The design of complex optical elements was developed (Fig.3) and superimposed complex relief structures (Fig.4) were realized by EBL using high precision electron beam positioning computer soft. The mechanism of electron-beam recording of diffraction gratings in chalcogenide films mainly is attributed to periodic modulation of their refractive index and transmittance, caused by induced structural transformation.

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Surface plasmon resonance using As_2S_3 film for water salinity detection

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Amorphous chalcogenide As_2S_3 films used in surface plasmon resonance structures improves the sensitivity of sensors using such structures by providing them with sharp resonance characteristics: changes at the sixth decimal of the ambient medium refractive index cause important changes of the reflectivity. This high sensitivity is fructified to determine the salinity of the water. The salinity of the water changes the refractive index of the water under test and these changes are put in evidence by the plasmon resonance.

A four layers Kretschmann configuration was taken into consideration, comprising a BK7 prism, a gold thin film, a chalcogenide As_2S_3 film and the ambient medium, which is the sea water. The transfer matrix formalism was used in our study to determine the reflectances characterizing the plasmonic structure.

First a large amount of combinations of thicknesses of gold and As_2S_3 layers over a large wavelength range (using 21 wavelengths corresponding to usual laser sources, mostly laser diodes, emitting in the range 405 – 1625 nm) and for incidence angles ranging between 10° and 80° are calculated in order to determine a plasmonic structure with an optimal sensitivity for the sea water. The two polarization modes (TE and TM) will be taken into consideration, in order to determine the best configuration that allows an optimal sensitivity.

This optimal structure is selected also by choosing a convenient operating wavelength that allows both a good sensitivity and a cheap light source. With these data, the design will be improved by refining the determination of the thicknesses of gold and As_2S_3 layers.

Graphs of the reflectance vs. incidence angle for different refractive index variations of the sea water will show the incidence angle at which the resonance occurs (a parameter useful to the design of the sensor) and the sensitivity of the setup (the sensitivity of the sensor made using this setup).

These simulations are important for the design of a salinity sensor that uses surface plasmon resonance structures with amorphous chalcogenide film. Thus are set the constructive parameters of the structure: the thicknesses of the amorphous chalcogenide film and of the metal film, the light source (and hence, the wavelength) and the incidence angle at which the resonance occurs.

Influence of Ag, Sb or Ge doping on short-range order of As-S chalcogenide glasses

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Amorphous chalcogenides are important due to their remarkable properties, which make them useful in optoelectronics for infrared elements, for electrical switches, holography and information storage media. Information on the short-range order structure of chalcogenide glasses is particularly valuable for establishing useful correlations between their structural and macroscopic properties. It can help in the optimization of the sensitivity and relief formation processes of composite nanomultilayer structures based on As-S alloys, which are perspective for the direct recording of optical elements [1,2].

In this work X-ray diffraction (XRD) technique is employed to investigate the structural properties amorphous As-S-Sb, As-S-Ag and As-S-Ge chalcogenide glasses. The aim of this study is to perform analysis of parameters of short-range order of the As-S amorphous alloys doped with Ag, Sb and Ge.

The experimental X-ray diffraction profiles are confirmed amorphous nature of studied glasses. Pair distribution function (PDF) for As-S samples doped with Ag (concentration 0%, 4.7 %, and 7.3 at. %), Sb (concentration 3, 5, 20, 25 and 30 at. %) and Ge (concentration 5% and 30 at. %) were calculated. The addition of silver and germanium does not significantly affect the position of first coordination sphere. The positions of the first peak correspond to the value of 2.29 Å and 2.25 Å, position of the second peak to 3.48 Å for glasses doped on Ag and Ge, respectively. The radius of first coordination sphere of As-S-Sb alloys is shifted towards the longer distances: from 2.29 Å to 2.42 Å with the increase of Sb content.

In this study the results of XRD for characterization of As-S glasses doped with Ag, Sb and Ge are presented. It was shown that doping on elements (in our case, Sb) can significantly affect the position of first and second coordination spheres in chalcogenide glasses.

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