

Effects of annealing temperature on structural and optical properties of CdS Films prepared by RF magnetron sputtering

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CdS thin films were deposited on glass substrates by R.F. magnetron sputtering method and some of the samples were treated by rapid thermal annealing (RTA) process. Effects of thermal annealing on structural and optical properties were investigated at different temperatures ranging from 100 to 600°C. The crystallographic structure of the films and the size of the crystallites in the films were studied by X-ray diffraction. The crystallite sizes were found to increase, and the X-ray diffraction patterns were seen to sharpen by annealing. Optical properties of the films were calculated using the envelope method and the photoluminescence measurements. The optical properties of the films were seen to be dependent on the film thicknesses. The energy gap of the films was found to decrease by annealing. The band edge sharpness of the optical absorption was seen to oscillate by thermal annealing. Annealing over 400°C was seen to degrade the optical properties of the film. The best annealing temperature for the films was found to be 400°C from the optical properties. It is observed that the CdS film annealed at 400°C reveals the strongest UV emission intensity and narrowest full width at half maximum among the temperature ranges studied. The enhanced UV emission from the film annealed at 400°C is attributed to the improved crystalline quality of CdS thin film due to the effective relaxation of residual compressive stress and achieving maximum grain size. The results show that heat treatments under optimal annealing condition can provide significant improvements in the properties of CdS thin films.