International Workshop on Woman in Ceramic Science
(WoCeram2019)

April 7-9, 2019/ Budapest, Hungary
Novotel Danube Budapest

ABSTRACTS

Table of content

[1] P. Wyżga, J. Laszkiewicz-Łukasik, L. Jaworska, Badania odporności na zużycie ścierne potencjalnych materiałów narzędziowych (Wear behaviour of prospective tool materials), Mechanik, vol. 2, 109-112, 2016.
[2] ISO 20808, Fine ceramics (advanced ceramics, advanced technical ceramics) – Determination of friction and wear characteristics of monolithic ceramics by ball-on-disc method, 2016.

GBN/ZIRCONIA COMPOSITES: A STUDY OF THE POWDER PROCESSING METHOD AND SINTERING TECHNIQUE ON THE MICROSTRUCTURAL, MECHANICAL AND ELECTRICAL PROPERTIES

C. López-Pernía[1,2], C. Muñoz-Ferreiro[1,2], C. González-Orellana [1,2], A. Morales-Rodríguez [1,2], A. Gallardo-López [1,2,] R. Poyato[1]

[1] Instituto de Ciencia de Materiales de Sevilla, ICMS, CSIC-Univ. de Sevilla, Avda. Américo Vespucio 49. 41092, Sevilla, Spain
[2] Departamento de Física de la Materia Condensada, Universidad de Sevilla-ICMS (CSIC), Apdo. 1065, 41080 Sevilla, Spain

Keywords: graphene, zirconia, microstructure, electrical conductivity

Graphene based nanomaterials (GBNs)/ceramic composites have been investigated in the last decade and have shown to possess intriguing properties which make them attractive candidates as structural and multifunctional materials. However, there are still many questions to solve about which mechanisms control the properties of these materials. Zirconia is a very interesting ceramic material since it presents excellent mechanical properties, particularly its high fracture toughness. On the other hand, the outstanding properties of graphene, turn it into a potential nano-scale reinforcement for ceramics. In the present study, the incorporation of different GBN to a zirconia matrix is considered: graphene nanoplatelets (GNP) and reduced graphene oxide (rGO). An important effort has been made to avoid the agglomeration of the carbon nanostructures and to improve their incorporation into the ceramic matrix. Therefore, different powder processing methods have been used and compared: ultrasonication, high-energy planetary ball milling and colloidal method. The sintering techniques assisted by pressure, such as Spark Plasma Sintering, are typically used to consolidate these materials. However, there is a lack of studies about GBN/zirconia composites prepared by conventional pressureless sintering (PLS). Therefore, a comparison between these two methods has also been carried out.
Techniques like electronic microscopy and Raman spectroscopy are used to assess the integrity of the GBN and its distribution throughout the matrix. Mechanical properties, such as Vickers hardness and elastic modulus, are evaluated by indentations tests and the impulse excitation technique, respectively. Finally, the effect of the powder processing and the sintering method on the electrical conductivity of the composites with GNPs is analysed at room temperature for two orientations of the samples: parallel and perpendicular to the pellet axis.

INFLUENCE OF GD3+ DOPING ON THE NAYF4 :YB3+,ER3+ STRUCTURAL AND UP-CONVERSION PROPERTIES

Marina Vukovic[1], Lidija Mancic[2], Ivana Dinic[1], Predrag Vulic[3], Marko Nikolic[4], Zhenquan Tan[5], Olivera Milosevic[2]

[1]Innovation Center of the Faculty of Chemistry, University of Belgrade, Serbia
[2] Institute of Technical Sciences of SASA, Belgrade, Serbia
[3]Faculty of Mining and Geology, University of Belgrade, Serbia
[4]Photonic Center, Institute of Physics Belgrade, University of Belgrade, Serbia
[5]School of Petroleum and Chemical Engineering, Dalian University of Technology, China

Synthesis of the up-conversion nanoparticles (UCNPs) is of a great interest due to their wide application as lasers, displays, photo-thermal agents and biomarkers. Due to efficient two-phonon excitation and the large anti-Stocks shift UCNPs are able to emit visible or UV photons under excitation by near-infrared (NIR). Over the last decade, decomposition of organometallic compounds has been indicated as one of the most convenient method for the synthesis of monodisperse $NaYF_4:Yb^{3+},Er^{3+}$ UCNPs with a hexagonal crystal structure. Herein, $NaY_{0.8-x}Gd_xYb_{0.18}Er_{0.02}F_4$ (x= 0.3 or 0.15) up-conversion nanoparticles crystallized in the hexagonal space group *P63/m* were successfully synthesized solvothermally utilizing rare earth nitrates, NaF and polyvinylpyrrolidone (PVP) in ethanol-water mixture at 200 °C. Rietveld refinement of the X-ray powder diffraction (XRPD) data and high resolution transmission microscopy (HRTEM) analysis show that all UCNPs are monocrystalline (60-70 nm), have low defect concentration and uniform dopants distribution. Fourier-transform infrared (FTIR) spectroscopy indicate existence of the PVP ligands at the UCNPs surface, while photoluminescence (PL) spectra shows characteristic green (at 520 and 540 nm, due to $2H_{11/2}$, $^4S_{3/2} \rightarrow {}^4I_{15/2}$ transitions) and red (at 655 nm, due to $^4F_{9/2} \rightarrow {}^4I_{15/2}$ transition) emission lines under excitation by NIR (λ =980 nm) light.

INFLUENCE OF CERAMIC PARTICLES ON BIOACTIVITY OF ELECTROSPUN POLYMER/CERAMIC NANOFIBERS

Eva Stastna[1], Klara Castkova[1,2]

[1]Central European Institute of Technology, Brno University of Technology, Czech Republic
[2]Faculty of Mechanical Engineering, Brno University of Technology, Czech Republic

Polymer and polymer-ceramic composite nanofibers are promising materials for tissue engineering, e.g. as scaffolds for treating large skin or bone wounds. Ceramic-polymer composites combine advantages of both constituents – mechanical properties (young modulus, elasticity) of the polymer and low dissolution rate of the ceramics but their preparation is more complicated than preparation of one-component fibers. [1] An easy way of fibers preparation is electrospinning when a solid fiber is formed from a liquid precursor after applying an electrostatic voltage. [2] Polycaprolactone was chosen as the polymer and hydroxyapatite as the ceramic constituent of the biocompatible electrospun fibers. The polycaprolactone and polycaprolactone/hydroxyapatite nanofibers were prepared to evaluate importance of the ceramic phase for the biological properties of the fibers. The difference between polymer and composite structure can be seen in Figure 1. Cytotoxicity of both materials in the form of continuous layer and the electrospun nanofibers was tested by direct contact with L929 mice fibroblasts. The test showed positive influence of the fibrous structure as well as of the ceramic particles on activity of the cells – the cell proliferation rate on the composite fibers was approximately 1.8 times higher than the proliferation rate on the pure polycaprolactone fibers and more than twice higher than proliferation rate on the polycaprolactone layer.

[1] JANG, Jun-Hyeog, Oscar CASTANO a Hae-Won KIM. Electrospun materials as potential platforms for bone tissue engineering. Advanced Drug Delivery Reviews. 2009, 61(12), 1065-1083. DOI: 10.1016/j.addr.2009.07.008. ISSN 0169409X.
[2] RAMAKRISHNA, Seeram. An introduction to electrospinning and nanofibers. Hackensack, NJ: World Scientific, c2005. ISBN 98-125-6415-2.