity by applying nano enabled products containing carbon nanotubes

Anna Boczkowska and **Paulina Latko-Durałek**
Warsaw University of Technology, Poland

Due to their low weight and high mechanical performance, carbon fiber reinforced polymer (CFRP) is used in the aerospace, automotive and defense industries. In comparison to metal parts, they can reduce total mass but cannot reduce electrostatic discharge or protect against lightning strikes. Therefore, a new challenge is to find a way to improve the electrical conductivity of CFRP, especially throughout its thickness. The most promising idea is to use carbon nano tubes (CNTs), which show not only high electrical conductivity but also good thermal conductivity and mechanical strength, while maintaining low density. There are different approaches to introducing CNTs into CFRP in manufacturing. One such approach is mixing the resin with CNT powder before performing the infusion. However, the significant increase of resin viscosity in the presence of CNTs makes the infusion process difficult. Another way is to bond CNTs covalently onto carbon fabrics. A more convenient way is to apply nano-enabled products such as thermoplastic non-woven fabrics containing CNTs (CNT-doped veils). The first manufacturing method involves the production of fibers and their thermal bonding; the second way is direct melt blowing of thermoplastic polymers doped with CNTs. Implementation of both types of non-woven fabrics in CFRP as inter layers by pre-preg and resin infusion results in good impregnation. When compared to the reference CFRP, the addition of CNTs increases the electrical volume conductivity throughout the panel thickness by as much as 350%. The obtained results are very promising for the further application of CFRP with CNTs as novel, lightweight and conductive structures for the replacement of metallic parts in many industrial sectors.

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Biography

Anna Boczkowska is an Associate Professor in the Faculty of Materials Science and Engineering at Warsaw University of Technology in Poland. She has completed her Graduation from the same faculty in 1989 and completed her PhD in 2000 and DSc in 2011. Her scientific experience is related to the processing and structure of polymer matrix composites, nano composites and smart materials and industrial background of over 15 years in the development and application of polymers and composites. She is a member of many international organizations (e.g., ACS, AAAS, and SPIE) and author of numerous scientific publications, books and patents.

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Notes:

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Boron carbide-based ceramics for thermostructural application: Sintering by SPS and mechanical performances

Alexandre Maître, G Antou, N Pradeilles and **R Belon**
University of Limoges, France

Boron carbide is a promising ceramic in the armor field and in nuclear reactors due to its low weight, its high hardness and its high capacity to absorb neutrons. These excellent properties result from unusual characteristics of B-B and B-C chemical bond. In the literature, there is a general agreement about the existence of solid solubility of carbon with the stable phase BxC and a large range extending from 8 to 20 at.% C. So, the mechanical properties of boron carbide monoliths depend on their chemical composition (i.e. carbide stoichiometry, presence of secondary phases such as free carbon) and on microstructural characteristics (i.e. porosity level, grain size). In the present work, fully-dense boron carbide monoliths exhibiting fine microstructure (i.e. submicrometric grain size) are shaped and sintered by spark plasma sintering. Two different commercial powder batches, exhibiting different stoichiometries and various amounts of secondary phases are used. Their chemical composition is well-defined by coupling different methods (TEM, XRD, IGA) and are correlated with their mechanical properties, characterized from meso- to macro-scopic scales by nano-indentation and ultrasonic pulse echography. The presence of secondary phases (graphite and boric acid) is noticed in various proportions in each powder batch. Their effect on the mechanical features of the corresponding boron carbide-based ceramics has been investigated. So, if the boric acid disappears during the sintering step, the graphite remains. However, for the considered amounts of graphite (lower than 1 wt.%), the low variation in graphite content have no significant effect on hardness and elasticity. At the opposite, the presence of oxygen in solid solution, leading to a boron oxycarbide phase, induces a decrease of both hardness and elasticity.

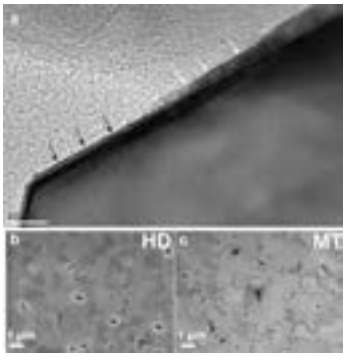

Figure 1: TEM observation of a particle of boron carbide (batch HD) exhibiting free carbon under the graphite form (indicated by the white arrows) and an amorphous layer (black arrows).

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Biography

Alexandre Maître is a Professor at IRCER at Limoges in France. His thesis diploma was devoted to the Kinetic and Thermodynamic aspects of the Synthesis of Transition Metal Carbides by Carbothermal Reduction. In 2000, he has obtained a permanent position as CNRS Researcher at the Laboratory of Chemistry of Inorganic Solid at Nancy to develop investigations concerning the thermodynamic modeling, the electrochemical behavior in corrosive environment and the metallurgical aspects of lead-based alloys. Further, he became Assistant Professor in IRCER to implement research activities about the elaboration by polymer derived ceramics route and the mechanisms of sintering of high temperature ceramics. His scientific production (h index: 22) is now composed of 82 publications in international journals, 25 invited conferences, 98 oral communications, 3 chapters of books and 3 grants.

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Notes:

Yutaka Oyama, Res. Rev. J Mat. Sci. 2018, Volume 6
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Synthesis of 2D layered semiconductor GaSe for the application of Terahertz non-destructive inspection

Yutaka Oyama
Tohoku University, Japan

Terahertz (THz) wave has both superior characteristics of radio wave and light, in which high permeability for non-polar materials and efficient reflection from metal surface are principal features. Thus, THz wave reflected from the opaque coated metal surface can be used for nondestructive testing (NDT). In addition, specific inter molecular vibrations (finger print spectra) of soft and hard materials are appeared in THz frequency region. We have developed various THz wave generators by careful control of lattice vibrations in semi conducting GaSe crystals. THz wave has low quantum photon energy, thus it is safe for human tissues even for radiation. We have established a data base of terahertz permeability characteristics for industrial materials and successfully constructed non-destructive THz diagnosis of building blocks, polymers, insulated copper cable and hot-dip galvanized steel sheet, etc. For the efficient THz light sources, two-dimensional (2D) layered GaSe has been attracted much interest because of its superior crystallographic, optical features and even for spintronics. Layered crystals combine thin sheets by out-of-plane Vander Waals interactions. For the use of practical applications, mechanical strength needs to be improved. However, no direct experimental determination has been performed up to now for Vander Waals bonding energy. In our group, a precise tensile testing machine was constructed for the quantitative determination of the inter layer Vander Waals bonding force. In this study, low temperature liquid phase growth of GaSe and its characterization are shown with the improvement of Vander Waals bonding energy by the addition of Te and In. Then, some killer applications of THz wave for the health evaluation of infrastructures will be shown.

Figure 1 Some examples of THz killer applications based on our THz light source technologies

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2. Hasegawa R, Kimura T, Tanabe T, Nishihara K, Taniyama A and Oyama Y (2018) Analysis of the specific vibration modes of goethite (α-FeOOH) by terahertz spectroscopy and calculations of the vibration frequencies of a single molecule using density functional theory. Journal of Biomedical Graphics and Computing 8(1):29-34.
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5. Takahashi S, Hamano T, Nakajima K, Tanabe T and Oyama Y (2014) Observation of damage in insulated copper cables by THz imaging. NDT&E International 61:75-79.

