ModTech 2013®

1st International Conference
Modern Technologies in Industrial Engineering

BOOK OF ABSTRACTS

27 - 29 June, 2013
Sinaia
Romania

ModTech 2013®

ModTech Publishing House

Blvd. Carol I, No. 28A, Bl. E4, Sc. B, Et.1, Ap. 6, 700504 Iasi, Romania
http://www.modtech.ro
Tel.-Fax: 0040. 332. 415 472
E-mail: office.modtech@gmail.com

Director of Publishing House: Professor Octavian Pruteanu

Redactor: Associate Professor Constantin Carausu

Scientific Referees:
Professor Octavian Pruteanu, DHC
Professor Traian Gramescu

ISSN 2286-4369

Invited Speaker

AEROSOL-ASSISTED PROCESSING OF HIERARCHICALLY ORGANIZED FUNCTIONAL NANOPARTICLES

Olivera Milosevic[1], Lidija Mancic[1], Ivan Dugandzic[1], Maria Eugenia Rabanal[2], Luz Gomez[3]

[1] Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Knez Mihailova 35/IV, 11000, Belgrade, Serbia
[2]University Carlos III of Madrid, Dept. of Materials Science and Engineering and Chemical Engineering, Avd. Universidad 30, 28911 Leganes, Madrid, Spain
[3] Instituto de Geociencias (CSIC-UCM), Spain

Corresponding author: Olivera Milosevic, olivera.milosevic@itn.sanu.ac.rs

Abstract: Global warming, climate change and natural resources depletion forces tremendous technological and scientifical research activities for the development of next generation of materials able to address both the energy and environmental problems. This implies an exciting progress in the field of nanoscience and nanotechnology, particularly regarding the control synthesis of nanoscaled materials that might have a great potential for use in solid-state functional materials and devices, like phosphors, sensors, photovoltaics, catalysts, drug delivery carriers etc. The feasibility of the dispersion phase-aerosol route for the generation of innovative nanomaterials having advanced optical properties for solving energy/environmental problems is here presented. Particularly, the opportunities of the hot wall aerosol processing, provided by high heating and cooling rates, short residence time and high surface reaction, is demonstrated for the synthesis of spherical three-dimensional (3D), hierarchically organized nanostructured particles with uniformly distributed components and phases. The particles composite inner structure, representing an assembly of nanosized primary particles, opens the possibility for particle surface modification and functionalization emphasizing their application in photovoltaics, energy transfer and bioimaging. The diverse levels of structural, morphological and functional complexity are explored by means of appropriate selection of different precursor solutions, either true or colloid, surface modification and proper selection of rare-earth based dopants for the generation of either photocatalytic titanium (IV) oxide or Yb^{3+}, Er^{3+}, codoped yttrium(III) oxide–based phosphor particles. Their advanced optical properties as the consequence of the particle nanostructure nature are proved by using various characterization techniques like x-ray powder diffraction (XRPD), scanning electron microscopy (SEM, FE-SEM), analytical and high-resolution transmission electron microscopy (TEM/HR-TEM) in combination with energy dispersive x-ray analysis (EDAX), selected area electron diffraction (SAED) and nanotomography. The optical properties and surface structure were analyzed by UV-Vis diffusive reflectance (UV-Vis DRS), Fourier transform infrared (FTIR) spectroscopy and by fluorescence measurements in the near infrared region. The obtained results offer a general route for the synthesis of nanomaterials with tunable structure, morphology and optical properties.

Key words: nanoparticles, aerosol, processing, yttria, titanium (IV) –oxide, phosphors