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Non–Vacuum Processed Chalcopyrite $Cuinga(Sete)_2$ Thin Films: Effect Of Pre– And Post–Annealing Temperatures On Photoinduced Electron Transfer Efficiency

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Extended Abstract

The chalcopyrite $CuInGa(SeTe)_2$, commonly known as CIGST, thin films have recently attracted significant research interest as a potential alternative energy–harvesting system for the next generation. The aim of our work is to synthesis CIGST thin films produced by sol–gel method and to investigate the effects of pre– and post–annealing temperatures on the structural modification, surface morphology evolution and photoinduced electron transfer efficiency. Coumarin dye molecules are attached to CIGST thin films and fluorescence dynamics of such a dye–compound semiconductor material assembly is investigated with a conventional time correlated single photon counting technique. Due to photoinduced electron transfer mechanism caused by the interaction of coumarin dye molecules (donor) and CIGST (acceptor), the fluorescence lifetime of dye molecules bound to these semiconductor materials decreases from 5.993 ns to 3.778 ns. The pre– and post–annealing temperatures have been varied between 300–500 °C and 500–600 °C, respectively, and it has resulted on a critical parameter in the complete and homogeneous formation and crystalline quality, suitable band gap of the CIGST thin films and increased electron transfer rate from dye to CIGST thin films which are very promising for applications in photovoltaic devices. These novel absorbing layers may open a new avenue for optoelectronic and photonic device applications in the near future.

Keywords: Chalcopyrite CIGST film; Sol–gel process; Annealing optimization; Coumarin; Fluorescence lifetime; Electron transfer.

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