CHAPTER 7

CONCLUSIONS AND FUTURE OUTLOOK

7.1 CONCLUSIONS

- High quality undoped and doped CdS sensitized TiO₂ photoanodes have been successfully prepared by cost effective simple chemical methods.

- The structural studies of the undoped and doped electrodes confirm the presence of undoped and doped CdS nanocrystals closely situated near the TiO₂ nanoparticles.

- The light harvesting property in the visible region is significantly improved due to undoped and doped CdS penetration into the TiO₂ nanoporous structure. The energy band gap values of the electrodes are found to decrease with the increase of doped CdS SILAR cycles.

- The emission peaks in PL spectra of doped CdS films are slightly blue shifted in the same region with respect to the undoped film suggesting the possible interaction of dopant with CdS material.

- Based on the structural and optical studies, it is evident that the optical behaviour is improved with the addition of dopants like Mm and Co with CdS nanoparticles as they interlock into the surface of nanoporous TiO₂ photoanodes.
• The surface morphological analysis depicts the enabled penetration of undoped and doped CdS nanocrystals into the nanoporous TiO$_2$ structure.

• EDX and EDS studies record the elemental composition of the undoped and doped films which confirm the presence of all the constituent elements on the film.

• The electrical studies reveal that the doped CdS sensitized electrodes demonstrate better electrical performance than the undoped electrode. Accordingly, the doped photoanode has great potential for designing high efficiency semiconductor sensitized solar cells.

7.2 FUTURE OUTLOOK

In order to improve the properties of the film prepared in the present work, the following suggestions are given:

➢ The doped and undoped films could be annealed at higher temperatures and the variation in structural, optical and electrical properties could be studied.

➢ Using the same TiO$_2$ precursor, the other chemical methods such as dip coating and spray pyrolysis could be employed to study the change in physical properties of the film.

➢ Various dopants can be introduced with the same TiO$_2$ precursor and the behaviour of the doped TiO$_2$ film could be studied.

➢ The other electrical studies such as Hall measurement and impedance spectroscopy could be carried out for the above prepared films.

➢ The same dopants with different molar concentrations can be used with CdS to study the change in physical properties of the film.
- CdSe can be used along with CdS (CdS/CdSe) as a sensitizer in order to improve the optical and electrical properties of the prepared film.

- TiO$_2$ nanotubes, nanorods or nanowires as a photoanode could be prepared which is viewed as efficient structures to improve the electron transport property by decreasing the charge recombination between TiO$_2$ and sensitizers.

- Instead of CdS sensitizer, Ag$_2$S and Ag$_2$Se could be used which have shown a broadband photoresponse especially in the IR region to yield high current densities.