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ADVANCED CERAMICS AND APPLICATION II
New Frontiers in Multifunctional Material Science and Processing

Serbian Ceramic Society
Institute of Chemistry Technology and Metallurgy
Institute for Technology of Nuclear and Other Raw Mineral Materials
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PROGRAM AND THE BOOK OF ABSTRACTS

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Biodiesel synthesis based on $CaO{\cdot}ZnO{\cdot}K_2CO_3$ as catalyst

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Mixed oxide-carbonate with composition $CaO{\cdot}2ZnO{\cdot}_xK_2CO_3$ obtained by ball milling of CaO, ZnO, K_2CO_3 (where x=0, 1, 2 and 4, moles of K_2CO_3 per 10 moles of CaO) and water, after calcination at 700 ^oC was used as catalyst for biodiesel synthesis in 300 cm^3 batch autoclave at 70 ^oC. Used molar ratio of methanol to sunflower oil of 10:1 and 2 wt% of catalyst based on oil weight was usual working condition in all the experiments of biodiesel synthesis. The prepared catalysts were characterized by base strength using Hammett indicator, by measurement of bulk and surface catalyst composition using inductively coupled plasma (ICP) and X-ray photoelectron spectroscopy (XPS), as well as by determination of Ca, Zn and K ions solubility in methanol at 60 ^oC. Conversion of triglyceride (TG) during methanolysis catalyzed with prepared catalyst was determined by gas chromatography. Addition of K_2CO_3 in the process of $CaO{\cdot}ZnO$ mixed oxide preparation significantly improve an initial rate of methanolysis (during the first hour of biodiesel synthesis) comparing to the "pure" $CaO{\cdot}ZnO$ catalyst. It was shown that addition of higher amount of K_2CO_3 for mixed oxide-carbonate preparation significantly increases the initial activity of catalyst and that such an effect is caused by homogeneous–heterogeneous catalysis of biodiesel synthesis.

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Aerosol-assisted synthesis of hierarchically organized titania and titanates nanostructures

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The aerosol route, representing a feasible bottom-up technique for nanomaterials processing in disperse system, was applied for the low-temperature (T=150 ^oC) synthesis of spherical, non-agglomerated, hierarchically organized titania and titanates nanostructures. The diverse levels of structural, morphological and functional complexity were explored by using appropriate colloidal precursors comprising either spherical nanoparticles or nanotubes. In both cases, spherical, grained, submicronic sized particles with the average diameter of ~350 nm for titania and ~ 450 nm for titanates were obtained. The detailed structural and morphological investigations were done according to X-ray powder diffraction (XRPD), scanning and field emission electron microscopy (SEM/FESEM), particle size distribution (PSD) and transmission electron microscopy (TEM)

results. Results revealed that particles have clustered inner structure and are composed from primary nanounits in form of nanoparticles or nanotubes. Such hierarchically organized particles are expected to have potential application not only in the field of photovoltaics but also in various branches of photocatalysis.

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Characterization of mechanically activated ZnO powder

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Materials based on ZnO structure have more frequently application as fillers in polymer ceramics nanocompozites. Performances of these materials depends on fillers morphology, surfaces texture and particles size. According to this, in this paper, the authors investigated the influence of mechanical activation of ZnO powder on crystal and micro structure. Commercially available ZnO powder was activated in a planetary ball mill for 2, 5, 10 and 30 minutes. Characterization of such obtained powders was performed using XRD, SEM and Raman spectroscopy. XRD patterns indicated at lowering of peak intensities along with its broadening wich is realted to partical fragmentation and amorphyzation. Micrographs show irregularly shaped particles at the beginning and with prolonged milling time, particles gained uniformed distibution, while after 30 minutes of activation agglomerates started forming. The results we got by investigation of dynamical structure by Raman spectroscopy are in correlation with the other results of structures analysis. Results presented here enable further optimization of, polymer nanocompozite based on ZnO and PVDF, making process.

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ZnO/Ag hybrid nanocubes in alginate matrix

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Ag/ZnO heterostructure of ZnO nanocubes decorated with spherical Ag nanoparticles were prepared in the presence of alginate biopolymer. It has been shown that nanostructures of two or more distinct components and geometries may exhibit additional properties due to an anisotropic distribution of surface functional groups and charges. The obtained ZnO/Ag nanostructures were characterized by UV–vis absorption and photoluminescence spectroscopy, as well as scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The photocatalytic activity of ZnO/Ag-nanohybrids was significantly improved with respect to the bare ZnO particles. Antimicrobial activities ZnO/Ag-alginate nanocomposites were tested against gram-positive (*S. aureus*) and gram-negative (*E. coli*) types of bacteria.