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Effect of growth temperature on the structural, optical and luminescence properties of cadmium telluride nanoparticles

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Key words: Cadmium telluride; excitation; luminescence; optical properties; Crystallite size.
CdTe was synthesized by a simple wet chemical process at different reaction temperatures. Temperature is known to be a key thermodynamic factor that plays an important role in controlling the growth rate of the nanoparticle, the morphology, size and size distribution of the as-prepared CdTe nanoparticles. In this study, the effects of growth temperature on the structure and optical properties of CdTe nanoparticles were investigated in detail. X-ray diffraction (XRD) analysis displayed a cubic crystal structure with the plane 111, 200, 220, 311 being the main observed peaks. XRD pattern for samples prepared at temperatures lower than 50 ℃ had many impurities from unreacted precursors while those prepared at temperatures above 100 ℃ displayed polycrystalline nanoparticles. The photoluminescence (PL) spectra displayed a red shift (540 to 560 nm) in emission as growth temperature is increased from 50 to 200 ℃. Highest PL peak intensity was realized for growth temperature of 150 ℃. Absorption band maxima were observed to shift towards longer wavelength for higher growth temperatures. Spherical shaped nanoparticles were formed as displayed by the HRTEM and SEM images. The CdTe nanocrystals of different sizes caused tunable emission from green to red due to the quantum confinement effects and these nanomaterials can be applied for biomedical imaging [1].
Reference: [1] C. B. Murray, D. J. Norris, M. G. Bawendi, J. Am. Chem. Soc. 1993, 115, 8706 -8715.

Summary

Growth temperature was found to play a key role in the optical and structural properties of CdTe nanoparticles. The effects of the growth temperature was studied in order to know the optimum temperature required to prepare the CdTe nanoparticles for a desired applications.X-ray diffraction (XRD) analysis displayed a cubic crystal structure with the plane 111, 200, 220, 311 being the main observed peaks. XRD pattern for samples prepared at temperatures lower than 50 ℃ had many impurities from unreacted precursors while those prepared at temperatures above 100 ℃ displayed polycrystalline nanoparticles. The photoluminescence (PL) spectra displayed a red shift (540 to 560 nm) in emission as growth temperature is increased from 50 to 200 ℃. Highest PL peak intensity was realized for growth temperature of 150 ℃. Absorption band maxima were observed to shift towards longer wavelength for higher growth temperatures. Spherical shaped nanoparticles were formed as displayed by the HRTEM and SEM images. CdTe nanoparticles can be applied in a many optical devices and bioimaging due to its emission tunability.

Apply to be
 considered for a student
   award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
   PhD, N/A)?

MSc

Main supervisor (name and email)
and his / her institution

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Would you like to <br> submit a short paper <br> for the Conference
 Proceedings (Yes / No)?

Yes

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