

hexagonal wurtzite phase of CdS (JCPDS card no.89-2944) and can be indexed respectively to the (1 0 0), (0 0 2), (1 0 1), (1 0 2), (1 1 0), (2 0 1) crystal planes.

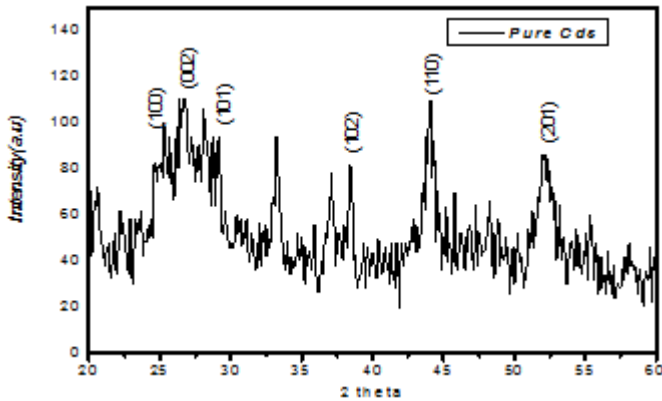


Figure 1: (a) XRD pattern of pure CdS

Fig 1 (b) shows XRD diffraction pattern of various concentration of Ag doped CdS nanoparticle. The prominent new peaks appeared at 2θ values 38.11° corresponds to silver and it matches well with JCPDS Card no.04-0783. The other prominent peaks also appeared at various 2θ values (24.82°, 28.20°, 36.64°, 44.87°, 52.85°). This 2θ value of Ag doped with CdS nanoparticle are compared with pure CdS, the intensity slightly increased for various concentration of Ag doped with CdS. This indicates the formation of Ag nanoparticle in CdS. It confirms structure of Ag doped CdS nanoparticle is hexagonal.

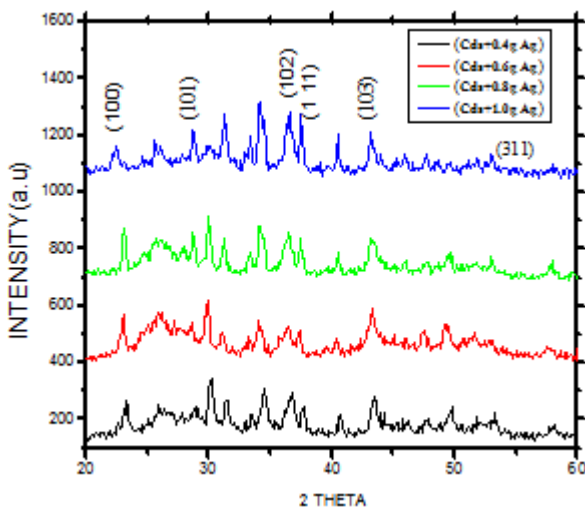


Figure 1: (b) XRD pattern of Ag doped CdS

The crystalline size D of the nanoparticle was found from the peak width with the Scherrer's formula $D = 0.94\lambda / \beta \cos\theta$, Where D is the average crystalline size, λ is the X-ray wavelength, β is the full width half maximum (FWHM) of the diffraction peak, θ is the diffraction angle. The average particle size is found to be 27 nm. All the reflections can be assigned to the standard pattern for the hexagonal phase of Ag doped CdS nanoparticle with lattice constants $a=9.3401$ and $c=7.8518$.

4. Optical Studies

UV-Visible Analysis

The optical absorption spectra of CdS and Ag doped CdS nanoparticle was recorded as a function of wavelength in the wavelength range 200-900 nm. Fig(2 a,b,c,d,e) shows the UV-Visible absorption spectra of CdS nanoparticles undoped and doped with different concentrations of Ag.