Biography

Yutaka Oyama has completed his BS, MS and PhD degrees in Electronics at Tohoku University, Japan. He was a Researcher with the Semiconductor Research Institute (SRI) in Japan and became a Senior Researcher with SRI. He was a Group Leader of the Nishizawa Teraherz Project of the Research Development Corporation of Japan (JRDC). He has been an Associate Professor and Professor of Materials Science and Engineering, Graduate School of Engineering, Tohoku University. He was a Visiting Researcher with IHP (Institut für Halbleiterphysik) at Frankfurt (Oder) Germany, and also EPFL (École Polytechnique Fédérale de Lausanne) at Lausanne Swiss. He is the author or co-author of over 300 international journals and conference publications on material science and its application for ultrafast semiconductor devices.

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Notes:

Mahabubur Chowdhury et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Solution deposition of Cu doped Co_3O_4 for electrooxidation of glucose

Mahabubur Chowdhury[1], **Micaela Harry**[1], **Franscious Cummings**[2] and **Christopher Arendse**[2]
[1]Cape Peninsula University of Technology, South Africa
[2]University of the Western Cape, South Africa

One of the major causes of death and disability in the world is due to diabetes mellitus. The frequent testing of physiological blood glucose levels to avoid grave emergencies is vital for the confirmation of effective diabetic treatment. The current glucose sensors that are being used by diabetic patients are glucose oxidase sensors. However, due to problems associated with fabrication of enzymatic glucose sensors, non-enzymatic glucose sensors have been of focus recently. In this study, a simple solution-based deposition process has been utilized to fabricate a Cu doped Co_3O_4 electrode for non-enzymatic glucose detection. The substitution of Cu into the Co_3O_4 host lattice resulted in an enhanced electrochemical performance compared to the pristine Co_3O_4 as was measured from the Hall Effect measurement. The sensor exhibited two distinctive linear ranges covering upto 7.6 mM at an applied potential of +0.65 V vs. Ag/AgCl in 0.1 M NaOH solution. The sensor depicted good repeatability (RSD of <10%), stability and reproducibility (RSD of <10%). The sensitivity of the sensor was determined to be 1333 μA/cm2 mM (lower concentration range) and 141 μA/cm^2 mM (upper concentration range), with a lower detection limit of 0.15 μM (S/N=3). The as prepared electrode showed a response time of <10 seconds and was very selective towards glucose in the presence of various interference species (Figure-1). The ease of fabrication, good electrochemical activity and good inter and intra electrode reproducibility makes this electrode a promising candidate for non-enzymatic glucose detection.

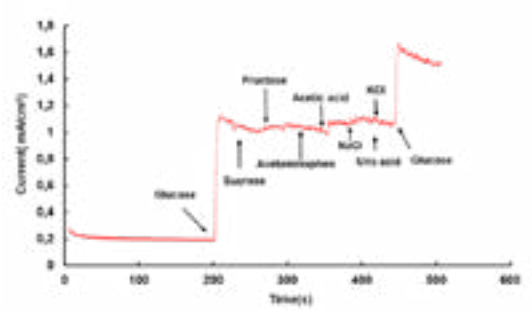

Figure-1: Amperometric response of the sensor in the presence of glucose and other interfering species.

Recent Publications:

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Biography

Mahabubur Chowdhury has received a Doctoral degree in Chemical Engineering and is currently a Senior Lecturer in the Department of Chemical Engineering at Cape Peninsula University of Technology. His research is on advanced functional materials for bio sensing and water treatment. His interest is on the relationship of electronic structure and ionic transport properties in semiconductor electrodes. He has published many journal articles, conference proceedings, book chapter and patent.

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Wolfgang Weber et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Cu metal/Mn phthalocyanine organic sprinter faces atop Co with high spin polarization at room temperature

Wolfgang Weber[1], E Urbain[1], F Ibrahim[1], M Studiarnek[1], F Ngassam[1], L Joly[1], J Arabski[1], F Scheurer[1], M Alouani1, E Beaurepaire1, S Boukari1, M Bowen[1], F Bertran[2], P Le Fèvre[2], G Garreau3 and Denys P Wetzel[3]
[1]IPCMS-CNRS France
[2]Synchrotron SOLEIL, France
[3]IS2M, Université de Haute-Alsace - CNRS, France

Spin polarized charge transfer between a ferromagnetic metal and a molecule can magnetize the molecule atoms and generate an interface with a high spin polarization of electronic states at the Fermi level at room temperature. Similarly, the Mn-phthalocyanine molecule's central paramagnetic site Mn can couple magnetically to a Co layer thanks to interlayer exchange coupling upon separating both interfacial constituents with an ultra-thin non-magnetic Cu spacer. However, the large spin polarization at the Cu/Mn-phthalocyanine sprinter face atop Co has so far only been predicted. We experimentally demonstrate this high spin polarization at room temperature through spin resolved photo emission spectroscopy measurements on the prototypical system Co (001)/Cu/Mn-phthalocyanine. Surprisingly, we find that the Cu thickness dependence of the spin polarization remains essentially constant up to 10 monolayers, which is inconsistent with the interlayer exchange coupling description of magnetic coupling between the Co layer and the molecule's Mn site. *Ab-initio* calculations account for this fundamental discrepancy by showing that the top most Cu layer before Mn-phthalocyanine adsorption is already significantly spin-polarized and contributes to the formation of the Cu/Mn-phthalocyanine sprinter face atop Co. We thus find that this example of a non-magnetic metal/molecule organic sprinter face atop a ferromagnet is advantageously impervious to variations in the non-magnetic metal layer thickness as expected from an interlayer exchange coupling description of its formation. Our results open a route toward integrating electronically fragile molecules within organic sprinter faces and electrically manipulating molecular spin chains using the well-documented spin-transfer torque properties of ferromagnetic metal/non-magnetic metal bilayers.

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Biography

Wolfgang Weber has completed his PhD at RWTH Aachen, Germany during 1988-1992. He has completed his Postdoctoral studies and worked as a Senior Scientist at IBM Ruschlikon, Switzerland during 1993–2002. Since 2002, he is working as a Professor at University of Strasbourg. During 2007-2014, he was the Leader of the Department of Surfaces and Interfaces at the IPCMS. Currently, he is mainly working on the Magnetism of Thin Films and has great expertise in Spin Polarized Electron Spectroscopies.

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Janos Dobranszky, Res. Rev. J Mat. Sci. 2018, Volume 6
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Producing of aluminium matrix composite wire

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Continuous fibre reinforced aluminium matrix composite wires were perspective materials as reinforcing core wire whether in electrical conductors or preferentially reinforced castings. Since the last years of the 2nd millennium composite cores were developed as reinforcement instead of a steel core in the high-tension electrical conductors. The much lower thermal expansion and the much higher specific strength were their advantages. Actually the leading type between these special products is the aluminium conductor composite core (ACCC) cable, in which the reinforcing is made of polymer composite tube that is filled with carbon fibre. Another type of low sag electric conductors is the ACCR cable (aluminium conductor composite reinforced), in case of that high strength steel or invar alloy core wires are replaced by aluminium matrix, alumina fibre reinforced composite wires. In the long-term practice, only two solutions were successfully applied for producing aluminium matrix composite wires. The first one is the 3M's ultrasonic-assisted infiltration and the second one is the Blucher's process. This last one applies continuous infiltration with gas pressure, but only the first infiltration is used on an industrial scale. The most critical step of the Blücher's process is that, the reinforcing fibre roving is pulled across the molten aluminium containing gas-pressure system. The Blucher's process was developed at the Metal Matrix Composite Laboratory of the Northeastern University (Boston MA, USA), but in 2005 the laboratory was transferred to Budapest University of Technology and Economics. The article describes those results, which were achieved in the new working period of the Metal Matrix Composite Laboratory.

