

Unraveling the effect of Bi₂S₃ on the optical, electrical and magnetic properties of γ -MnS-based composite thin films

Z.Amara, M.Khadraoui, R.Miloua, A.Boukhachem, A. ZIOUCHE

Abstract: (Bi₂S₃)_x (γ -MnS)_{1-x} composite thin films have been deposited onto glass substrates using spray pyrolysis method. The structural and compositional investigations confirmed the co-existence of Bi₂S₃ and γ -MnS binary compounds in the thin films. The surface morphology indicated that the increase in Bi₂S₃ concentration influences both the shape and the size of γ -MnS crystallites. The optical analysis via transmittance and reflectance measurements revealed that the band gap energy E_g decreased from 3.29 eV to 1.5 eV in terms of Bi₂S₃ content. The electrical parameters such as resistivity ρ , mobility μ , carrier concentrations and Hall coefficient have been obtained by Hall Effect measurements. It is found that incorporation of Bi₂S₃ enhances the conductivity, and p-type conduction of γ -MnS could be converted to n-type at $x = 0.5$. The vibrating sample magnetometer measurement has revealed that (Bi₂S₃)_x (γ -MnS)_{1-x} composite thin films have a ferromagnetic behavior at room temperature.

Keywords : γ -MnS, Bi₂S₃, Spray pyrolysis, Magnetic Properties