crystal structures of $YH_3(PO_4)_2$ and earlier studied $YH_3(PO_4)_2 \cdot 0,5H_2O$ [3] have much in common.

References

1. A. F. Selevich, A. S. Lyakhov, A. I. Lesnikovich. Phosphorus Res. Bull. (1999) 10 : 171.
2. A.F.Selevich, A.I. Lesnikovich. Rus. J. Inorg. Chem. (1994) 39 : 1322.
3. L.S.Ivashkevich, A.S.Lyakhov, A.F. Selevich. 7th Int. conf. on Chem. and Chem. Education «Sviridov Readings 2015»: Book of Abstr. Minsk (2015) : 22.

Chalcogenide glasses: advances in research and applications

A. Stronski
V. Lashkaryov Institute of Semiconductor Physics NAS of Ukraine, Kyiv, Ukraine, *e-mail: stronski @isp.kiev.ua*

Chalcogenide glasses and films attract much attention due to their unique combination of properties: high transparency in the IR region, photoinduced change of properties (shift of the fundamental absorption edge, solubility changes, photoamorphization-photocrystallization, etc.), quasi-stability, ion-conductivity of doped chalcogenide glasses and films which serve as a base of their numerous applications. Chalcogenide glasses (CG) are widely used in versatile technological applications such as infrared optical elements, acousto-optic and all-optical switching devices, holography recording media, etc.

In present report the recent results of studies of chalcogenides glasses (CG), films and structures on their base are reviewed. Main attention is devoted to the investigations of nanocomposites on the base of chalcogenide glasses which provide possibility of direct relief formation and applications in optical elements fabrication, holography, etc. [1–3]. Structural properties of CG and films are discussed [2,4]. Direct surface patterning of materials (in our case composite nanomultilayer (NML) structures on the base of chalcogenide glasses) by a laser or electron beam without chemical etching, attracts high interest due to advantages like high flexibility and precision, moderate cost, and high rate. Nanomultilayer CG structures are simplest artificial nanostructures that can be rather easily fabricated with controlled geometrical parameters and investigated as thin films using vacuum evaporation technique.

Holographic recording properties of different types of NML structures on the base of chalcogenide glasses were analyzed. Optical parameters for NML integrally and constituent nanolayers are discussed on the base of single-oscillator model. Scalar and vector holographic methods were exploited for explanation of diffraction efficiencies dependencies. The studying of the diffraction efficiency vs. exposure dose shows the strong dependence of η on the state of polarization of recording beams. Considerable increase of NML diffraction efficiency in comparison with CG component nanolayers has been demonstrated. The possibility of direct one-step magnetic relief formation simultaneously with surface relief formation using NML was shown. Results of gratings recording using chalcogenide NML structures show that fabrication of optical gratings with the unique combination of properties by direct laser recording on the base of chalcogenide glasses NML is possible. Such media are also perspective for the recording of digital holograms.

Experimental results on non-linear optical properties investigations and perspective of their use in all-optical switching are considered. One of the ways of increasing the rate of information transfer in the fiber-optical communication systems is the use of materials with large values of the nonlinear refractive index. Perspective in this direction is the use of chalcogenide glasses, which have many properties for the all-optical signal processing. In particular, femtosecond response times, large values of Kerr nonlinearities, compatibility with the existing fiber-optic technologies. Measurements of nonlinear refractive index have shown that it's value for chalcogenide glasses can range from 100 to 1000 times of that in silica glass. High nonlinear refractive index combined with moderate to low nonlinear absorption can be exploited in all optical signal processing devices to enhance the performance of telecommunication systems. The main problem for such application of chalcogenide glasses is their operational stability under high intensity optical fluxes.

Phase-change chalcogenide materials using photo-crystallization effect have applications in optical information recording, solid state memory cells (in this case phase change is carried out by thermal heating and different conductivity values in amorphous and polycrystalline states are used). Sensor applications of chalcogenide glasses include ion-selective membranes, displacement sensors, IR thermometry, passive elements of sensors, etc.

Reviewed investigation results concerning chalcogenide glasses show that chalcogenide glasses are perspective for applications in photonics, sensorics and information storage.

References

1. E. Achimova, A. Stronski. Functional structures based on chalcogenide glasses obtained via nanocomposite techniques and their applications, OAHOST. (2017) 3 : 28.
2. A.V. Stronski, E.F.Venger, P.F.Oleksenko, A.V.Melnichuk. Chalcogenide vitreous semiconductors, properties and their practical application, NSU, Nizhyn, 2016.
3. A. Stronski, E. Achimova, O. Paiuk [et al.].Nanoscale Research Letters (2017) 12:286.
4. K. Shportko, L. Revutska, O. Paiuk [et al.]. Optical Materials (2017) 73 : 489.