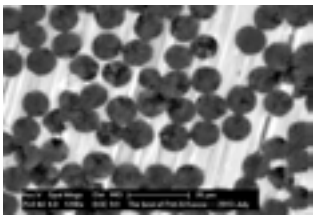

Figure: Cross section of a carbon fibre reinforced aluminium matrix composite wire

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Biography

Janos Dobranszky is working as a Scientific Advisor in the common research group for composite science and technology at the Hungarian Academy of Sciences and Budapest University of Technology and Economics. He is a Mechanical Engineer and International Welding Engineer. Since 2015, he is a Habilitated Doctor of the Faculty of Mechanical Engineering of BME and Doctor of the Hungarian Academy of Sciences. His main research field interests are Metal Matrix Composites, Biomaterials and Biocomposites, Weldability of Stainless Steels, Failure Analysis of Wood cutting Band Saw Blades. He is the Hungarian Delegate in the Commission VI of the International Institute of Welding.

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V Gayathri et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Chitosan asiaticoside nanoparticles synthesized from *Centella asiatica* for glioma therapy

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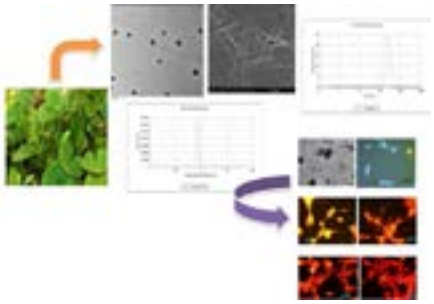
Centella asiatica is a high value medicinal plant widely distributed in the tropical and sub-tropical regions. The main active principles are asiaticoside and madecassoside. Both these compounds have wide spectrum of biological activities. The plant is famous in the label of memory booster and it shows neuropharmacological activity. The brain targeted delivery of a drug is very challenging. Previous studies have shown that the penetrability of drug inside the brain is limited due to the presence of defensive mechanism of brain. Free diffusion transposition through the interstitium of the brain is restricted by complex anatomy of blood brain barrier (BBB). The poor solubility and low penetrability of a drug into the brain is the major drawback in the neuropharmacology related studies. To overcome these limitations nanovehicles were used. To enhance the permeability of a drug into the site of action was performed using nano delivery systems were developed. The brain permeability is a risk factor for a drug to exhibit therapeutic effects at a target site. The main objective of our study focuses on the development of a novel drug-based nanoparticle for the effective brain targeted delivery. Ionic gelation method was used for the encapsulation of asiaticoside into the chitosan alginate nanoparticle. Physicochemical and Biological characterization: The physical and chemical characterization study was done by Fourier transform infrared (FTIR), size distribution measurements using dynamic light scattering (DLS), surface morphology by scanning electron microscopy, internal structure by transmission electron microscopy and nature of the particle were analyzed by X-ray diffraction. The thermal characteristics were studied using thermo gravimetric analysis (TGA), differential scanning calorimetry (DSC) and differential thermal analysis (DTA). Interfacing the nanoparticles with glioma cells showed significant death of the cells. The work concludes that Chitosan asiaticoside nanoparticles are potential remedy for the second level treatment of glioma.



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Biography

V Gayathri is a Senior Scientist at Phytochemistry and Phytopharmacology Division of Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Thiruvananthapuram, Kerala, India. She has obtained her Bachelors' and Masters' in Biochemistry from Bharathidasan University, Tamil Nadu, India. She has obtained her PhD from Jawaharlal Nehru Tropical Botanic Garden and Research Institute (formerly Tropical Botanical Garden and Research Institute) and Rajiv Gandhi Centre for Biotechnology, Trivandrum, India. She has been engaged in various research activities as Post-Doctoral Fellow in Nano- Material Chemistry at Biomedical Technology, Sree Chitra Tirunal Institute for Medical Sciences and Technology, India. Her field of expertise includes toxicological profiling of various materials/drugs/nanoparticles on various cell types and tissue engineering with several bio materials. She has 10 years of experience in the field of nano material chemistry and toxicology and her area of specialization is green nano chemistry. She has 20 research papers to her credit in peer reviewed journals.

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Nataraj J R et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Investigation on weldability behavior of chromium-free nickel filler with stainless steel AISI-304

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Two novel Cr-free nickel based welding filler rods were fabricated and used to weld austenitic grade stainless steel 304 (SS304) by tungsten inert gas (TIG) welding. Two welding wires designated as 3S (without Mn) and 4N (with 2% Mn) of %wt composition 43.499Ni, 25Fe, 10Mo, 10Cu, 10Co, 0-2 Mn, 1Ti, 0.5Al and 0.001C were fabricated and welded to SS304. Comparative studies of the joints welded by these two filler rods are presented. The weld joints were characterized for microstructure, mechanical and fracture properties. The microstructure of the weld interface showed presence of TiC and MoC precipitates within the grains and along the grain boundaries which is attributed for its strength of the weld joints. The Unmixed zone in the joint welded by 3S filler rod is wider than that welded with 4N filler rod. Presence of 2% Mn in 4N filler rod promotes the formation of γ' (gamma prime) precipitates and hence may be responsible for better joint strength than joints welded by 3S filler rod. Tensile tests results showed joint strength due to 4N filler rod is marginally superior (by 3.5%) to joints welded by 3S filler rod. However the ductility of the joint welded by 4N filler rod was lower by 6% compared to the joint welded by 3S filler rod. The hardness across the weld joints showed softer heat affected zone (HAZ) and hence is susceptible for failure during mechanical loading. The joint welded with 4N filler rod underwent significant amount of plastic deformation before failure. The joints welded with both the filler rods showed ductile mode of failure.

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Biography

Nataraj J R is an Associate Professor in the Mechanical Department at R V College of Engineering, Bengaluru. He has more than 12 years of teaching and research experience and two years of industrial experience. He has completed his ME at University of Applied Sciences, Wildau, Berlin, Germany with scholarship grants from prestigious DAAD in the year 2003-05. He has completed his Doctoral degree at Kuvempu University, Karnataka, India in 2014 in the field of Cr-free welding and new materials development. He has 27 research publications and is a member of several societies such as ISSS, ISTE, ISSE, ASM, and IEI. He is also a Reviewer/Editorial Board Member for several national and international journals. His research areas are Stainless Steel Welding, New Materials Development, Composite Materials, Heat Treatment, Thin Film Sensors, Inter Metallic and Renewable Energy.

