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SnO_2 NANOPARTICLES: THEIR STRUCTURAL, ELECTRICAL AND OPTICAL PROPERTIES

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Thin films or nanocrystalline particles of metal-oxide materials are an important class of inorganic polymers. Nanotechnology, by which these materials are being synthesized is an active area of current research activities in various fields, including energy production, medicines, electronics etc. In a span of past few decades nanomaterials have attracted a great research interest due to their unique properties and novel potential applications. Out of these, non-stoichiometric SnO_2 nanoparticles form an important class of materials which is a wide gap (3.64 eV), transparent in visible and NIR region, n-type semiconductor. It has a wide range of applications in the field of optics, electronics and catalysis. Oxide or mixed metal oxide nanomaterials of tin are an important class of materials because of their tunable physico-chemical properties. On the other hand, they have high chemical and mechanical strength. These materials have wide spread applications as gas sensors, transparent conducting electrodes e.g. solar cells, optoelectronic devices and as a catalyst for oxidation of solids. Structural features of the SnO_2 lattice can be controlled using various dopants in suitable concentrations and hence it's optical and electrical properties can also be controlled accordingly. Many synthetic routes have been developed for the preparation of SnO_2 nanoparticle or films such as MOCVD, spray pyrolysis, hydrothermal route, sputtering of oxides and sol-gel technology. Out of these methods sol-gel technology (that involves a series of hydrolysis and polymerization reactions) is simple to perform by which homogeneity in composition as well as in morphology of nanoparticles could be achieved with high purity at comparatively low temperatures. This low temperature condition allows deposition of thin films of oxides at soft surfaces. Our previous studies on Sol-gel technology using metallorganic derivatives as single source molecular precursors and also by others are in good agreement with this. In this report some structural, electrical and optical aspects of these materials (pure and doped) will be discussed in detail and will be compared with the results obtained from the studies on the sol-gel synthesis of mixed metal oxide ($xSnO_2$. SrO) nanoparticles of SnO_2 with SrO in basic medium. Results from XRD, SEM, TEM and electron diffraction patterns have shown the structural features of these SnO_2 nanoparticles. Electrical properties have been discussed with respect to carrier concentration and carrier mobility that ultimately effects the conductance in these materials. Particle size also play an important role. Optical properties are determined by direct energy band gap between conduction and valence band. Results from UV-vis spectroscopy (absorption, reflectance and transmittance) show the actual band gap in these materials. Direct measurement of the bad gap (Eg) from the intercept of the energy axis in Tauc Plots, show its dependence on the type of dopant and its concentration and also on particle size.

Biography

Dr. Vinita Sharma is Associate Professor in Chemistry at Department of Higher Education, State Government of Rajasthan, India, Received M.Sc., Ph.D. in 2003 from University of Rajasthan, Jaipur, also carried out some research work at Bhabha Atomic Research Center-Mumbai, Post doctorate (2004-2007) from University of Rajasthan, Jaipur, working with present employer since last 15 years. Published 15 papers and 3 review articles in the field of metallorganic derivatives and materials Chemistry in the Journals of international repute and presented around 16 papers in various international/national seminars/conferences. Delivered 5 invited talks in conferences. Meanwhile received Research Award from UGC New Delhi of Central Government and Young Scientist award from Indian Chemical Society.

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