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X-ray peak profile analysis and optical properties of CdS nanoparticles synthesized via the hydrothermal method

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Cadmium sulfide (CdS) nanoparticles were prepared by hydrothermal method at 150 oC under different reaction times. It was found that hydrothermal method is an effective, quick, and eco-friendly method to synthesis CdS nanoparticles of hexagonal structure at lower temperature. X-ray peak profile analysis by Williamson–Hall analysis and size–strain plot was employed to estimate the crystallite size and lattice strain of the synthesized CdS nanoparticles and to investigate their effects on the peak broadening. The values of strain, stress and energy density were determined for all XRD peaks of wurtzite hexagonal phase of CdS, by applying various forms of Williamson–Hall procedure such as; UDM (uniform deformation model), USDM (uniform stress deformation model) and UDEDM (uniform deformation energy density model). The obtained results indicate that the crystallite size of CdS nanoparticles estimated from Scherrer's equation, Williamson-Hall plots and size-strain plot, are nearly similar and in the range of 14-37 nm. CdS nanoparticles were also investigated using high resolution transmission electron microscopy (HR-TEM), Fourier transform infra-red spectroscopy (FT-IR), and UV–visible and fluorescence spectroscopy. A dependence of the band gap and the nanoparticle size on the reaction time was reported.

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