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Ricardo A M Gotardo et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Multiferroic properties and structural characterizations in Mn and Cr doped $0.9BiFeO_3$-$0.1BaTiO_3$ compositions

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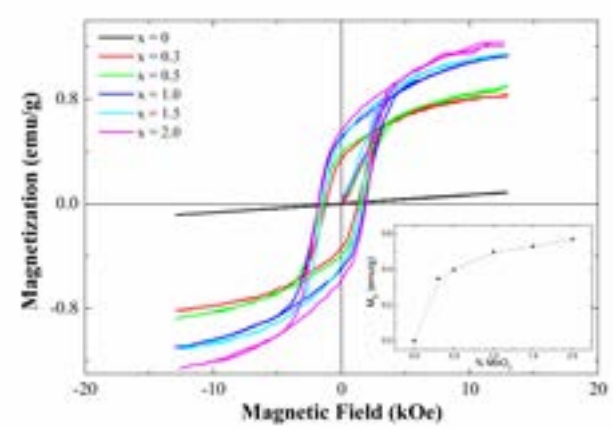
Bismuth ferrite ($BiFeO_3$; BFO) is one of the most studied multiferroic materials, mainly due to its reported magnetoelectric properties at room temperature, potential use in nonvolatile memory applications and developments in the fundamentals of solid state physics. BFO ferroelectric and antiferromagnetic phase transitions are found significantly above room temperature, i.e., it is a ferroelectric material below Tc~1100 K and an anti-ferromagnetic one below TN~650 K. The drawbacks of BFO for bulk practical applications are the low resistivity and the difficult to synthetize single-phased polycrystalline materials. To overcome the low DC electrical resistivity, one solution is doping these materials with multiple valence ions like Mn. Also, Cr ions can be used to improve polarization. Therefore, in this work, we describe the structural; dielectric, magnetic and Mossbauer spectroscopy studies in $0.9BiFeO_3$ - $0.1BaTiO_3$ solid solutions doped with Mn and Cr processed by high-energy ball milling. Especially for the Mn doped samples a structurally correlated magnetization enhancement is reported. X-ray diffraction and Rietveld refinement studies revealed a distorted perovskite structure with the coexistence of rhombohedral and monoclinic symmetries. Mössbauer spectroscopy results showed a magnetic spectral signature of ordered Fe^{3+} ions for the rhombohedral phase of the undoped sample and for both rhombohedral and monoclinic phases of the Mn doped samples. A significant magnetization increase (reaching 0.50 emu/g), associated to the magnetic ordering of the Cm phase and to the retention of the Mn^{3+} valence state was observed for Mn doped samples.



Magnetic hysteresis loops for $0.9BiFeO_3$ – $0.1BaTiO_3$ – x wt.% MnO_2 solid solutions, at room temperature.
Inset: remnant magnetization as a function of the MnO_2 content

Biography

Ricardo A M Gotardo has studied Physics and has pursued his PhD in Condensed Matter Physics at the State University of Maringa. He is a Professor at the Technological Federal University of Paraná in Cornélio Procópio since 2013. His research focuses on multiferroic materials, relating materials structure with the magnetic and electronic properties.

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Shen Lin et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Synthesis of Pt-WO_3@W/GNs as a bifunctional electro-photo catalyst for catalyzing methanol oxidation and oxygen reduction reaction

Shen Lin, Shuhong Xu and **Zhongshui Li**
Fujian Normal University, China

Direct methanol fuel cells (DMFCs) have attracted increasing attention due to its low cost, high power density, ease of handling, and low operating temperature. And the multifunctional electro-catalysts which can be used simultaneously in both the anode (methanol oxidation reaction, MOR) and cathode (oxygen reduction reaction, ORR) are eagerly needed. So in this work, a bifunctional electro-photo catalyst Pt-WO_3@W/GNs was synthesized by high temperature solid phase synthesis method, with two-dimensional plane structure graphene (GNs) as a support, and it was characterized by TEM, HAADF-STEM, XRD, XPS and Raman. It is found that Pt-WO_3@W/GNs has two forms of W at the same time, that is the metal state (W) on the surface and the internal oxidation state (WO_3), which is due to that only partial surface of WO_3 is reduced during high temperature solid phase reaction. Furthermore, it is observed that its substrate GNs show an obvious wrinkle undergoing the high temperature process, and Pt-WO_3@W nanoparticles are evenly dispersed on the surface of GNs, with the average particle size about 7.5 nm. Electro-catalytic properties of Pt-WO_3@W/GNs were investigated by cyclic voltammetry (CV), linear sweep voltammetry (LSV), chronoamperometry, and electrochemical impedance spectrum (EIS), to discuss the effect of W oxophilic property and its different states on its catalytic properties towards MOR and ORR. The results indicate that both W and WO_3 in Pt-WO_3@W/GNs have a promoting effect on catalyzing MOR and ORR, resulting in a superior electro-catalytic property than that of commercial Pt-Ru/C. Especially, the presence of some W (0) can endow semiconductor WO_3 different contact modes (Ohmic and Schottky contact) between W or Pt, which leads to a strong charge separation efficiency under light irradiation, so an efficient electro-photo-synergistic catalytic properties towards MOR and ORR under simulated sunlight was achieved. The founding in this work is helpful for converting solar energy into electric energy during traditional electro-catalytic process.

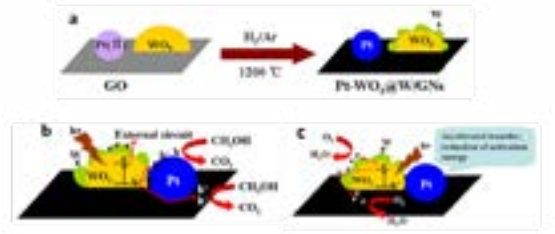

Figure 1: a. Synthetic diagram of Pt-WO_3@W/GNs (a); Schematic illustration of the electro-photo synergistic catalysis of Pt-WO_3@W/GNs on methanol oxidation (b) and oxygen reduction (c) reaction.

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8. Z. Li, L. Zhang, X. Huang, L. Ye, S. Lin*, Shape-controlled synthesis of Pt nanoparticles via integration of graphene and beta-cyclodextrin and using as a noval electrocatalyst for methanol oxidation, Electrochimica Acta, 121 (2014) 215-222.
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10. Z. Li, X. Huang, X. Zhang, L. Zhang, S. Lin*, The synergistic effect of graphene and polyoxometalates enhanced electrocatalytic activities of Pt-{PEI-GNs/ $PMo_{12}O_{40}^{3-}$}n composite films regarding methanol oxidation, Journal of Materials Chemistry, 22 (2012) 23602-23607.

Biography

Prof. Dr. Shen Lin obtained her B.S. Degree at Xia Men University in China in 1982, and completed her Ph.D. with Prof. Shixiong Liu at Fuzhou University in China in 2002. She works as a professor since 2000 in College of Chemistry and Material Science, Fujian Normal University, China. Her current research focuses on the development of new synthesis strategies of Pt/GNs based and non- noble metal electrocatalysts for their application in cathode and anode reaction of fuel cell, hydrogen evolution reaction and carbon dioxide reduction. Until now, she has published 20+ the related papers with average Impact Factor (corresponding author) over 3 (IF>3).

