"PROPERTIES *OF SINGLE POT SYNTHESIZED COMPOSITION TUNABLE PbSe-CdSe CORE-SHELL and $Cd_xPb_{1-x}Se$ NANOCRYSTALLITES*"

A

Project Report

submitted in partial fulfillment of the requirement for the award of the degree of

MASTER OF TECHNOLOGY

In

NANOSCIENCE AND TECHNOLOGY

By

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Roll. No. 05/NST/2K10

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CANDIDATE DECLARATION

I hereby declare that the work which is being presented in this thesis entitled ***"Properties of Single Pot Synthesized Composition Tunable PbSe-CdSe Core-Shell and $Cd_XPb_{1-X}Se$ Nanocrystallites"*** my own work carried out under the guidance of Dr. Shailesh .N Sharma, Scientist "E-I" National Physical Laboratory, New Delhi.

I further declare that , to the best of my knowledge, my report does not contain any material previously published or written by another person for the award of any other degree or diploma, except where due reference is made in the text. The work in this thesis is my own, except for the contributions made by others as described in the Acknowledgements.

Date: ***(Kanchan Sharma)***

Place: New Delhi Roll. No. 06/NST/2K10

CERTIFICATE

This is to certify that the project entitled *" **Properties of Single pot synthesized Composition Tunable PbSe-CdSe core-shell and $Cd_XPb_{1-X}Se$ nanocrystallites"*** completed by Ms. Kanchan Sharma, student of M.Tech., Nanotechnology under Physics Department from **Delhi Technological University, New Delhi** embodies the original work carried out by her under my supervision and guidance. Her work has been found excellent for the partial fulfillment of the requirement of the degree of M.Tech.

It is further certified that, the student has developed the project during the period starting from 2nd November, 2011 to 30th June, 2012.

This report has not been submitted in part or full in any other University for award of any other degree or diploma.

Ms. Kanchan Sharma is student of good moral character. She is dynamic and hard working. I wish success in her future ventures.

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ABSTRACT

This work describes an experimental investigation of method of synthesis, and determination of structural and physical properties, and analysis and correlation of the properties to the structures of PbSe-core, PbSe-CdSe core-shell, ternary $Cd_XPb_{1-X}Se$ nanocrystallites and nanocrystallites - polymer hybrid structures. These structures are investigated for applications in flexible solar cell devices. ***The main synthesis process used in the work was a Single Pot Synthesis of PbSe-core quantum dots as well as core- shell structure which is the novel approach for the core shell formation in our case.*** As, in literature survey, it was found that same material PbSe-CdSe was synthesized using double pot synthesis, SILAR (successive ion layer adsorption and reaction)process and Partial Cation Exchange method in most of the research papers).

Analytical instruments that include Atomic Force Microscopy (AFM) and Transmission Electron Microscopy (TEM), Scanning Tunneling Microscopy (SEM), X –Ray Diffraction (XRD) were used for structural characterization and Fourier Transform Infrared Spectroscopy while optical absorption spectroscopy was used for determining the quantum confinement of charge carriers in PbSe-core as well as in core-shell and ternary nanostructures. In addition, fluorescence quenching of nanocomposite of P3HT with various structure with varied amount of CdO precursor (from 0 to 20%) as per molarity ratio of CdSe/PbSe was also studied.

With this single pot approach, absorption spectroscopy shows red shift in the spectra as Cd content increases .Fluorescence quenching also shows higher charge transfer in core-shell structure as well as in ternary $Pb_xCd_{1-x}Se$ quantum dots as compare to PbSe-core nanostructures.

From results one can infer that PbSe-CdSe core-shell nanocrystallites and its respective composites with polymer can be used for OPV (Organic Phovoltaic Devices) owing to its higher charge transfer efficiencies.