LIST OF FIGURES

Figure 1.1: Density of states of different semiconductor nanostructures.

Figure 1.2: Schematic presentation of energy levels of bulk semiconductor and quantum dots.

Figure 1.3: Density of states in bulk and metal nanocrystals.

Figure 1.4: Origin of surface plasmon resonance due to coherent interaction of the electrons in the conduction band with light.

Figure 1.5: Schematic presentation of coupled and core-shell metal–semiconductor nanostructures.

Figure 1.6: Schematic illustrating the mechanisms for plasmon-enhanced chemical reactions with metal/semiconductor hybrid nanostructures. a) Plasmonic enhancement of light absorption. b) Hot-electron effect. c) Processes involved in the hot-electron effect.

Figure 1.7: (a) Schematic diagram of PL enhancement mechanism and (b) distance dependent PL quenching and enhancement spectra of CdS/Au colloidal mixture.

Figure 2.1: Experimental setup for wet chemical synthesis.

Figure 2.2: Scattering of rays from different planes, in same direction make constructive interference.

Figure 2.3: Schematic representation of x-ray spectrometer.

Figure 2.4: Schematic diagram of transmission electron microscopy

Figure 2.5: Schematic diagram of excitation process of material.

Figure 2.6: Schematic diagram of UV-Vis absorption spectrophotometer.
Figure 2.7: Schematic presentation of photoluminescence emission process.

Figure 2.8: Schematic diagram of photoluminescence spectrophotometer.

Figure 2.9: Experimental setup of high resolution low-temperature photoluminescence.

Figure 2.10: Experimental setup for time resolved photoluminescence.

Figure 2.11: Histogram of start-stop times in time-resolved photoluminescence measurement with TCSPC.

Figure 2.12: Diagram of the Rayleigh and Raman scattering processes.

Figure 2.13: Experimental setup for Raman spectroscopy.

Figure 3.1: Chemical reaction for formation of CdS NCs.

Figure 3.2: X-ray diffraction patterns of Au NCs, CdS NCs and Au–CdS I core–shell NCs.

Figure 3.3: Electron diffraction (ED) pattern and TEM images with histogram of Au NCs (a and e), CdS NCs (b and d) and Au–CdS I core–shell NCs (c and f), respectively.

Figure 3.4: (a) ED pattern, (b) TEM image of amine capped Au NCs, and (c) TEM image of Au–CdS II nanostructure.

Figure 3.5: Optical absorption spectra of (a) CdS NCs, (b) Au–CdS I NCs, (c) Au NCs and PL spectra of (d) CdS NCs, (e) Au–CdS I core–shell NCs. Inset gives the corresponding PLE spectra recorded at the wavelength corresponding to the maximum emission intensity.

Figure 3.6: Optical absorption spectra of (a) CdS NCs, (b) Au–CdS II, (c) amine capped Au NCs and PL spectra of (d) CdS NCs, (e) Au–CdS II nanostructure.

Figure 3.7: TRPL decay curves of CdS NCs and Au–CdS I core–shell NCs.

Figure 3.8: TRPL decay curves of CdS NCs and Au-CdS II nanostructure.
Figure 3.9: HRTEM image of (a) CdS NCs (Inset shows lattice fringes and histogram) and (b) Au-CdS core-shell NCs (Inset shows lattice fringes).

Figure 3.10: Integrated PL intensity $[I_{\text{Temperature}}/I_{300}]$ of CdS and Au-CdS core-shell NCs as a function of temperature. Inset shows room temperature PL spectra.

Figure 3.11: Schematic presentation of charge transfer in Au-CdS core-shell NCs.

Figure 3.12: Normalized PL spectra of CdS and Au-CdS core-shell NCs recorded at different temperatures with excitation energy 3.54 eV.

Figure 3.13: PL spectrum of CdS NCs recorded at 10 K with excitation energy 3.54 eV. The ascription of five narrow peaks is given.

Figure 3.14: Temperature dependence PL emission peaks of CdS NCs. Symbols indicate experimental data while solid curve indicates calculated result using Varshni equation.

Figure 4.1: X-ray diffraction pattern of ZnO and Au-ZnO nanostructures.

Figure 4.2: TEM images of (a) ZnO NCs and (b) Au-ZnO nanostructures at 200 keV.

Figure 4.3: Optical absorption spectra of ZnO NCs and Au-ZnO nanostructures.

Figure 4.4: Photoluminescence spectra of ZnO and Au-ZnO NCs with excitation wavelength 325 nm.

Figure 4.5: Raman scattering spectra of ZnO and Au-ZnO nanostructures.

Figure 4.6: Energy level diagram of Au-ZnO nanostructure. $E_{F(ZnO)}$ and $E_{F(Au)}$ represents Fermi level of ZnO and Au respectively. $E_{F(equ)}$ represents Fermi level at equilibrium position after charge distribution.

Figure 5.1: Schematic presentation of band structure of semiconductor (TiO$_2$).

Figure 5.2: Schematic presentation of the different steps involved in a photocatalytic process.
Figure 6.1: Schematic representation of gas chromatography.

Figure 7.1: XRD pattern of CdS NCs, CdO NCs and CdO-CdS nano-composites calcinated at $300^0\text{C}$ for 2 h.

Figure 7.2: Representative (a) TEM image and (b) SAED pattern of CdO-CdS nano-composite calcinated at $300^0\text{C}$ for 2 h.

Figure 7.3: Absorption spectra of CdS NCs, CdO NCs and CdO-CdS nano-composites calcinated at $300^0\text{C}$ for 2 h.

Figure 7.4: PL spectra of CdS NCs, CdO NCs, and CdO-CdS nano-composites calcinated at $300^0\text{C}$ for 2 h.

Figure 7.5: Life time decay curve of CdS NCs, CdO NCs, and CdO-CdS nano-composites calcinated at $300^0\text{C}$ for 2 h.

Figure 7.6: Photo-catalytic activity of CdS NCs, CdO NCs, CdO-CdS nano-composites, Pt (0.5 wt %)-CdO-CdS and Au (0.5 wt %)-CdO-CdS nano-composites calcinated at $300^0\text{C}$ for 2 h.

Figure 7.7: Photo-catalytic activity of CdO-CdS nano-composites prepared with different concentration of sulfur source. CdO: thiourea mole ratio 1:0.25 (sample 1), 1:0.5 (sample 2), and 1:0.75 (sample 3).

Figure 7.8: Photo-catalytic activity of CdO-CdS nano-composites subjected to different cycles.

Figure 7.9: Schematic representation of electron-hole charge transfer in CdO-CdS nano-composites.
LIST OF TABLES

Table 3.1: Varshni equation fitting parameters of CdS NCs.