Acknowlegments

The authors acknowledge financial support by the Slovak Science Foundation, projects VEGA No.1/0238/17 and VEGA No.1/0235/18, the Czech Science Foundation, project No. 19-07456S, and by the Czech Academy of Sciences within the programme of a long-term conceptual development of research organization RVO 67985891.

Electrical and dielectric properties of glass system Sb_2O_3-$PbCl_2$-AgCl

O. Bosak[1], P. Kostka[2], D. Le Coq[3], S. Minarik[1], & M. Kubliha[1]

[1]*Faculty of Materials Science and Technology, Slovak University of Technology, Bottova 25, 917 24 Trnava, Slovakia,*
[2]*Laboratory of Inorganic Materials, joint workplace of the University of Chemistry and Technology Prague and the Institute of Rock Structure and Mechanics of the CAS, V Holešovičkách 41, 182 09 Prague 8, Czech Republic*
[3]*Université de Rennes 1, Institut des Sciences Chimiques de Rennes, Eq. Verres et Céramiques, UMR CNRS 6226, Bât. 10B - Porte 252, Campus de Beaulieu, 35042 Rennes, France*

Corresponding author: ondrej.bosak@stuba.sk

The glass system (Sb_2O_3)-$(PbCl_2)$-(AgCl) is interesting due to his potential application in the infrared part of the electromagnetic spectrum [1]. The $(Sb_2O_3)_y(PbCl_2)_{y-x}(AgCl)_x$ glasses, with y = 50 mol. % or 70 mol. %, and 5 mol. % $\leq$ x $\leq$ 25 mol. % were prepared by the melting-quenching method from high purity components. The prepared glass has a yellow to brown colour. The characteristic temperatures (*T*g and *T*x) have been determined. *T*g values decrease with the increase of AgCl content. DC and AC electrical conductivity, permittivity, and complex electrical modulus were measured in the temperature range from room temperature up to 200 °C in the frequency range between 0.2 and 10^5 Hz. Temperature dependences of the DC conductivity obey Arrhenius-like relation. The DC conductivity at constant temperature significantly increases with increasing AgCl and $PbCl_2$ content. The conduction activation energy decreases with increasing AgCl and $PbCl_2$ content from 0.98 eV up to 0.56 eV for $(Sb_2O_3)_{70}(PbCl_2)_{25}(AgCl)_5$ and $(Sb_2O_3)_{50}(PbCl_2)_{25}(AgCl)_{25}$, respectively. The influence of the composition on the AC conductivity values of glasses is similar.

Acknowlegments

The authors acknowledge financial support by the Slovak Science Foundation, projects VEGA No.1/0238/17 and VEGA No.1/0235/18, the Czech Science Foundation, project No. 19-07456S, and by the Czech Academy of Sciences within the programme of a long-term conceptual development of research organization RVO 67985891.

References

[1] D. Yezli, M. Legouera, R. El Abdi, M. Poulain, and V. Burgaud, Mechanical, thermal, and optical properties of new chloroantimonite glasses in the Sb_2O_3–$PbCl_2$ –AgCl system, Materials Science (2016)

Influence of the phase state of $Ge_2Sb_2Te_5$ thin cover on the parameters of the optical waveguide structures

V. Kovaluyk[1], P. Lazarenko[2], S. Kozyukhin[3,4], P. An[1], A. Prokhodtsov[1,5], G. Goltsman[1,5], A. Sherchenkov[2]

[1]*Moscow State Pedagogical University, Moscow, Russia*
[2]*National Research University of Electronic Technology, Zelenograd, Russia,*
[3]*Kurnakov Institute of General and Inorganic Chemistry of RAS, Moscow, Russia,*
[4]*National Research Tomsk State University, Tomsk, Russia*
[5]*National Research University Higher School of Economics, Moscow, Russia*

Corresponding author: lpi@org.miet.ru

The fast switching time of Ge-Sb-Te thin films between amorphous and crystalline states initiated by laser beam as well as significant change of their optical properties and the preservation of metastable states for tens of years open wide perspectives for the application of these materials to fully optical devices [1], including high-speed optical memory [2].

Here we study optical properties of the $Ge_2Sb_2Te_5$ (GST225) thin films integrated with on-chip silicon nitride O-ring resonator. The rib waveguide of the resonator was formed the first stage of e-beam lithography and subsequent reactive-ion etching. We used the second stage of e-beam lithography combining with lift-off method for the formation of GST225 active region on the resonator ring surface. The amorphous GST225 thin films were prepared by magnetron sputtering, and were capped by thin silicon oxide on their tops. The length of the GST225 active region varied from 0.1 to 20 μm. Crystallization of amorphous thin films was carried out at the temperature of 400 °C for 30 minutes. Auger electron spectroscopy and transmission electron microscopy were used for studying composition and structure of investigated GST225thin films, respectively.

It was observed that crystallization of amorphous GST225 film lead to a decrease of the optical power, transmitted through the waveguide. Comparison of the optical transmittance of O-ring resonators before and after the GST225 deposition allowed to identify the change in the Q-factor and the wavelength peak shift. This can be explained by the differences of the complex refractive indexes of GST225 thin films in the amorphous and crystalline states. From the measurement data, the GST225 effective refractive index was extracted depending on the ring waveguide width of the resonator for a telecommunication wavelength of 1550 nm.

References

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