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Structural, Optical, Morphological and Electrical Properties of Core-Shell Nanowires based on ZnO and CuO for Energy Applications

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Hitherto, going towards the nanoscale to explore new properties of materials given by the reduced sizes became the point of interest of an increased number of researchers. The main goal is to improve the physical and chemical characteristics of the nanostructures by controlling the preparation methods. Among nanostructures, nanowires denote a special category due their high aspect ratio and high surface area which can influence their optical and electrical properties. In core-shell radial junctions the light absorption and charge separation directions are more efficient than in planar junctions being orthogonal (absorption along the nanowire length, while the separation of charges within the diameter). Furthermore, when a staggered gap heterojunction (type II) is created, efficient charge separation occurs due to the built in internal field formed at the interface between the two semiconductors.

In this work, for promoting efficient charge separation for solar energy harvesting applications, radial staggered gap heterojunctions have been obtained as ZnO-CuO core-shell nanowires. ZnO is a n-type semiconductor having a direct wide band-gap of about 3.3 eV and CuO is a p-type semiconductor with an indirect band gap around 1.2 eV-1.6 eV.

The core-shell nanowires are prepared by dry physical methods, thermal oxidation in air and magnetron sputtering. The properties of the core-shell nanowires based on ZnO and CuO were assessed from the structural (X-ray diffraction, transmission electron microscopy), optical (reflection and luminescence measurements), morphological (scanning electron microscopy), compositional (energy-dispersive X-ray spectroscopy, X-ray Photoelectron spectroscopy) and electrical (electrochemical impedance spectroscopy) point of view. Different shell thicknesses of the core-shell radial staggered gap heterojunctions exhibit particular photocatalytic properties which are explained based on a mechanism which takes into account the partial or total dissolution of ZnO.

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Biography:

Dr. Camelia Florica received her bachelor degree in Medical Physics from the University of Bucharest, Romania in 2009 and followed a Master program in Advanced Materials at the University of Bucharest, Romania and Université catholique de Louvain, Belgium. She has completed her PhD in Solid State Physics in 2015 from University of Bucharest, Romania. At the moment she is a Senior Researcher Degree III at the National Institute of Materials Physics, having 26 scientific articles in ISI journals and 7 national patent requests. She is currently leading a national research project on the topic of core-shell nanowires, *Nanowire Photodet*.