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Effect of composition on electrical and optical properties of thin films of amorphous GaxSe100-x nanorods

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Abstract

We report the electrical and optical studies of thin films of a-GaxSe100-x nanorods ($x = 3, 6, 9$ and 12). Thin films of a-GaxSe100-x nanorods have been synthesized thermal evaporation technique. DC electrical conductivity of deposited thin films of a-GaxSe100-x nanorods is measured as a function of temperature range from 298 to 383 K. An exponential increase in the dc conductivity is observed with the increase in temperature, suggesting thereby a semiconducting behavior. The estimated value of activation energy decreases on incorporation of dopant (Ga) content in the Se system. The calculated value of pre-exponential factor (σ_0) is of the order of $10^1 \Omega^{-1}\text{cm}^{-1}$, which suggests that the conduction takes place in the band tails of localized states. It is suggested that the conduction is due to thermally assisted tunneling of the carriers in the localized states near the band edges. On the basis of the optical absorption measurements, an indirect optical band gap is observed in this system, and the value of optical band gap decreases on increasing Ga concentration. © 2010 The Author(s).

Author Keywords

a-GaxSe100-x nanorods; Absorption coefficient; Activation energy; dc conductivity; Optical band gap; SEM images; TEM image; XRD pattern

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