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Notes:

Sylvain G Cloutier, Res. Rev. J Mat. Sci. 2018, Volume 6
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Low-cost printable hybrid hetero structures for energy harvesting and lighting

Sylvain G Cloutier
Ecole de Technologie Superieure, Canada

The urgent demand for better and cheaper optoelectronic device architectures is a crucial road block towards a better use of our energy resources. As such, we explore new additive manufacturing paradigms in printable electronics to realize ultralow-cost, light weight and fully-integrated light-harvesting and energy-efficient optoelectronic devices using commercial-grade printing capabilities. While solution-processing techniques have yielded a wide range of new hybrid nano-engineered materials for optoelectronic applications, many key parameters including compatibility, interface engineering, surface treatment and processability are essential to achieve the best device performances. More recently, new solution processed materials including organometallics, new high-mobility conductive polymers and nanoparticle inks have shown tremendous potential for low-cost optoelectronic device integration. For example, power conversion efficiencies from printable organometallic solar cells have now surpassed 20%. These advances have also transposed into new photo detector devices with high responsivities. Just in the last year, our team made tremendous ground breaking progress towards viable devices by dramatically enhancing structure and material properties, enhancing conductivities by several orders of magnitude using hybrids, significantly improving stability and lifetime and dramatically improving the performances through advanced processing. In this presentation, we will summarize our work from the last five years exploring new hybrid heterostructures for low-cost opto electronic applications, including mainly light harvesting and lighting. We will present new printable sol gel based TiO_2 collector architectures, which then led to promising low-cost solar cell architectures for production using commercial grade inkjet or aerosol printing capability. We will also describe in details how methyl ammonium lead-halide perovskite deposition and chemistry was adapted to produce low-cost photodetectors and LEDs using commercial-grade inkjet printing capability.

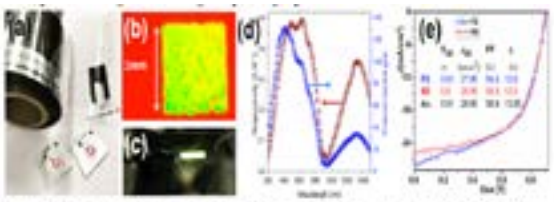

Figure 1. (a) Printable battery technology manufactured by our partners at XTI. (b) High-performance printable near-IR LED and (c) high-performance printable green LED. (d) Printable two-color photodetector's responsivity and (e) printable organometallic solar cell response.

Recent Publications:

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3. I Ka, et al. (2017) Scientific Reports 7, 45543-8
4. S Sepulveda, et al. (2012) Journal of Nanomaterials 286104-7.

Biography

Sylvain G Cloutier has completed his PhD at Brown University in 2006. He then received the DARPA Young Faculty Award for his work on the use of nano-engineered materials for lasers at the University of Delaware. In 2011, he joined Ecole de Technologie Superieure, Canada (ÉTS), where he leads both the Canada Research Chair on printable hybrid optoelectronic materials & devices and the Ariane Group Industrial Research Chair on Emerging Materials for Aerospace and Space. He was Lead Investigator on several large-scale research projects in the USA and Canada. He contributed over 80 publications and was elected at the College of the Royal Society of Canada in 2014.

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Anna Lewandowska et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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New generation of Colorcoat Prisma®

Anna Lewandowska and **Peter Barker**
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Tata Steel Colors, UK

Tata Steel has launched its new generation three layer Colorcoat Prisma® pre-finished steel, following a substantial investment on the manufacturing line. New Colorcoat Prisma® offers superior ultraviolet (UV) resistance and durability. The latest evolution is based on revolutionary three-layer technology, completely chromate free to be REACH compliant, that delivers greatly enhanced aesthetics with superior color and gloss retention. The new Colorcoat Prisma® product pushes the boundaries of pre-finished steel and is available with an extended Confidex® guarantee for up to 40 years. Colorcoat Prisma® is the result of many years of product development with R&D support, which provided all R&D data required for the product launch, including producing signed technical product specifications for all colors and trials. Working closely with the manufacturing, marketing, commercial and business development teams, R&D managed and delivered all the technical requirements, which enabled the enhanced guarantee package to be signed off by both Tata Steel Exco and back to back guarantee from the paint supplier. In order to develop a profitable business from outside of Europe markets for Prisma®, R&D delivered full assessments according to ASTM standards, performed externally which represent a distinct advantage.

Figure: Active classroom based on Swansea University Bay Campus in United Kingdom with new generation of Colorcoat Prisma® Element (Seren Black, Seren Gold and Seren Copper)

Biography

Anna Lewandowska has completed her PhD in Centre of Molecular and Macromolecular Studies at Polish Academy of Sciences in Poland then furthered her Postgraduate career with Postdoctoral placements at McMaster University in Canada. She has her expertise in Polymer Chemistry with "Experience in design and control of surface science". She joined Tata Steel R&D in 2015 where she has built her technical knowledge of experience in Research & Development team being involved with many of research projects. Currently, she is a New Product Development Design Manager in Tata Steel UK Ltd. focusing on new generation of OCS products for building envelope sector.

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Notes:

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Young Researchers Forum Day 2

Junshi Ichikawa et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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FEM analysis for burring process of large diameter SUS304 tube

Junshi Ichikawa[1], Shinichi Nishida[1], Yuta Kashitani[1], Kentaro Tsunoda[1], Yuto, Horigome[1], Naoki Ikeda[1], Daichi Uematsu[1], Makoto Hagiwara[1], Hideto Harada[1] and **Yutaka Sato[2]**
[1]Gunma University, Japan
[2]SK Co.,Ltd., Japan

This paper describes a finite element method (FEM) analysis for cold burring process of large diameter SUS304 pipe. The large diameter pipes such as 216.3 mm are used for a plant as a flow channel of gas and liquid. A burring process of pipe is generally for forming the branch. Burring molding is one of the typical molding techniques for branch pipes. The burring process is achieved by drawing of die from prepared hole. And the branch pipes are generally joined by welding. However this process has some problem. First, the burring process is depending on the forming limit of pipe. Second, the wall thickness and strain distribution of formed branch edge is unequal. These problem is caused the pre-hole shape. It generally has difficulty to determine the optimum pre-hole shape. Many try and error is needed. In this study, we proposed that the method of estimation for optimum pre-hole shape of mother pipe by finite element method analysis. The nominal diameter of mother pipe is 200A. And the target nominal diameter of branch pipe is 100A. The diameter is 114.3 mm, and the wall thickness is 3.0 mm. And target burring wall height is 10 mm with uniformly wall height around the edge. The height 10 mm means that is not needed the machining after burring process and is easy to weld to join the branch pipe to mother pipe. Initial pre-hole shape of analysis model is simple circle. After FEM analysis, the height of burring position was measured. Then the diameters of longitudinal direction and circumferential direction was adjusted. After optimum diameter of both direction diameter was determined, the diameter of 45 °direction was analyzed by using point tracking function to estimate of initial optimum diameter. Eventually, the burring formed shape had an uniform 10 mm height. It was clarified that the method of estimation for optimum pre-hole was effective.

