Au/InSe interface designed as resonators for optical communications

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Abstract

In the current work a 200 nm Gold is used as substrate to 200 nm thick InSe thin film. Both layers are prepared by the physical vapor deposition technique. The optical transmittance, reflectance, and absorbance of the glass/InSe the Au and the Au/InSe films are measured and analyzed in the incident light wavelength range of 300-1100 nm. From these optical spectra the effects of the Au layer on the energy band gap and on the dielectric spectra are determined. Particularly, it was observed that the energy band gap of the InSe films diminish from (1.50/2.76) to (1.00 /1.80) eV upon Au layer interfacing leading to a band offset of (0.50/0.96) eV. The real and imaginary parts of the dielectric constant of Au/InSe thin film exhibit resonance at 361 THz. The value corresponds to an energy of 1.50 eV which indicate that the dielectric resonance happens as a result of the direct allowed electronic transitions from the valence to the conduction bands that create the energy band gap of InSe. Such behavior are of interest as it indicate that the corresponding 834 nm wavelength become a standing wave traveling between the valence and conduction band edges. This wavelength value is very close to the 850 nm which is used for optical encoding of communication signals in fiber optics.

Keywords: InSe; dielectric resonance; fiber optics; interface