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Growth Mechanism and Some Properties of $Cd_{1-x}Mn_x$ Se Semimagnetic Semiconductor Thin Films

V. S. KARANDE, S. H. MANE, V. B. PUJARI and L. P. DESHMUKH
Department of Physics, Shivaji University Centre for Post Graduate Studies,
Solapur-Pune Road, Kegaon, Solapur 413002, MS., INDIA
e-mail: vskvikram@yahoo.co.in

 [Keywords](#)
 [Authors](#)



phys@tubitak.gov.tr

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Abstract: (Cd, Mn) Se dilute semiconductor or semimagnetic semiconductors have recently become the focus of intense research due to their interesting combination of magnetic and semiconducting properties, and are employed in a variety of devices including solar cells, gas sensors etc. A series of thin films of this material, $Cd_{1-x}Mn_x$ Se ($0 \leq x \leq 0.5$), were therefore synthesized onto precleaned amorphous glass substrates using a solution growth technique. The sources of cadmium (Cd^{2+}) and manganese (Mn^{2+}) were aqueous solutions of cadmium sulphate and manganese sulphate, and selenium (Se^{2-}) was extracted from a reflux of sodium selenosulphite. The different deposition parameters such as temperature, time of deposition, speed of mechanical churning, pH of the reaction mixture etc were optimized to yield good quality deposits. The as-grown samples were thin, relatively uniform, smooth and tightly adherent to the substrate support. The colour of the deposits changed from deep red-orange to yellowish-orange as the composition parameter, x , was varied from 0 to 0.5. The terminal layer thickness decreased with increasing value of, x . The optical energy gap decreased from 1.84 eV to 1.34 eV for the change of x from 0 to 0.5. The coefficient of optical absorption α is of the order of $10^4 - 10^5 \text{ cm}^{-1}$ and the type of transition ($m \cong 0.5$) is of the band-to-band direct type. The dc electrical conductivities were measured at room temperature and in the temperature range 300 K - 500 K. It was observed that the room temperature electrical conductivity increased with the composition parameter x up to 0.1, gradually decreasing thereafter. The thermo power measurements showed n-type conduction in these films.

Key Words: Dilute semiconductor, reflux.

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