Structural and Optical Characterisation of Thin Films of the Polymer Polystyrene Doped by Semiconductor Nanocrystals of CdS

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1. Introduction

Semiconductor nanocrystals are of great interest for both the fundamental research and industrial developments because of their exciting utilization in the fields of light-emitting diodes, electroluminescent devices, laser, hydrogen producing catalysts, biological labels, and immune diagnosis [1–17]. Cadmium sulphide is an important II–VI semiconducting material owing to its applications as photo catalyst [18], non-linear optical material [19–21] in solar cells [22], X-ray detectors [23], photo catalyse, solar energy stockings [24], and in display devices [25].

An important field of interest for semiconductor quantum dots is their incorporation within polymers. Semiconductor QDs can be dispersed in polymers by both *ex situ* and *in situ* methodologies and polystyrene has been used extensively as matrix of the nanocomposite [27–32].

2. Results and discussion

The typical XRD result indicates the amorphous structure of polystyrene and confirms the existence of CdS in films of CdS QDs/Polystyrene composites. The crystalline structure of CdS is of hexagonal phase and its space group is P63mc in accordance with the JCPDS cards. The CdS XRD peaks are relatively broad due to the small size of the particles. The UV–VIS spectrum was recorded on UV - visible spectrophotometer (UV 3101 PC Shimadzu), whose spectral range is spread out over the field 190 nm with 3200 nm. It can be seen that the absorption is blue shifted relative to bulk CdS (***2.5*** eV), suggesting the presence of exciton confinement.

The photoluminescence spectrum was obtained on a Perkin-Elmer LS 50B spectrophotometer using a 350 nm excitation line. The photoluminescence spectrum of the CdS/Polystyrene film note that it exhibits two PL bands: a sharp one centred at 450 nm attributed to transition from conduction band to valance band and a broad band centred at 520 nm that can be assigned to recombination at defects. A shift of the signal of photoluminescence towards the red as compared to that absorption edge was observed. This result was also obtained by T.R Ravindran et al [33].

3. Conclusion

The CdS/Polystyrene nanocomposites films were prepared through *ex situ* methodology and deposited by spin-coating technique. The structural characterization through the diffraction of X-rays revealed the introduction of crystalline particles of CdS of Wurtzite structure in the polystyrene films.

A quantum size effect was evaluated by optical absorption measurement that had a blue-shift characteristic in the band gap energy with decreasing crystallite size. The estimates of average sizes of CdS nanocrystals indicate that it is in a mode of strong confinement

The photoluminescence showed that the elaborate samples present bands of luminescence in the visible field from where the possibility of regarding these samples as active mediums.

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