

**PREPARATION, CHARACTERIZATION AND
PHOTOELECTROCHEMICAL BEHAVIOUR OF CuInS_2
AND CuInSe_2 THIN FILMS
AND
PHOTOELECTROCHEMICAL INVESTIGATIONS ON
POLYPYRROLE COATED CdTe**

by
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**SUBMITTED
IN FULFILMENT OF THE REQUIREMENTS
OF THE DEGREE OF
DOCTOR OF PHILOSOPHY**

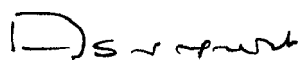


**to the
INDIAN INSTITUTE OF TECHNOLOGY, DELHI
JUNE, 1990**

CERTIFICATE

This is to certify that the thesis entitled, "Preparation, Characterization and Photoelectrochemical Behaviour of CuInS_2 and CuInSe_2 Thin Films; and Photoelectrochemical Investigations on Polypyrrole Coated CdTe " being submitted by Akhlesh Gupta to the Indian Institute of Technology, Delhi, for the award of the degree of "Doctor of Philosophy" in Chemistry, is a record of bonafide research work carried out by him. Mr. Akhlesh Gupta has worked under our guidance and supervision and has fulfilled the requirements for the submission of the thesis, which to our knowledge, has reached the requisite standard.

The results contained in this thesis have not been submitted, in part or in full to any University or Institute for the award of any degree or diploma.



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ABSTRACT

The thesis reports investigations on the preparation of thin films of CuIn alloy, CuInS₂ and CuInSe₂. All the materials have been characterized by X-ray diffraction, Auger electron spectroscopy, scanning and transmission electron microscopy and X-ray photoelectron spectroscopy. CuInS₂ and CuInSe₂ have also been examined for their photoelectrochemical behaviour. In addition, a novel method has been employed to prevent photocorrosion of CdTe in aqueous electrolytes.

Thin films of CuIn alloy have been prepared by a simple electroless technique which involves short circuiting a Ti substrate with an easily oxidizable metal like Al in an acidic bath containing CuCl₂, InCl₃, triethanolamine and ammonia. Conditions have been optimized after a detailed examination of the effect of different variables to obtain a uniform film.

CuInS₂ films have been prepared by annealing the CuIn alloy films (as above) in H₂S atmosphere at high temperatures. The films have been well characterized and the conditions established for obtaining a uniform photoactive film. The PEC characteristics of such films have been examined in detail in polysulphide electrolyte and various device parameters evaluated.

CuInSe₂ films have been prepared by electroless technique from an acidic bath containing CuCl₂, InCl₃, SeO₂, triethanolamine and ammonia. The structural, compositional and morphological characteristics of the films have been determined. Results on the PEC characterization of the films are critically examined.

Photoassisted electropolymerization of pyrrole on CdTe single crystal has been found to be effective in preventing photocorrosion of CdTe in PEC cells containing acidic polyiodide solutions. Stability and power characteristics have been investigated.

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