photoacoustic spectroscopy studies of metal nanoparticles

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this work, a recently developed method was used to synthesize metal(Au & Ag) nanoparticles, semiconductor(CdS) quantum dot (Q.D) and then to prepared metal/semiconductor Au/CdS core/shell hybrid nanocomposite. Seed of gold nanoparticles was prepared by reduction of gold acetylacetonate organometallic complex using alkyl amine. Different shell thicknesses have been grown directly on the Au core by organometallic pyrolysis method. Absorption spectroscopy, photoacoustic spectroscopy(PAS), High Resolution Transmition Electron Microscope (HRTEM) were used to characterize the Au/CdS core/ shell samples. The effect of Au -plasmon core on the optical properties of CdS shell is discussed in the weak exciton plasmon coupling regime.The absorption spectra are a superposition of the Au metal core plasmon absorption and the CdS semiconductor shell exciton absorption, indicating that there is a weak exciton-plasmon coupling. The presence of the plasmon core increases the CdS shell absorption, in spite of the weak coupling. The obtained UV-Vis spectra shows the surface Plasmon band of Au-core 524 nm and the excitons band for CdS shell shifted from 412 nm to 457 nm. The particle sizes were estimated from the band gap values obtained from the optical absorption spectra using both the effective mass approximation (EMA), and Polynomial fitting function (PFF).A complete theoretical treatment of the PAS technique is presented which includes the solution of the heat diffusion equation in the sample and surrounding media in case of front illumination, then, the temperature distribution within the photoacoustic (PA) cell and the production of the PA signal is introduced. Finally, the PA signal is separated into two measurable quantities amplitude and phase which are complicated expressions and can be simplified in case of thermally thick samples.(PA) technique has been used to study the optical and thermal properties of core/shell (Au/CdS) nanostructure. The nonradiative Photoacoustic technique is a photothermal detection; that is proved to be a powerful tool to study the optical, electronic, and thermal properties of such material in a nondestructive manner without particular sample treatment. It is, also, been observed that the excitonic transitions of semiconductor shell nanocrystals are well resolved in PA spectra as compared to the corresponding optical absorption spectra. The obtained spectra are also combination of the surface Plasmon (SP) absorption bands of the -Au core and the band gap of CdS shell giving further evidence of the weak exciton plasmon coupling. Second derivative fitting method was used to determine precise absorption peaks and band of PA spectra. (HRTEM) was employed to measure the

Au-core size and the CdS-shell thickness, which show that results of the EMA and PFF are in good agreement with the determined ones.PA has also been used to measure the values of thermal diffusivity and conductivity of the Au/CdS nanoparticles. This was carried out using the characteristic frequency and shows at least one order of magnitude larger than the bulk value for the shell, which is in part, is due to the presence of Au core. This thermal measurement has a great importance in the design of photovoltaic solar cell.