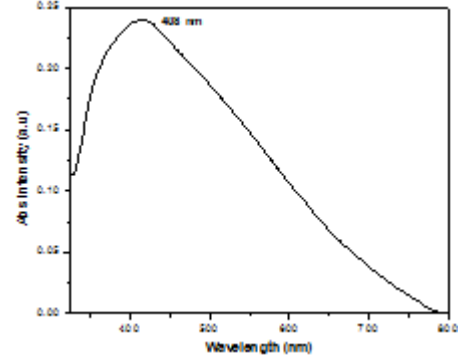


Figure 2: (a) UV spectra of CdS

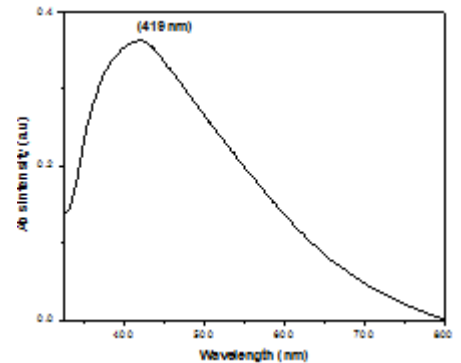


Figure 2: (b) UV spectra of Ag doped CdS (0.4 g)

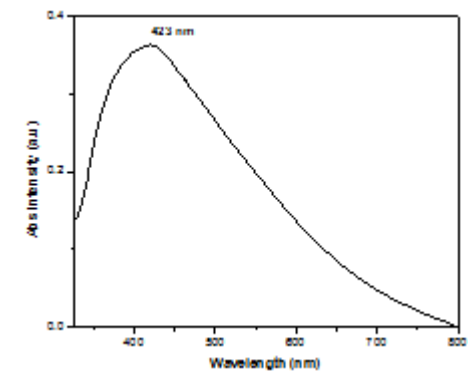


Figure 2: (c) UV spectra of Ag doped CdS (0.6 g)

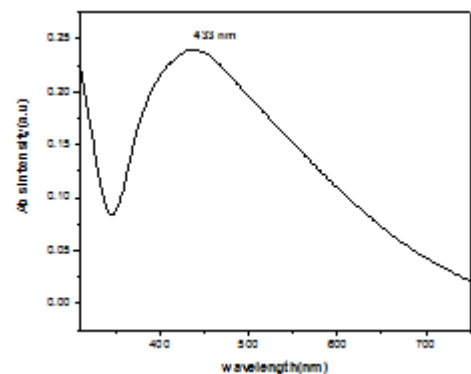


Figure 2: (d) UV spectra of Ag doped CdS (0.8 g)

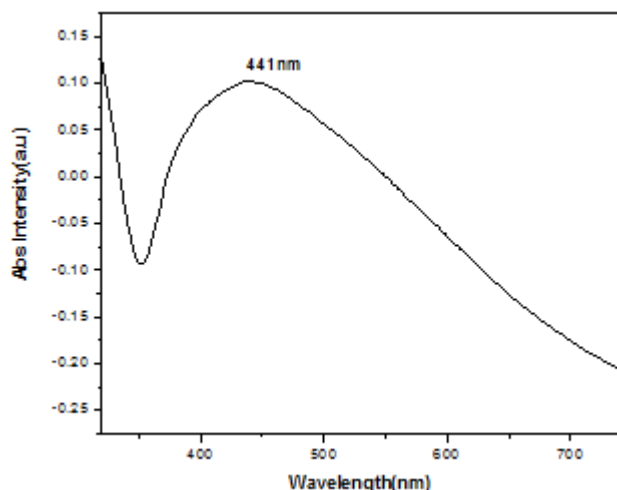


Figure 2: (e) UV spectra of Ag doped CdS (1 g)

The absorption spectra of the samples are very strong and show long absorption tails due to light scattering at high concentration of nanoparticle. The absorption onset wavelengths of pure CdS and at different doping concentrations of silver namely Ag (0.4), Ag (0.6), Ag (0.8), Ag (1.0) are 408, 419, 423, 433, 441 nm respectively, which are all blue-shifted compared with the absorption of bulk CdS which is 515 nm. This is because of quantum confinement effect. Also a slight red-shifted has been observed in the absorption edge on doping the nanoparticles with Ag. But no appreciable broadening or shift in the absorption band suggests that the interaction of the silver metal atoms with the CdS is weak, and no surface plasmonic effects emerged on silver doping. Higher concentrations of Ag should be tried to study the effects more prominently. The band gap of nanoparticle has been calculated from the differential minima of the absorbance curve. The band gap values of the pure and Ag doped CdS nanoparticles are less than that of the bulk value of 3.42 eV.

