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Optical Properties of Thermally Evaporated $Bi_2Te_{3x}Se_{3(1-x)}$ Thin Films for Optoelectronic Applications

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Abstract: *This study investigates the optical properties of thermally evaporated bismuth telluride-selenide ($Bi_2Te_{3x}Se_{3(1-x)}$) thin films with varying selenium content. The films were deposited on glass substrates using thermal evaporation technique under high vacuum conditions. Optical characterization was performed through UV-Visible-NIR spectrophotometry to determine transmission, reflection, absorption coefficient, refractive index, extinction coefficient, and optical band gap. For all the films, transmittance spectra reveal very pronounced interference effects for wavelength away from the fundamental absorption edge. With increasing the composition of Bi_2Te_3 (x = 0. to 0.9) the absorption edge shifts towards lower wavelength region. The optical band gap has been found to be direct and allowed, it increases from 0.62 to 0.82 with increase in composition from x = 0.1to 0.9. The value of extinction coefficient 'k' varies between 0.36 and 1.48, while refractive index 'n' varies between 1.48 and 7.64, for all the compositions. The number of well-defined turning points is observed in variations of optical constants n and k with λ.*

Keywords: $Bi_2Te_{3x}Se_{3(1-x)}$, thermal evaporation, optical properties, thin films, band gap, refractive index