

Photoinduced refractive index in amorphous arsenic selenide film for optical memory based on surface plasmonic resonance

A. Popescu¹, S. Miclos^{1*}, Georgiana Vasile^{2*}, D. Savastru¹, M. Stafe², C. Negutu², V. Savu¹, and N. Puscas²

¹National Institute of R&D for Optoelectronics INOE 2000, Magurele, Ilfov, Romania;

²University POLITEHNICA of Bucharest, Physics Department, Bucharest, Romania

* Corresponding authors: miclos@inoe.ro; georgiana.vasile@physics.pub.ro

Keywords. Amorphous chalcogenide, surface plasmon resonance, materials engineering.

Abstract.

In amorphous solid materials, several photo-induced phenomena are highlighted, which are not specific to the crystalline state. Such photo-induced changes lead to the change of the refractive index, respectively of the reflectance and optical transmission. The phenomenon is known in the films of amorphous As₂Se₃. However, the changes are not large, of the order of 10⁻²-10⁻³, which limits the practical applications. The resulting effect can be amplified if the material is placed in a resonance structure, such as surface plasmon resonance. The structure and configuration are the conventional one proposed by Kretschmann which uses total attenuated reflection, the coupling being made through the evanescent wave.

The report shows the results of numerical calculations for thin films of arsenic selenium. The thickness of the films has an important role, given that only for certain thicknesses obtained by us can the wave guide modes be excited. It has been established that for film thickness of 700 nm and the incident light with wavelength 1064 nm, the resonance angle is equal to 49.16°. The resonance peak is very sharp and supports a considerable displacement (shifting) following the increase of the refractive index by +/- 0.03 from the initial refractive index value of the material equal to 2.7. For setting values of incident angle 50.0° and 50.5°, a fall is observed first, then a sharp increase in reflectiveness, which is favorable for the development of devices with bistability or optical memory.