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SnO_2-PbS nanocomposites and hetero structures: Fabrication, structures and applications

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SnO_2 is a significant metal-oxide, n-type wide band gap (3.6 eV at 300K) semiconductor. Due to its outstanding electrical, optical and electrochemical properties, SnO_2 offers a broad range of applications in solar cells, catalytic support materials, transparent electrodes and solid state chemical sensors. However, in terms of several of these applications, pure SnO_2 nanocrystals show a few classical drawbacks, mainly due to their large surface-to-volume ratio. Two standard strategies to advance the application-based performance of SnO_2 are its mixing and coating with another semiconductor material. Nowadays, nanocomposite and heterostructure materials comprised of two semiconductors of different band gap are proving of immense interest to researchers due to their superior electrical, optical, and electrochemical properties. In my presentation, I will discuss the fabrication, structures and application-based properties of SnO_2-PbS nanocomposite and heterostructure materials. First I will describe some innovative solution and microwave synthetic techniques for the preparation of pure SnO_2 nanoparticles/nanospheres, pure PbS nanocubes, SnO_2-PbS nanocomposites and heterostructures. The structures are confirmed by X-ray diffraction (XRD)/Reitveld study, Raman spectroscopy and transmission electron microscopy (TEM) analysis. Elemental mapping and line scan EDX analysis successfully demonstrate the effective PbS deposition on SnO_2 nanospheres as well as the mixing of SnO_2 and PbS to form nanocomposites. I will present a model to explain different relaxation processes in SnO_2-PbS nanocomposite and heterostructure which helps to understand how the two semiconductors interact. Lastly, I will discuss some application-based properties of as-synthesized nanocomposite and heterostructure materials which are found to be significantly improved relative to pure SnO_2 or PbS.

Biography

Arik Kar obtained his BSc (Hons) in Chemistry from Serampore College, University of Calcutta, in 2005. In 2007, he obtained his MSc degree in Chemistry from the University of Calcutta with a specialization in Inorganic Chemistry. He then completed his PhD in Materials Science from Jadavpur University in 2013. He was awarded a Newton International Fellowship from the Royal Society for the academic years 2014–2016. He is now continuing his research as a Newton International Fellow at the University of Cambridge. He has published 23 papers in reputed journals and has presented his research at 9 international conferences so far.

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