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Aqueous electrodeposition and properties of tin selenide thin films

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SnSe thin films were prepared by electrodeposition method on indium doped tin oxide glass substrate from aqueous bath containing tin-ethylenediaminetetracetic acid complex and sodium selenite solutions at room and elevated temperature. Cyclic voltammetry was performed to elucidate the electrode processes occurred at the working electrode and to determine the potential range for electrodeposition process. The thin films were characterized using X-ray diffractometry, scanning electron microscopy and energy dispersive analysis of X-ray for their structure, morphology and composition. Tin selenide films prepared at elevated temperature show better morphology and X-ray patterns. The deposition bath mixture containing low concentration of selenium produced tin selenide films in stoichiometric amount. The film thickness increased as the deposition time was increased. The photoresponse of the film evaluated in the presence of Fe²⁺/Fe³⁺ redox solution confirms the p-type conduction mechanism and thus could be used as a photocathode in the photoelectrochemical cell. Annealing in nitrogen atmosphere improved the crystallinity of the film and thus increased the photoresponse of the film compared to the untreated sample. The bandgap value observed for the film prepared at elevated temperature was 1.08 eV with indirect transition.