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Abstract

Polycrystalline In_6Se_7 thin films are prepared on glass substrate by reactive evaporation technique at a substrate temperature of 523 K under a vacuum of 10^{-5} mbar. The samples are characterized using XRD, SEM, EDAX and UV-Vis-NIR Spectrophotometer. Photoconductivity studies in the prepared sample shows that the decay follows stretched exponential function with an effective relaxation time of 3.45×10^4 s. dc conductivity measurements are done to study the dependence of conductivity on temperature. Dielectric properties and ac conductivity studies of the prepared sample are done in the frequency range 5 Hz to 300 KHz and in the temperature range 303 K to 383 K. The ac conductivity is found to vary as ω^s with the index $0.9389 \leq s \leq 0.9631$ and it decreases with increase in temperature. The calculated ac activation energy value is less than that of dc activation energy and it decreases with increase in frequency. These result shows that correlated barrier hopping (CBH) mechanism is the dominant conduction mechanism in the prepared In_6Se_7 sample. From ac conductivity, the density of states at fermi level is calculated and is of the order of $10^{18} \text{ eV}^{-1} \text{ cm}^{-3}$. Capacitance and dielectric loss are found to decrease with increase in frequency and increase with increase in temperature, which is in agreement with the existing equivalent circuit model. Studies using complex impedance spectroscopy shows a non-Debye type relaxation in the prepared film. Dielectric modulus studies reveal a long range to short range transition in the mobility of the charge carriers with the increase in frequency.

Keywords: In_6Se_7 thin films, reactive evaporation, stretched exponential function, ac conductivity, dielectric properties.

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