

ES9.

PREPARATION AND CHARACTERISATION OF CdS, CdS_xSe_(1-x) AND CdSe
THIN FILMS FOR SOLAR CELL APPLICATIONS

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There has been considerable interest in the electrochemically grown electronic materials because of the simplicity of the preparation technique, low cost and significantly high material quality. Among these materials cadmium chalcogenides have very promising characteristics required for solar energy conversion, because their band gaps overlap with the most utilizable region of the solar spectrum. The possibility of modification of band gap of these materials through the introduction of predetermined proportions of chalcogenide elements has practical advantages. Solar energy conversion for example, could be improved through the use of multilayer device structures incorporating such materials with varying band gaps.

The main objectives of this work were to study the variation of optical band gap of CdS_xSe_(1-x) with the parameter x, the differences in crystal structure and to examine the performance of different composites prepared under various experimental conditions.

In this study, thin films of CdS_xSe_(1-x) were deposited on transparent indium-tin-oxide conducting glasses by cathodic electrodeposition of metal chalcogenides in a non-aqueous ethylene glycol solution under galvanostatic conditions. In the preparation of CdS (x=1) films CdCl₂ and sulphur(S) were used in the solution as starting material. In the case of CdS_xSe_(1-x), varying amounts of SeO₂ were added to the above solution. The deposition was carried out at 170°C under 20 mA/cm² current density for about 30 minutes.

The materials were grown for x = 0, 0.22, 0.50, 0.76 and 1.00, and the x values quoted here are obtained from the XRF measurements. The resulting materials were characterised by optical absorption method for determination of band gap variation, and by XRD for bulk structure variation. It has been demonstrated that the band gap could be varied from 1.7 eV for x = 0 (CdSe) to 2.4 eV for x=1 (CdS) by varying the parameter x. Bulk structure remains as hexagonal, but the corresponding lattice spacing gradually increases as the smaller S²⁻ ions are replaced by larger Se²⁻ ions. The photoresponse shown in photoelectrochemical cell demonstrates that all compounds grown are suitable for solar cell applications.