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Electronic Structure and Conductivity of n-type CdS films for Solar Energy Conversion

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CdS thin films which are popular window materials of solar cells were deposited on glass substrates at 60°C, and annealed in air at different temperatures. Temperature dependent electrical conductivity of films was measured by using four point probe technique. The NEXAS of films were collected at Cd L3 edge (3538 eV). The measurements were performed at beamline 9.3.1 at ALS, Berkeley, California. A chemical shift to lower energy with increasing temperature was observed in the Cd L2,3 spectra. The pre-peak growing at around 3554 eV become dominant in the spectra of the films annealed at 373 K and 573 K. Interestingly these films have the lower temperature coefficient of resistivity (αTCR =-1.75·10^{-3} K^{-1}, between 305 K and 800 K) than the others. There is also some changes in the Sulphur K edge spectra which shows a transition from S (1s) to conduction band S 2p-like orbitals.

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Near Edge X-ray absorption studies on CdSe thin films grown by Chemical Bath Deposition

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CdSe films were synthesized by CBD at 60°C, followed by subsequent annealing in nitrogen atmosphere up to 500°C. Films were subjected to NEXAS at Cd L2,3 edges (3400 eV – 3600 eV) at beamline 9.3.1 at Advanced Light Source in Berkeley, California. Since the films present a concentrated system with a high potential for self-absorption, we recorded the spectra in the TEY mode. Close inspection of the Cd L3 region of the spectra suggests a small chemical shift towards lower energies with increasing temperature, suggesting a chemical reduction of cadmium. Precise quantitative analysis of the pre-edge region shows actually a chemical shift of totally ~ 0.5 eV confirming that the cadmium is slightly reduced with increasing annealing temperature. Interestingly, the spectra of the films annealed at 100°C and 200°C having optical band gap at around 1.8 eV are completely different from those of the others.