Fourier Transform Infrared (FTIR) Spectroscopy

The formation of CdS and Ag doped CdS nanoparticle was examined by recording their FTIR spectra in the range 4000 to 500 cm^{-1} . Powdered samples were used in FTIR Spectrum BX-II (Perkin Elmer) spectrometer, without any further specimen preparation. Figure 3(a) shows the FTIR Spectrum for CdS and Ag doped CdS nanoparticle.

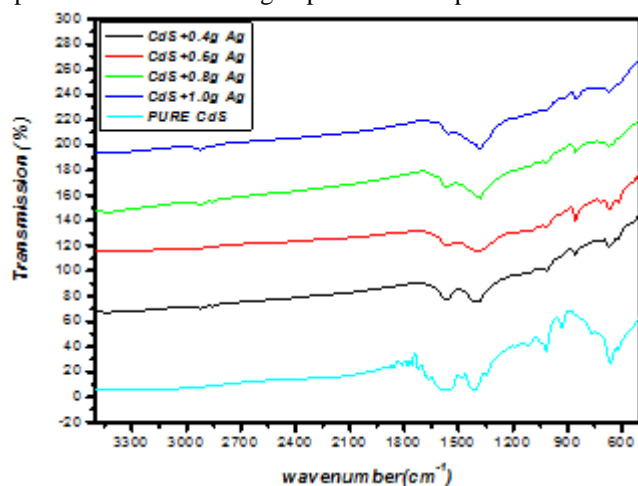


Figure 3: (a) FTIR spectra of Ag doped CdS

The peak at 1410.89 cm^{-1} in pure CdS due to C-C bonds becomes narrower and shift to 1388.19 cm^{-1} after the formation of Ag doped CdS. The functional group of Ag exhibited prominent peak at 1381.18 cm^{-1} . The band observed at 1645.76 cm^{-1} due to O-H bending mode of vibration of CdS becomes narrower and shift to 1539.35 cm^{-1} after the formation of Ag doped CdS nanoparticle. The peaks at 1017.08 cm^{-1} , 1024.87 cm^{-1} and 1115.70 cm^{-1} due to C-C stretching of CdS nanoparticle. The peaks at 669.33 cm^{-1} and 608.34 cm^{-1} corresponds to of O-H bending vibration of CdS. No appreciable change has been observed for other peaks. This confirms the coordination and conjunction of Ag doped CdS nanoparticles.

5. Surface Morphology Studies

SEM Analysis

Surface morphology of CdS and Ag doped CdS nanoparticle were done using Scanning Electron Microscope (SEM). The morphology of CdS and various concentration of Ag doped CdS nanocomposites are shown in fig(4 a,b,c,d,e).

