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Low-temperature heat treatment (80°C) effect on the electrochemically synthesized CuInTe₂ thin films for energy harvesting applications

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We have investigated the effect of low-temperature (80°C) heat treatment onto CuInTe₂ (CIT) thin films prepared by one-step electrochemical synthesis technique. Aqueous precursor solution consisting ionic species of Cu, In and Te with pH 4.0 was used to optimize the deposition potential using cyclic voltammetry (CV). A conventional three-electrode geometry consisting working, reference and counter electrodes was used for the potentiostatic electro-deposition of CIT films onto CdS substrate. CdS layers were deposited onto fluorine doped tin oxide (FTO) conducting substrates by chemical bath deposition technique. The structural, optical, morphological, compositional, and transport properties were studied with the aid of XRD, Raman, HR-TEM, UV-Visible, FESEM, EDAX and I-V and C-V measurements. As-deposited samples were amorphous in nature, however upon heat treatment at 80°C for 30 minutes, the highly crystalline CIT thin films with tetragonal crystal structure were revealed. The values of energy band gap of the film deposited at -0.7 and -0.8 V versus Ag/AgCl was estimated to be in the range 1.02 to 1.08 eV. Compact, uniform, void free and well adherent films were deposited at -0.7 and -0.8 V. As the samples were heat treated at 80°C for 30 minutes therefore not much visible change in the surface morphology was observed after heat treatment. In-rich films were electrodeposited for above potentials, however after heat treatment sample deposited at -0.8 V showed the stoichiometric composition. Non-ohmic, schottky diodes are formed with Au metal contact in all cases. The dark current in I-V measurement was found to be increased by two orders of magnitude after heat treatment. This low-temperature heat treatment is advantageous for the fabrication of low temperature CIT based solar cell devices onto flexible substrates.

Biography

Lakhe M G is working as a PhD student under the guidance of Dr. N. B. Chaure in Department of Physics, Savitribai Phule Pune University since 2010. The title of her thesis is "Studies on ternary and quaternary semiconducting thin films and their solar cell applications". Also she is working on heterojunction thin film solar cells consisting CuInTe₂ and Cu₂ZnSnS₄ as an absorber layers and CdS as an emitter/buffer layer. For growth of both type of materials, low cost electrodeposition and chemical bath deposition techniques are used respectively. Conditions have been optimized for both superstrate and substrate configuration of solar cells. She has also published one paper in international journal of *Solar Energy Materials and Solar Cells* and one has been submitted to *Journal of Materials Chemistry and Physics* and which is under review.

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