RESUME

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7. Brief account of your research interests with special focus on Nano Science and Technology (strictly within 300 words):

(i) Doctoral Research Work at Shivaji University, Kolhapur

During the course of my Ph.D. research work, I have deposited $Cd_{1-x}Pb_xSe$ thin films with varying composition 'x' from 0.0 – 1.0 on glass/stainless steel plate using chemical deposition method at low temperature. Crystallographic studies revealed that films containing lower concentration of Pb^{+2} ($x \leq 0.5$) form solid solution of Pb^{+2} in CdSe with prominent peaks due to reflection from (100), (002), (101), (102), (110), (103) & (112) planes of a hexagonal CdSe structure; while higher concentration of Pb^{+2} ($x > 0.5$) form solid solution of Cd^{+2} in PbSe with prominent peaks corresponding to cubic structure of PbSe. XRD grain size was found to be in the range of 195-270 Å as lead content added into CdSe. Whereas SEM grain size in the range of 203-276 Å with

composition parameter. Band gap of thin films found to be in the range of 2.01-0.45 eV. Dark specific conductance of the CdSe and PbSe was found to $4x10^{-6}(\Omega\ cm)^{-1}$ and $2x10^{-3}(\Omega\ cm)^{-1}$ respectively. Also, it was found to be increased systematically for ternary films with composition parameter 'x' as well as temperature showing semiconducting nature. TEP measurement shows that films with $x<0.5$ behave as n-type, while films with $x\geq0.5$ behave as p-type. For better solar conversion efficiency, the host lattice of $Cd_{0.7}Pb_{0.3}Se$ was doped with antimony in varying mole %.

(ii) Deposition of other semiconducting thin films & their characterization:

a) CdHgSe & CdZnSe thin films

The method is based on the reaction of $CdSO_4$, $Hg(NO_3)_2$ & Na_2SeSO_3 in an aqueous alkaline medium at 278 K. XRD study confirms the polycrystalline nature in a single cubic phase. Dark dc electrical conductivity was found to be increase non linearly from $10^{-6}(\Omega\ cm)^{-1}$ to $10^{-2}(\Omega\ cm)^{-1}$. All films have n-type conductivity.

Similarly, we have deposited CdZnSe thin film materials.

b) PEC Characterization of $CdIn_2S_4$ thin films

Thin films of $CdIn_2S_4$ have been deposited onto stainless steel & FTO-coated glass substrates from aqueous acidic bath using an electrodeposition technique. Optical absorption shows the presence of direct transition with band gap energy 2.17 eV. XRD analysis of as-deposited & annealed films showed the presence of polycrystalline in nature. SEM reveals that spherical grains are uniformaly distributed over the surface indicates the well defined growth. Fill factor & power conversion efficiency of the cell are 69 & 2.94 %, respectively.

c) Synthesis & Characterization of Indium Selenide, Molybdenum Selenide & $ZrSe_2$ thin films

In_2Se_3 thin films have been deposited using CBD method. Tartaric acid is used as complexing agent; while hydrazine hydrate improves compactness and adherence of the film. XRD analysis showed polycrystalline nature with hexagonal crystal structure. Eg of the film was found to be 2.35 eV. SEM reveals the homogenous grains without cracks.

Similarly, $MoSe_2$ & $ZrSe_2$ thin films have been deposited & characterized by routine techniques.

8. Keywords related to your research interests:

My research interests are as follows

(i) Synthesis, Characterization & optoelectronic Applications of Semiconducting Materials

I am very much interested to carry out work on "preparation, characterization & optoelectronic studies on semiconducting materials in nano form". I will use colloidal method or sol-gel route for synthesis of semiconducting materials. The prepared material will be characterized with techniques like XRD, TEM, SEM, XPS, AAS, TGA/DTA, DR-UV-VIS Measurement, Electrical measurement, etc. The optoelectronic as well as structure relationship will be studied for optoelectronic devices like solar cell, IR detectors, etc.

(ii) Ni-Mn-Lithium batteries

Synthesis of Ni-Mn doped in Lithium host lattice in nano form will be carried out different chemical routes. The crystal system, particle size, external features, band gap, electrical conductivity, etc of synthesized material will be studied with varying particle size, composition, temperature, etc. using different techniques. The materials will also be tested for batteries in order to know the performance.

(iii) Use of nano mixed metal oxides in organic synthesis

Along with optoelectronic materials, I will also devote for use of mixed oxides of Zinc, Titanium, Cadmium, Tin, etc in organic conversions. Along with characterization of material with routine techniques, the various organic conversions will be tested by these oxides as a catalyst.

Dr. S.D.Delekar