Twelfth Young Researchers' Conference
Materials Science and Engineering

December 11-13, 2013, Belgrade, Serbia
Serbian Academy of Sciences and Arts, Knez Mihailova 36

Program and the Book of Abstracts

Materials Research Society of Serbia
Institute of Technical Sciences of SASA

December 2013, Belgrade, Serbia

Book title:
Twelfth Young Researchers' Conference - Materials Science and Engineering:
Program and the Book of Abstracts

Publisher:
Institute of Technical Sciences of SASA
Knez Mihailova 35/IV, 11000 Belgrade, Serbia
Tel: +381-11-2636994, fax: 2185263
http://www.itn.sanu.ac.rs

Editor:
Dr. Smilja Marković

Technical Editor:
Aleksandra Stojičić

Printer:
Gama digital centar
Autoput No. 6, 11070 Belgrade, Serbia
Tel: +381-11-6306992, 6306962
http://www.gdc.rs

Edition:
130 copies

Acknowledgement
The editor and the publisher of the Book of abstracts are grateful to the Ministry of Education, Sciences and Technological Development of the Republic of Serbia for its financial support of this book and The Twelfth Young Researchers' Conference - Materials Sciences and Engineering held in Belgrade, Serbia.

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

66.017/.018(048)(0.034.2)

YOUNG Researchers Conference Materials Sciences and Engineering (12 ; 2013 ; Beograd)
Program ; #and the #Book of Abstracts / Twelfth Young Researchers' Conference Materials Sciences and Engineering December 11-13, 2013, Belgrade, Serbia ; [organized by] Materials Research Society of Serbia [and] Institute of Technical Sciences of SASA; [editor Smilja Marković]. - Belgrade : Institute of Technical Sciences of SASA, 2013 (Beograd : Gama digital centar). - XVI, 56 str. ; 30 cm

Tiraž 130. - Registar.

ISBN 978-86-80321-28-8
1. Materials Research Society of Serbia (Beograd)
a) Наука о материјалима - Апстракти b) Технички материјали - Апстракти
COBISS.SR-ID 203232780

IV/1

Photocatalytic and sonocatalytic degradation procedures of methylene blue dye using a ZnO nanostructured powders

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The elimination of organic pollutants from wastewater is an important procedure in environmental protection. Dyestuffs and other commercial pigments have emerged as a focus of environmental recovery efforts. Various chemical and physical processes, such as chemical precipitation and separation of pollutants, coagulation, and elimination by adsorption on activated carbon are applied for elimination of organic pollutants. The main disadvantage of these methods is that they only change the contamination from one phase to another. In recent years, semiconductor-assisted photocatalysis and sonocatalysis has been extensively investigated, primarily due to its capability to degrade a great number of chemicals in gaseous or aqueous systems, through relatively in-expensive procedures.

In this work we have investigated heterogenic photocatalytic and sonocatalytic degradation of methylen blue (MB) aqueous solution, as a common organic pollutant, in the presence of nanosized ZnO powder as a catalyst. The phase composition of synthesized ZnO nanopowder was identified by XRD, particles morphology was characterized by FE–SEM. The optical properties of ZnO nanocrystals were investigated by ultraviolet–visible (UV–Vis) diffuse reflectance spectroscopy (DRS). Concentration of the MB dye in the water solution containing ZnO nanoparticles before and after photocatalytic or sonocatalytic degradation was calculated according to the absorbance maxima value at 665 nm characteristic for MB. The experiments were performed on a UV–Vis spectrophotometer in the wavelength range of 300–800 nm.

IV/2

Design strategies for hydrogenation catalysts using colloidal and template-based synthesis routes

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Achieving optimal catalyst performance requires control over the number and structure of metal nanoparticles (NP) as well as over the pore morphology. The optimum balance between high surface area and fast pore diffusion can be realized in hierarchical pore systems, where large pores facilitate fast transport whereas small pores provide a high surface area and stabilize the active metal-particles.

We present a new general synthesis strategy for hierarchically structured catalytic coatings with ordered porosity. The strategy employs size-controlled metal-nanoparticle colloids as active sites and polymer-based pore templates to control the materials pore structure. The effect of catalyst composition and structure will be related to catalytic performance in gas-phase hydrogenation of butadiene.