Fig.1 Target shape after burring process

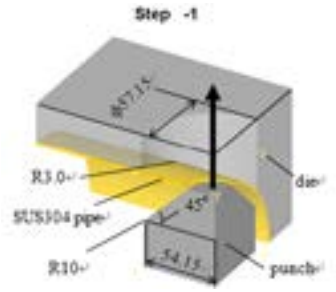

Fig.2 Schematic illustration of FEM model

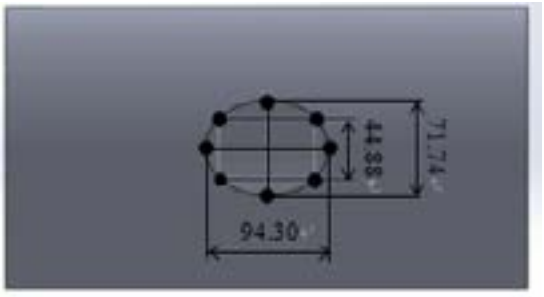

Fig.3 Estimated optimum pre-hole shape

Recent Publications

1. Ryosuke Okushima, Shinichi Nishida, Junshi Ichikawa, Yuta Kashitani, Yujiro Nitta, Atsuhiro Aoki, Yuto Takigawa, Hayato Aso, Hideto Harada and Akihiro Watanabe, FEM Analysis of Cold Flaring Process of SGP Pipe, International Journal of Advanced Engineering, Management and Science, Vol. 3 Issue 2, 75-76 (2017).
2. Nao Ozawa, Shinichi Nishida, Toshio Haga, Junshi Ichikawa, Yuta Kashitani, Ryosuke Okushima, Yujiro Nitta, Atsuhiro Aoki, Yuto Takigawa, Hayato Aso, Hideto Harada and Akihiro Watanabe, Forgeability of AZ Series Magnesium Alloy produced by Twin Roll Casting, International Journal of Advanced Engineering, Management and Science, Vol. 3 Issue 2, 77-80 (2017).
3. Sueji Hirawatari, Hisaki Watari, Shinichi Nishida, Yuki Sato and Mayumi Suzuki, Evaluation of Friction Properties of Magnesium Alloy during Hot Forging by Ring Compression Test, Materials Science Forum, Vol.889, 119-126 (2017).
4. Y. Kamakoshi, S. Nishida, K. Kanbe and I. Shoji, Finite element method analysis of cold forging for deformation and densification of Mo alloyed sintered steel, IOP Conference Series: Materials Science and Engineering, Vol.257, (2017).
5. Shinichi Nishida, Junshi Ichikawa, Yuta Kashitani, Kentaro Tsunoda, Yusuke Takeuchi, Yujiro Nitta, Yuto Takigawa, Atsuhiro Aoki and Yutaka Sato, FEM Analysis of Cold Flaring Process of SUS304 Pipe, Defect and Diffusion Forum, Vol.382, 120-126(2018).

Biography

Junshi Ichikawa is pursuing his 1st year postgraduate degree. He studied Metal Plastic Forming and FEM Analysis at the Gunma University, Japan. He has done his research at the Faculty of Mechanical Science and Technology of the Gunma University. He has attended six conferences presenting his research works and has published three papers in high impact journals.

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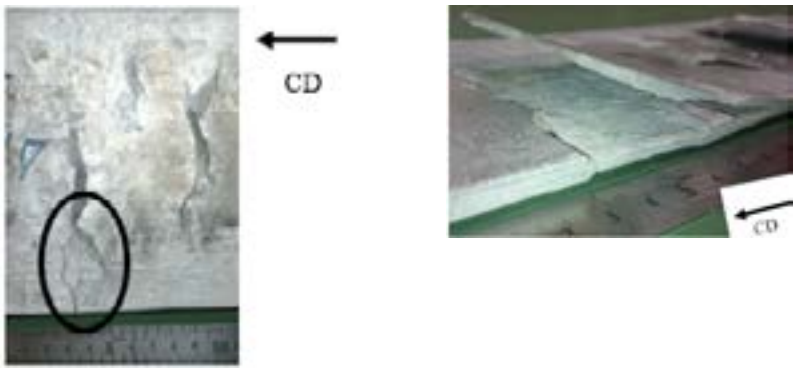
Notes:

Yuta Kashitani et al., Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-020

Horizontal twin roll casting of aluminum alloy A7075

Yuta Kashitani[1], Shinichi Nishida[1], Junshi Ichikawa[1], Kentaro Tsunoda[1], Yuto, Horigome[1], Naoki Ikeda[1], Daichi Uematsu[1], Makoto Hagiwara[1], Hideto Harada[1] and **Toshio Haga[2]**
[1]Gunma University, Japan
[2]Osaka Institute of Technology, Japan

This paper describes a horizontal type twin roll strip casting process for producing aluminum alloy strip of A7075. Twin roll casting process is able to produce a strip from molten metal directly. Thus this process has a possibility to reduce total cost of sheet making comparing to conventional rolling process. Strip casting process has some disadvantages. Casting speed depends on the material properties. It is difficult to determine the casting conditions. Aluminum alloy A7075 has high tensile strength, and it is known as a material for aerospace application. The sheet is manufactured in small quantities comparing to the other sheet aluminum alloy. Because A7075 alloy sheet is generally needed to a number of rolling and annealing process after hot extrusion. It is supposed that the demand of high tensile strength aluminum sheet such as A7075 is going to increase for weight saving of structural material. In this study, the effect of pouring temperature on the strip was investigated. Castability, surface conditions microstructure and strip thickness were estimated. It was possible to produce strip at any pouring temperature by horizontal twin roll strip casting process. Each surfaces of produced strip were transcribed form the roll surface, and the surfaces had a metallic luster. Minor cracks occurred at pouring temperature 710°C. Solidification cracking occurred at a pouring temperature of 740°C. Generally, the strip thickness tends to decrease as the pouring temperature increases. However, the strip thickness of pouring temperature of 710°C and 740°C increased compared with the pouring temperature of 680°C. Moreover, the strip thickness decreased at the pouring temperature of 770°C. As a result of observing the microstructure, equiaxed crystals were produced at any pouring temperature.



(a) Cracks (Pouring temperature was 710°C) **(b) Cracks (Pouring temperature was 740°C)**

Fig.1 Solidification cracks of produced A7075 aluminum alloy strip by twin roll caster

Recent Publications

1. Yuta Kashitani, Shinichi Nishida, Junshi Ichikawa, Hiroto Ohashi, Nao Ozawa, Ryosuke Okushima, Tomoya Suzuki, Yuto Takigawa and Hideto Harada, Twin Roll Casting of Aluminium Alloy ADC12, A3003, A7075, Key Engineering Materials, Vol.735, 18-23 (2017).
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5. Toshio Haga, Ryosuke Kozono, Shinichi Nishida and Hisaki Watari, Casting of aluminum alloy clad strip by an unequal diameter twin-roll caster equipped with a scraper, Advances in Materials and Processing Technologies, Vol.4, 511-521 (2017).

Biography

Yuta Kashitani is pursuing his 1st year postgraduate degree. He studied Metal Strip Casting at the Gunma University, Japan. He has done his research at the Faculty of Mechanical Science and Technology of the Gunma University. He has attended six conferences presenting his research works and has published three papers in high impact journals.

