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Theoretical approach to study the solid state and optical characteristics of calcium sulfide (CaS) thin film

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Calcium sulfide thin film has been studied in this work using theoretical approach in which a scalar wave is propagated through the material thin film deposited on a glass substrate with the assumption that the dielectric medium has homogenous reference dielectric constant term, ε_{ref} and a perturbed dielectric function, $\Delta_{\varepsilon p}(z)$ representing the deposited thin film medium on surface of the glass substrate is presented in this work. These two terms, constituted arbitrary complex dielectric terms that describes dielectric perturbation imposed by the medium of for the system. This is substituted into a defined scalar wave equation in which the appropriate green's function in conjunction Dyson's equation was defined on it to reduce it to Volterra equation of second type with the kernel $k(z,z')=G(z,z')V(z')$ is solved using series solution technique in conjunction with born approximation method in order to obtain a model equation of wave propagating through the thin film. This was used in computing the propagated field, $\Psi(z)$ for different input regions of field wavelength such as ultraviolet, visible and infrared region respectively during which the influence of the dielectric constants of the thin film on the propagating field were considered. The results obtained from the computed field were used in turn to compute the band gaps, solid state and optical properties of the thin film such as reflectance, transmittance and absorbance.

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