Original Paper

Size Distribution of SnO₂ Quantum Dots Studied by UV–Visible, Transmission Electron Microscopy and X-Ray Diffraction

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Abstract
Measuring the size of the quantum dots (QDs) with accuracy is crucial considering its effect on the physical and chemical properties. Size determination of SnO₂ QDs prepared by a soft chemical method using various techniques and their correlation is reported here. Direct method like high resolution transmission electron microscopy (HRTEM), and indirect method like X-ray diffraction and ultra violet–visible (UV–Vis) techniques used for size determination and then correlated. Effective crystallite size found from TEM morphological analysis is 2.4 ± 0.1 nm, which matches closely with the crystallite size of 2.3 ± 0.1 nm as calculated using Williamson–Hall plot. Particle size is also calculated from UV–Vis spectroscopy following quantum confinement effect in SnO₂. The obtained slopes from the Tauc’s plot provide a distribution of particle sizes which matches well with the result from TEM analysis.

Keywords
SnO₂ nanoparticles – Size distributions – Optical band gap – Transmission electron microscopy – X-ray Diffraction