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ELECTRICAL MEASUREMENTS OF CADMIUM ARSENIDE THIN FILMS COMPOUND SEMICONDUCTORS

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ABSTRACT

Cadmium arsenide is a II-V semiconductor which exhibits n-type intrinsic conductivity with high mobility and narrow energy band gap. The films were prepared by vacuum evaporation with deposition rates of 0.5 nm s^{-1} and substrate temperatures maintained at constant values of 293 K- 393 K. Sandwich-type samples were deposited with film thicknesses of 0.1-1.1 μm using evaporated electrodes of Ag and occasionally Au or Al. Various electrical measurements have been performed in this work. Van der Pauw measurements on film resistivity values in the range of 10^{-2} - 10^{-6} Ωm were determined, which were strongly dependent on the deposition conditions and the film thickness. The resistivity decreased with increasing film thickness in the approximate range 10^{-2} – 10^{-5}Ωm for films of thickness up to about 0.5 μm, retaining the lower value at higher thicknesses. AC capacitance studies were performed on Ag-Cd_3As_2-Al sandwich structures as functions of frequency and temperature over the ranges 100 Hz - 20 kHz and 163 - 453 K. It was observed that the capacitance decreased with increasing frequency and increased with increasing temperature, tending to constant values at high frequencies and low temperatures.
A linear log $J\alpha V^{1/2}$ dependence in sandwich structures it is clear that lowering of a potential barrier occurs at high fields in Cd_3As_2 thin films. The measured values of the field-lowering coefficient β for films having two Ag electrodes suggests that dominant Schottky field lowering in the thinner films (typically 0.1 μm) gives way to Poole-Frenkel field lowering for thicker films (typically 1 μm and above).

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