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Optical constants for Ge_{30-x}Se₇₀Ag_x (0 ≤ x ≤ 30 at%) thin films based only on their reflectance spectra

By: Aly, KA (Aly, K. A.)^[1,2]; Dahshan, A (Dahshan, A.)^[3,4]; Yahia, IS (Yahia, I. S.)^[5,6]

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Abstract

In this paper, different homogenous compositions of Ge_{30-x}Se₇₀Ag_x (0 ≤ x ≤ 30 at%) thin films were prepared by thermal evaporation. Reflection spectra, R(λ), for the films were measured in the wavelength range 400-2500 nm. A straightforward analysis proposed by Minkov [J. Phys. D: Appl. Phys. 22 (1989) p. 1157], based on the maxima and minima of the reflection spectra, allows us to derive the real and imaginary parts of the complex index of refraction and the film thickness of the studied films. Increasing Ag content at the expense of Ge atoms is found to affect the refractive index and the extinction coefficient of the films. The dispersion of the refractive index is discussed in terms of the single-oscillator Wemple-DiDomenico model. Optical absorption measurements were used to obtain the fundamental absorption edge as a function of composition. With increasing Ag content, the refractive index increases while the optical band gap decreases. The compositional dependence of the optical band gap for the Ge_{30-x}Se₇₀Ag_x (0 ≤ x ≤ 30) thin films is discussed in terms of the chemical bond approach.

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Author Information

Reprint Address: Aly, KA (reprint author)

+ King Abdulaziz Univ KAU, Fac Sci & Arts, Dept Phys, Khulais, Saudi Arabia.

Addresses:

- + [1] King Abdulaziz Univ KAU, Fac Sci & Arts, Dept Phys, Khulais, Saudi Arabia
- + [2] Al Azhar Univ, Fac Sci, Dept Phys, Assiut Branch, Assiut, Egypt
- + [3] Port Said Univ, Dept Phys, Fac Sci, Port Said, Egypt
- + [4] King Khalid Univ, Fac Girls, Dept Phys, Abha, Saudi Arabia
- + [5] Ain Shams Univ, Fac Educ, Dept Phys, Cairo, Egypt
- + [6] Firat Univ, Dept Met & Mat Sci Engr, TR-23169 Elazig, Turkey

E-mail Addresses: kamalaly2001@gmail.com

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