plasmon resonance [1] led to changes in optical reflection of up to 50%.
The Kretschmann configuration requires coupling prism the refractive index of which is greater than that of the film deposited over the gold layer. In the case of chalcogenide materials, the refractive index ranges from 2.5 (for As2S3) to 3.0 (for As2Se3) and does not normally allow excitement of surface plasmonic resonance with a prism made of conventional optical glasses such as crown, flint etc. The situation can be overcomed if the film thickness is rigorously chose so that surface plasmon-polariton wave resonates with one of the waveguide modes. Some experimental studies were perform and published by using arsenic sulphide films. Although As2S3 is a high band gap material and permits the operation in visible light, it is not the most appropriate material with considerable photo-induced changes.

Of particular interest for optoelectronic applications is the 1.55 μm telecommunication spectrum, where the quartz optical fibers have the best optical transmission. In this IR spectral range other amorphous materials with a lower bandwidth and considerable photo-induction are preferred. In the paper we studied surface plasmon configuration with dielectric film made of amorphous As2Se3 film. The optical constants of the films were rigorously measured by ellipsometric and spectral transmission methods. Numerical simulations were made for the BK7-Gold-As2Se3-Air structure from which the thickness of the film needed to achieve surface plasmon resonance was established. Experimental study of resonance curves was done in the infrared field. Amorphous As2Se3 films were obtained by thermal vacuum deposition. The performance of this structure was evaluated experimentally.

References

[1] M. Stafe, A. A. Popescu, D. Savastru, C. Negutu, G. Vasile, M. Mihailescu, A. Ducariu, V. Savu, D. Tenciu, S. Miclos, L. Baschir, V. V. Verlan, O. Bordian and N. N. Puscas *"Optical hysteresis in SPR structures with amorphous As_2S_3 film under low-power laser irradiation ",* J. Phys. D: Appl. Phys. **51** (2018) 125106 (9pp). https://doi.org/10.1088/1361-6463/aaa9cf

Effect of indium and tin ion implantations on the properties of $Ge_2Sb_2Te_5$ thin films

P. Lazarenko[1], A. Sitnikov[2], S. Kozyukhin[3,4], D. Seleznev[2], A. Kozlov[2], A. Yakubov[1], A. Sherchenkov[1], Yu. Vorobyov[5], O. Boytsova[3], E. Kirilenko[6], T. Kulevoy[2]

[1]*National Research University of Electronic Technology, Zelenograd, Russia,*
[2]*National Research Center "Kurchatov Institute"-ITEP, Moscow, Russia,*
[3]*Kurnakov Institute of General and Inorganic Chemistry of RAS, Moscow, Russia,*
[5]*Ryazan state radio engineering university, Ryazan, Russia,*
[6]*Nanotechnology Institute of Microelectronics of RAS, Moscow, Russia*

Corresponding author: lpi@org.miet.ru

One of the most perspective electrical and optical non-volatile memory type is phase change memory (PCM) based on the chalcogenide materials, particularly on GST225 [1]. Introduction of dopants is an effective method for purposeful change of the GST225 properties, which can be used for optimization of the characteristics of the material for PCM application. In this work, we investigated the influence of In and Sn dopants introduced by implantation on the properties of GST225 thin films. The ion implantations were carried out on Multipurpose Test Bench (MTB) at NRC "Kurchatov Institute"-ITEP. The MTB consists of the MEVVA type ion source, electrostatic focusing system, the system for the current and beam profile measurements. The beam charge spectra were measured by the time-of-flight method. The beam`s accelerating voltage was calculated by SRIM code to implant ions on the required film`s depth [3]. The composition distributions for the investigated thin films were investigated by Auger Electron and TOF-SIMS spectroscopies.

It was found that ion implantation leads to the change of the electrical properties of amorphous films in the temperature range from -120 to 100 °C, in particular, the conductivity activation energy, and also optical characteristics. Influences of the ion type and irradiation dose on the crystallization temperature range were determined. The results of the simultaneous measurements of resistivity and Raman spectra in the temperature range from 25 to 400 °C allowed to obtain additional information about the phase transitions. The transmission electron microscopy was used for the identification of the structure for thin films after annealing. Femtosecond laser pulses were used to excite the amorphous doped thin films. The effect of excitation by different energy and the number of laser pulses was investigated. The correlation between the dopant concentration and the range of laser fluence needed for crystallization was analyzed.

Acknowledgements

This work was supported by RFBR (project 18-33-20237\18).

References

[1] M. Wuttig, H. Bhaskaran, T. Taubner, Phase-change materials for non-volatile, Nature Photonics, vol. 15, pp. 465 – 476 (2017)

[2] Effect of tin ion implantation on the properties of amorphous $Ge_2Sb_2Te_5$ thin films, D.N. Seleznev et.al., Proceedings of RuPAC 2018, Protvino, Russia.

The similarity between two-dimensional magnetoexcitons and the excitons in transition metal dichalcogenides

S.A. Moskalenko[1], I.V. Podlesny[1] and I.A. Zubac[1]

[1]*Institute of Applied Physics, MD-2028 Academiei 5, Chişinău, Republic of Moldova,*

Corresponding author: zubac_ion@mail.ru

1. The exchange *e-h* Coulomb scattering takes place with the annihilation and the creation of the *e-h* pairs with the resultant electronic charges equal to zero. During the direct Coulomb scattering the electron and a hole remain in the same energy bands interacting as a charged particles. They have dipole-dipole interaction, when the interband dipole moments ρ_{c-v} are different from zero. It happens when the crystals have the dipole active optical quantum transitions. We have considered the semiconductor layers of the type *GaAs* with *s*-type