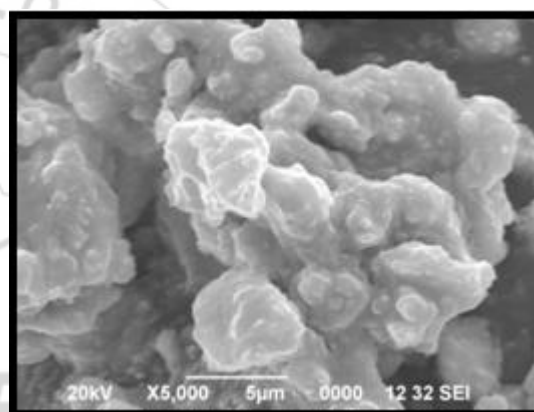


Figure 4: (a) SEM images of CdS

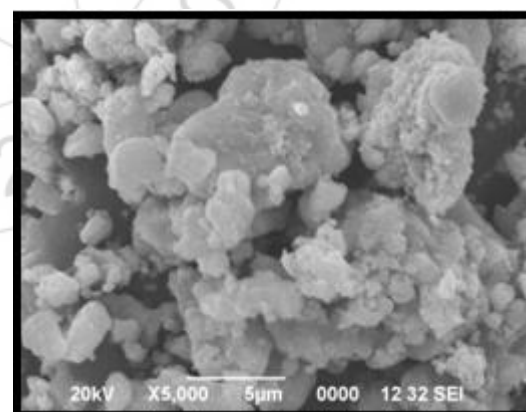


Figure 4: (b) SEM images of Ag doped CdS (0.4 g)

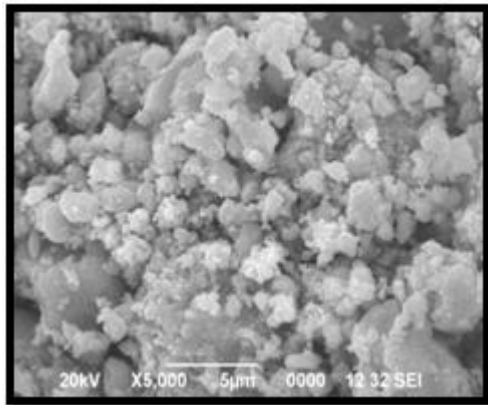


Figure 4: (c) SEM images of Ag doped CdS (0.6 g)

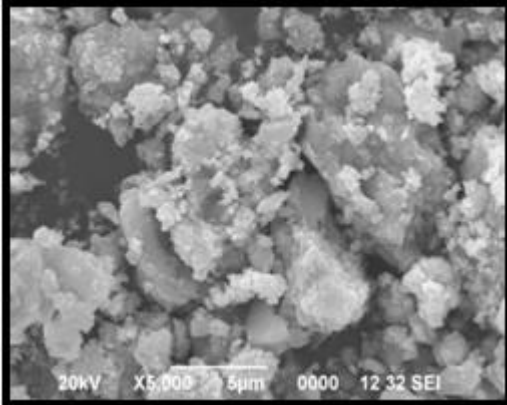


Figure 4: (d) SEM images of Ag doped CdS (0.8 g)

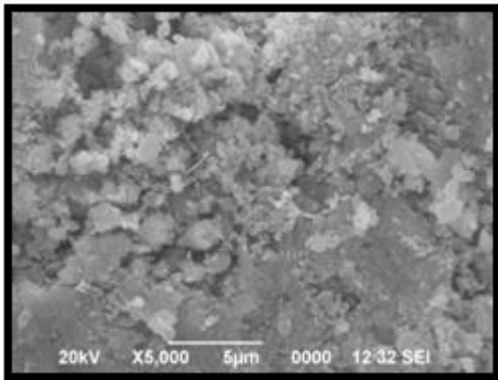


Figure 4: (e) SEM images of Ag doped CdS (1 g)

From the SEM images, we observed that the particles are uniformly distributed. The SEM images of CdS and Ag doped CdS nanoparticle confirms the existence of very small crystalline nanoparticle. The particle size and distribution of nanoparticle mainly depends upon the doping concentration. The SEM images of CdS nanoparticle reveals that the flower like structure. The Ag doped with CdS nanoparticle, the structure of CdS is flakes like structure. When the concentration of Ag is increased, the structure of CdS becomes cluster form. It can be clearly seen that the size of the CdS and Ag doped CdS nanoparticle increases rapidly with increase in molar concentration, however, the diameter of the nanocomposites increases slowly. The size of the CdS and Ag doped CdS nanoparticle can be controlled by molar concentration. The average particle size is found to be 28 nm which was calculated by using image J software. The result is compare with the particle size of 27 nm which was calculated by using XRD analysis.

References

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