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Nanosecond laser irradiation synthesis of CdS nanoparticles in a PVA system

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Abstract

A modified, *in situ* photolytic process for the nucleation and growth of cadmium sulphide nanoparticles in the presence of an optically transparent and semicrystalline polyvinyl alcohol (PVA) polymer matrix is reported. The laser causes a localized decomposition of the precursor species in the immediate vicinity of the polymer leading to highly confined nanocrystals. The as-synthesised PVA-CdS nanocomposite were characterised using using UV-vis absorption and photoluminescence spectroscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM), high resolution TEM (HRTEM) and powdered X-ray diffraction (XRD). Strong blue shift in the band gap was observed in UV visible absorption spectrum indicating the size confinement. The influence of deposition temperature (25 – 200 ^{o}C) on the optical properties, microstructure, and thermal stability was also investigated. Thermal decomposition behaviours of these composites exhibit decreased thermal stability as indicated by the shift in the decomposition temperature of the pure PVA. XRD patterns revealed a reduction in the crystallinity of the polymer due to the entrapped particles. The nanocomposites showed the existence of both cubic and hexagonal phases. The hexagonal phases dominates at lower temperature (25 and 50^{o}C) while the cubic phase dominates at higher temperature (100 – 200 ^{o}C).

Biography

Damian Onwudiwe obtained his PhD from the University of Fort-Hare, South Africa in 2011. His doctoral thesis was in Materials chemistry with focus on synthesis of semiconductor nanoparticles using the single source precursor route. He is currently a postdoctoral research fellow at North-West University, South Africa where he conducts research on laser enhanced synthesis of nanoparticles. He has published more than 20 papers in reputed journals and serves as reviewer for some Journals of repute.