CONFERENCE ABSTRACTS

International Student Conference

“Science and Progress”

DAAD

Санкт-Петербургский государственный университет

Freie Universität Berlin

German-Russian Interdisciplinary Science Center

St. Petersburg – Peterhof
November, 12-14
2018

CONFERENCE ABSTRACTS
International Student Conference “Science and Progress-2018” —
SPb.: SOLO, 2018 – 376 pp.

ISBN 978-5-98340-395-6

ISBN 978-5-98340-395-6

Cu-doped SnO_2 nanoparticles: synthesis and functional properties

Podurets Anastasiia
89111205088p@gmail.com

Scientific supervisor: Dr Bobrysheva N. P. , Department of General and Inorganic Chemistry, Saint-Petersburg State University

Photochemical processes involved in various significant operations, such as water treatment and hydrogen energetics which have a great impact on our lives. The principal way to improve photochemical reaction is to use an effective catalyst and according to the literature n-type nanosized SnO_2 semiconductors are of great interest due to their wide band gap (Eg =3.6 eV). However, the impact of electronic structure on photodegradation effect is still under discussion.

The objective of this research was to study the correlation between the structure of as-prepared nanoparticles (NPs) and their functional properties. To clarify this aspect, we used Cu as a dopant for SnO_2 nanoparticles. The Cu : Sn molar ratio were varied from 12,5 to 50 : 100; the influence of pH values and initial reagent nature on NPs structure were also studied. Bare and doped SnO_2 NPs were obtained by the co-precipitation method. As expected XRD data demonstrated only rutile SnO_2 peaks (PDF 01-072-1147), the crystallite sizes increased for the higher pH values. According to TEM and SSA data, the nanoparticle size does not exceed 10 nm.

X-ray photoelectron spectroscopy confirms the presence of Cu in 2+ state. UV-vis absorption spectra show the difference between bare and Cu-doped SnO_2 nanoparticles. Besides, such parameters as Cu : Sn molar ratio and pH impacts on the estimated band gap and its values fallen up to 2.4 eV for a higher dopant concentration.

The obtained results were in a good accordance with impedance spectroscopy data. The conductivity vs temperature pattern for all the samples demonstrated the typical semiconductor behavior. The activation energy values increased from 3,73 eV for bare SnO_2 to 2,31 eV for Cu-doped (pH = 7, 50 : 100).

The dependence of kinetic of organic dyes photodegradation (Methylene blue, Congo red, Rhodamine 6G, 205-315 nm irradiation) and derivatives natures on NPs structures was also shown.

Acknowledgements. Scientific research was performed at the Research Park of St. Petersburg State University Educational Resource Center of Chemistry: Centre for X-ray Diffraction Studies, Center for Optical and Laser Materials Research, Centre for Innovative Technologies of Composite Nanomaterials, Chemical Analysis and Materials Research Centre.