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Electrical Properties of Single Core-Shell Radial Heterojunction Nanowires Based on ZnO and CuO

A. Costas*, C. Florica, A. Kuncser, N. Apostol, N. Preda and **I. Enculescu**
National Institute of Material Physics, Romania

Recently, the researchers focused their attention on the preparation and characterization of the core-shell radial heterojunction nanowires in order to develop novel devices based on such one-dimensional nanostructures. These core-shell nanowires are featured by a large interface area which can facilitate the formation of electron-hole pairs or their recombination leading to innovative applications solar cells, photodetectors, photocatalysis, electronic devices, etc. ZnO is an n-type semiconductor with a wide direct band gap of 3.3 eV, while CuO is a p-type semiconductor with a narrow indirect band gap of 1.2 eV. Thus, by coupling the two semiconductors into core-shell radial heterojunction nanowires, an enhancement of their properties can results by mutual transfer of charge carriers (electrons and holes) from one semiconductor to another.

In this work, arrays of core-shell nanowires based on ZnO and CuO have been obtained by combining two techniques, thermal oxidation in air and RF magnetron sputtering. Structural, compositional, morphological, optical and electrical properties of the obtained core-shell nanowires were analyzed by X-ray diffraction, transmission electron microscopy, energy-dispersive X-ray spectroscopy, X-ray photoelectron spectroscopy, field emission scanning electron microscopy, diffusive reflectance, photoluminescence and current-voltage measurements, respectively. Further, the electrical properties of individual core-shell radial heterojunction nanowires were investigated using lithographic techniques such as photolithography, electron beam lithography and focused ion beam induced deposition and thin films deposition techniques like RF magnetron sputtering and thermal vacuum evaporation. In this way, field effect transistors and diodes based on single core-shell heterojunction nanowires were fabricated for potential applications in optoelectronic field.

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Biography:

Dr. Andreea Costas has received her doctoral degree in 2016 at the University of Bucharest in the field of Condensed Matter Physics. She is currently working as a young researcher at National Institute of Materials Physics in the Laboratory of Multifunctional Materials and Structures. Until now she has 10 publications, an H-index of 4 and was involved as a team member in more than five national research projects.