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Electrical and optical properties of a-Se_xTe_{100-x} thin films

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ABSTRACT

The dc electrical conductivity of as deposited thin films of a-Se_xTe_{100-x} (x=3, 6, 9 and 12) is measured as a function of temperature range from 298 to 383 K. It is observed that the dc conductivity increases exponentially with the increase in temperature in this glassy system. The value of activation energy calculated from the slope of ln σ_{dc} vs. 1000/T plot, is found to decrease on incorporation of dopant (Se) content in the Te system. On the basis of pre-exponetial factor (σ_0), it is suggested that the conduction is due to thermally assisted tunneling of the carriers in the localized states near the band edges. The optical absorption measurements show an indirect optical band gap in this system and it decreases on increasing Se concentration. The optical constants (extinction coefficient (k) and refractive index (n)) do change significantly with the photon energy and also with the dopant Se concentration. The decrease in optical band gap may be due to the decrease in activation energy in the present system. It is also found that the real and imaginary parts of dielectric constants show a significant change with the photon energy as well as with the dopant concentration. With large absorption coefficients and compositional dependence of optical band gap and optical constants (n and k), these materials may be suitable for optical disk applications.