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Kentaro Tsunoda et al., Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-020

Cold plastic forming of ABS plastic pipe: ABS plastic pipe

Kentaro Tsunoda[1], Shinichi Nishida[1], Junshi Ichikawa[1], Yuta Kashitani[1], Yuto, Horigome[1], Naoki Ikeda[1], Daichi Uematsu[1], Makoto Hagiwara[1], Hideto Harada[1] and **Nobuyuki Kamei[2]**
[1]Gunma University, Japan
[2]DIP Inc., Japan

This paper describes about cold plastic forming of ABS plastic pipe. Experiment and Finite element method (FEM) analysis of pipe expansion process were operated. The application of ABS plastic pipe for air conditioner is under consideration instead of metal pipe in Japan because of weight saving of air conditioner for lowering the gravity point against earthquake. The parts of ABS plastic pipe is generally produced by injection molding. The processes need the cooling time, and it takes much time. In addition, expensive mold die is needed for each application. Thus, cold plastic forming of ABS plastic pipe was proposed. The cold plastic forming of ABS plastic pipe chosen for this study is hardly studied by other authors. Product ability of cold plastic forming is higher than the injection molding or hot working. And the punch and die shape is simple comparing to these process. In this study, pipe expansion process was operated. The ABS plastic pipe has a 10 mm diameter and 8mm inner diameter and 1 mm thickness. At first, true stress and true strain curves at any strain rate were measured by ring compression test. Obtained flow stresses was used to FEM analysis. Experimental device for pipe expansion process was made by Dip Inc.. Objective inner diameter was 10 mm. FEM analysis was operated to clarify the deformation behavior such as load-stroke diagram. It was possible to produce the expanded ABS pipe. The whitening of worked pipe and strain recovery was observed. Analysis result was indicated the good agreement comparing to experimental result in load-stroke diagram.

Fig.1 Ring compression test

Fig.2 ABS pipe

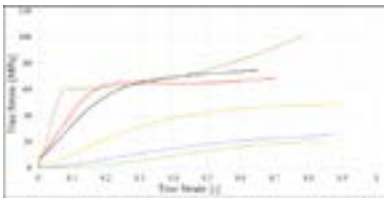

Fig.3 Flow curve

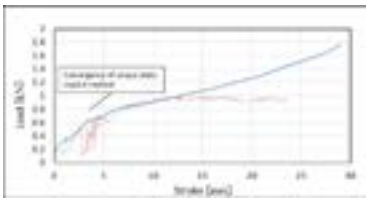

Fig.4 Load-stroke diagram

Recent Publications

1. Ryosuke Okushima, Shinichi Nishida, Junshi Ichikawa, Yuta Kashitani, Yujiro Nitta, Atsuhiro Aoki, Yuto Takigawa, Hayato Aso, Hideto Harada and Akihiro Watanabe, FEM Analysis of Cold Flaring Process of SGP Pipe, International Journal of Advanced Engineering, Management and Science, Vol. 3 Issue 2, 75-76 (2017).
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3. Sueji Hirawatari, Hisaki Watari, Shinichi Nishida, Yuki Sato and Mayumi Suzuki, Evaluation of Friction Properties of Magnesium Alloy during Hot Forging by Ring Compression Test, Materials Science Forum, Vol.889, 119-126 (2017).
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5. Shinichi Nishida, Junshi Ichikawa, Yuta Kashitani, Kentaro Tsunoda, Yusuke Takeuchi, Yujiro Nitta, Yuto Takigawa, Atsuhiro Aoki and Yutaka Sato, FEM Analysis of Cold Flaring Process of SUS304 Pipe, Defect and Diffusion Forum, Vol.382, 120-126(2018).

Biography

Kentaro Tsunoda is pursuing his 4th undergraduate. He studied cold plastic forming of plastic pipe at Gunma University, Japan. He has done his research at the Faculty of Mechanical engineering of the Gunma University. He has attended two conferences presenting his research works.

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Hai Chen, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-020

Engineering protein interfaces yields ferritin disassembly and reassembly under benign experimental conditions

Hai Chen
China Agricultural University, China

Ferritin is a class of naturally occurring iron storage protein; it usually consists of 24 subunits that form a hollow protein shell with high symmetry. Recently, scientists have subverted these nature functions and used reversibly self-assembled property of apoferritin cage controlled by pH for the encapsulation and delivery of bioactive nutrients or anticancer drug. In all these cases, the ferritin cages shield their cargo from the influence of external conditions and provide a controlled microenvironment. However, since ferritin disassociation generally needs extreme acidic condition (pH≤2), this strategy is limited to the structures of bioactive compounds that are unstable at such low pH. Here, we engineered protein interfaces to yield ferritin nano cages which disassemble at pH 4.0 and reassemble at pH 7.5. During this process, bioactive molecules can be encapsulated within protein cavity. Thus, this engineered protein has the potential to be exploited as an alternative nano carrier for pH-sensitive bioactive compounds or drugs.

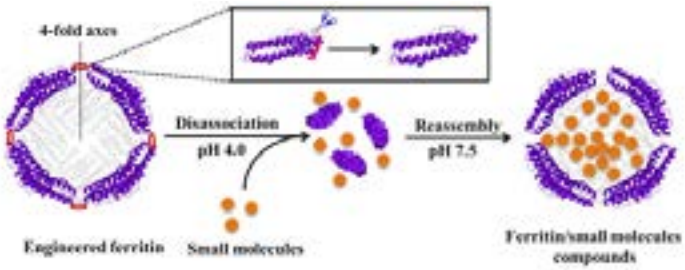

Figure: Schematic description of preparation of an engineered ferritin and its application in encapsulating small molecules by its reversible disassociation/reassembly. This new protein can be dissociated into subunits at pH 4.0, followed by reassembly into protein nano cage at pH 7.5

Recent Publications

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Biography

Hai Chen is a PhD student in College of Food Science and Nutritional Engineering at China Agricultural University, working on Engineering and Application of Protein Nanostructure, especially Ferritin Nano Cages.

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Yuto Horigome et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Dynamic analyses of damping alloy sleeves for boring

Yuto Horigome[1], **Shinichi Nishida**[1] and **Fumihito Sakurai**[2]
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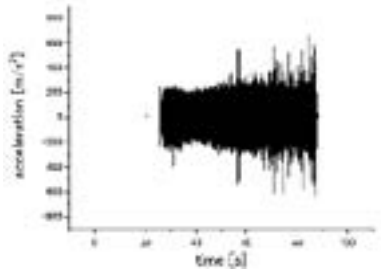
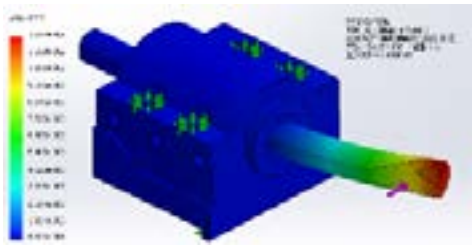
[2]National Institute of Technology, Gunma College, Japan

The NC lathe is one of the major metal cutting machine tool. The overhang amount of the tool become large at boring with the NC lathe. The tool vibration often become a problem at boring. The surface roughness and tool life are affected by the tool vibration. Therefore, it is necessary to reduce the tool vibration at boring with NC lathe. In this study, the application of damping alloy for the NC lathe sleeve was proposed. The characteristic of damping alloy is absorb vibration by transforming dynamic energy of the vibration into heat energy. A cutting experiment was operated by using the new type sleeve made of only damping alloy and the traditional type sleeve made of steel. The results such as vibration, surface roughness and tool life are compered between the both tools. The tool vibration became small and the tool life became long with new type sleeve compared to the traditional type sleeve. However the surface roughness became large by using new type sleeve. It is supposed that the rigid of new type sleeve is smaller than that of traditional type sleeve. Therefore, the composite sleeve that was combined with damping alloy and steel was developed for improving the rigidity. As a result, the tool vibration using the composite sleeve indicated one fifth and the surface roughness became half compared to the steel sleeve. The vibration analysis based on this experimental results was studied to clarify the vibration mechanism. The modal analysis was operated with the structural analysis software by using 3D models. And the FFT analysis was operated by the vibration data. As a result, it was revealed that the natural frequency of cutting tool system with new type sleeve was changed compared to the traditional system. And it was revealed that the bending mode frequency was closed to the twist mode frequency.

