

A Project report submitted to UGC under minor research project scheme

**SYNTHESIS OF CHEMICALLY DEPOSITED COPPER INDIUM
SULPHIDE FILMS AND THEIR APPLICATION IN
PHOTOVOLTAIC CELL.**

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Summary

In recent years, ternary semiconductors have been attracted due to their downshift of band gap as compared to their binary analogs. Also they have direct bandgap and they can be obtained in both p and n type conductivity. They are unique in this respect. These ternary compounds differ from binary analog in several ways such as non cubic crystal structure. Due to this fact properties of ternary compound differ much than that of binary, forbidden electronic transitions become allowed and several anomalous features of energy band structure.

In view of this increasing interest of ternary compound semiconductor, in the present investigation an attempt has been made to deposit uniform layer of Cu- In- S and to characterize them by structural, optical, compositional, morphological and electrical methods.

Cu- In- S (I-III-VI) ternary material is deposited by chemical bath deposition method. Purity of the material obtained in thin films depends on purity of material in starting solution. By optimizing deposition parameter such as concentration of solution, temperature of deposition good quality of films was obtained. These films are characterized by optical absorption, thickness, X- ray diffraction, compositional analysis, resistivity etc.

Out of these five chapters, first two are devoted to introduce the problem with sufficient theoretical background based on existing literature. Purpose of this project work is to deposit the material Cu-in-S using chemical bath deposition method. In the third chapter, experimental setup for deposition of films by chemical bath deposition is discussed. Substrate cleaning, preparation of solution for chemical bath and optimizing temperature of deposition is also discussed. Most important part of the project is to characterize the films by various characterizations.

X ray diffraction analysis, it is found that high intensity is obtained for (1 1 2) plane showing chalcopyrite structure of films. Thickness of film increases with increase in molar concentration of starting solution. But as molar concentration increases the atomic wt % of Indium also increases. The films obtained for higher molar concentration are Indium rich. This might be the reason for higher band gap of material obtained in optical absorption studies. Atomic wt % of Sulphur reduces for higher molar concentration of starting solution. From Energy dispersive spectra, it can

be concluded that films are having composition CuInS_2 and also some mixed phases of Cu_2S , In_2S_3 , CuIn_5S_8 etc.

There is a large scope to work in this area. Such as by changing the method of preparation of solution, using various complexing agents. Efforts can be made to deposit the films on conducting glass so that they can be used to get heterojunction photovoltaic cell etc.
