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Optical and structural characterisation of electrodeposited $CuInSe_2$ thin films

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$CuInSe_2$ thin films were prepared on ITO coated glass substrates by electrodeposition from aqueous solution containing 0.005 M $CuCl_2$0.005 SeO_2 and 0.01 M $InCl_3$ at room temperature for a period of 30 minutes. To obtain better quality films, samples were annealed at different temperatures (200 ^{0}C, 350 ^{0}C and 500 ^{0}C) in Ar.

XRD, optical absorption measurements, photovoltage measurements, spectral measurements and reflectance measurements were performed to characterize the films. According to the results, $CuInSe_2$ is a p-type semiconductor. XRD shows three sharp $CuInSe_2$peaks of (112), (200) and (116) reflections for the samples annealed at 200 ^{0}C and 350 ^{o}C. Photovoltage of samples annealed at 400 ^{0}C and 500 ^{0}C were negligible (alomost zero). For the sample annealed at 200 ^{0}C, photovoltage was around 10 – 15 mV. The highest photovoltage of around 150 mV was shown by the sample annealed at 350 ^{0}C.

According to optical absorption measurements and reflectance measurements, the direct band gap was around 1.1 eV for both samples annealed at 200 ^{0}C and 350 ^{0}C. Only the sample annealed at 350 ^{0}C gave spectral responses.