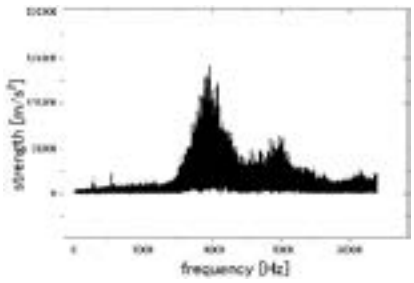
(a) Composite sleeve



(b) Tool vibration of composite sleeve



(c) Modal analysis



(d) FFT analysis

Fig.1 The composite sleeve, the tool vibration of the composite sleeve, the modal analysis and the FFT analysis

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5. 5. Satoshi Ema and Etsuo Marui, Suppression of chatter vibration of boring tools using impact dampers, International Journal of Machine Tools and Manufacture, Vol.40, Issue 8, 1141-1156(2000).

Biography

Yuto Horigome is pursuing master degree program. He studied the characteristics of the damping alloy sleeve for boring at National Institute of Technology, Gunma College (NITGC). He entered Gunma University after graduating from NITGC, and he studies Machining Science.

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Notes:

Amir Elsaidy, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-020

Infrared spectra of aluminum fluorocarbon polymer compositions to thermal signature of jet engine

Amir Elsaidy
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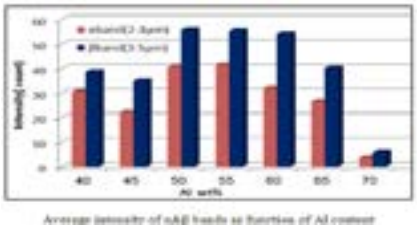
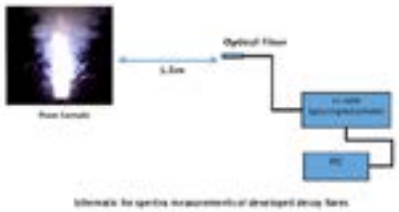
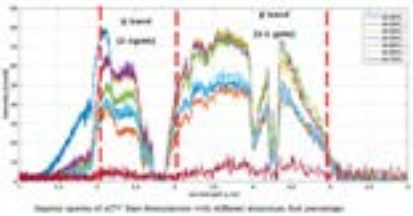
Decoy flares are energetic materials, which are capable of yielding thermal signature to interfere with IR guided missile seekers. The flare thermal signature depends on the duration and intensity of the exothermal reaction and on the chemical nature of the combustion products. Aluminum is the preferred metallic fuel for different pyrotechnic compositions because of its high stability and (high heat source), while magnesium runs in the second place due to lack of its stability. Aluminum is widely employed in wide applications particularly thermite compositions and flare compositions. In this study, different decoy flare formulations based on aluminum/Teflon/Viton (ATV) (with fuel percentage ranging from 40:70 wt %) were prepared by granulation and subsequent pressing. The spectral performance of developed decoy flare formulations were measured to the thermal signature of jet engine nozzle using (FT-MIR 2-6 μm) spectrophotometer. The thermal signature of jet engine was characterized with two characteristic peaks over α band (2-3 μm) and β band (3-5 μm); this thermal signature was correlated to black body emission by the nozzle at 690°C. The characteristic intensity ratio $\Theta=I_{\alpha}/I_{\beta}=0.3$. The developed decoy flares offered similar thermal signature but with higher intensity due to the formation of carbon soot and AlF as nearly ideal emitter and active IR emitter respectively. Quantification of these emitting species and combustion temperature was conducted using the ICT thermodynamic code. ATV decoy flare with 50wt % Al offered an increase in the intensity of α band and β by 6 and 1.5 times respectively. The main IR emitting species in this formulation is (AlF) in the combustion flame. The characteristic intensity ratio Θ was found to be 0.73. This manuscript would open the route for the development of customized decoy flares with tailored spectral performance.







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Biography

Amir Elsaidy has completed his Graduation in Chemical Engineering at Military Technical College, Egypt. He has experience in preparations and developments in the field of Chemical Engineering and Energetic Materials by creating new pathways for improvements and; his interest is focused on "Preparation and spectral performance evaluation of these materials". These materials were developed by granulation and subsequent pressing and their spectral performance was conducted.

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P M Radingoana et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Thermoelectric properties of ZnO-based ceramics prepared by spark plasma sintering technique

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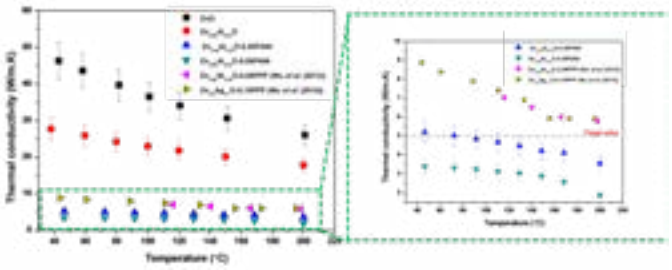
[1]Université de Toulouse, CIRIMAT, CNRS INPT UPS, Université Paul-Sabatier, Toulouse, France
[2]University of Johannesburg, South Africa
[3]Crismat-Ensicaen, France

The scarcity and toxicity of high performance thermoelectric materials (such as Bi, Pb, Sb, Te etc.,) has shifted research to focus on metal oxides and organic materials. Recently, inorganic–organic hybrids are of interest due to minimized thermal conductivity and selective scattering of charge carriers that leads to high sea beck coefficient. In this work, $Zn_{0.96}Al_{0.04}O$ prepared through co-precipitation route was sintered using spark plasma sintering. Polyaniline (PANI) concentrations of 5wt% and 9wt% were compared. High dense ceramic of 98.5±0.03% was obtained at a low sintering temperature of 250°C using $Zn_{0.96}Al_{0.04}O$/5wt% PANI. Increasing PANI concentration decreased the relative density. Incorporation of PANI into the inorganic material reduced the thermal conductivity from 27 W/mK (0 wt% PANI) to 5.2 W/mK (5 wt% PANI) and 3.2 W/mK (9 wt% PANI) at 40°C. Maximum ZT of $2.2x10^{-6}$ is obtained at 200°C with PANI concentration of 9 wt%. These findings are an opening for low temperature applications of ZnO-based ceramics.



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Biography

P M Radingoana is a PhD student at Université Paul Sabatier-CIRIMAT. She is currently working on "Spark plasma sintering of ZnO/polymer composites for thermoelectric application". Her research interests include Renewable Energies and Sustainable Development.

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