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# TEMPERATURE STUDIES OF OPTICAL ABSORPTION EDGE IN $(Ag_2S)_x(As_2S_3)_{1-x}$ ($x \leq 0.2$) SUPERIONIC GLASSES

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Optical absorption edge studies of glassy $(Ag_2S)_{0.05}(As_2S_3)_{0.95}$ have revealed two temperature ranges: a range of parallel red shift of the optical absorption edge within the temperature interval $77\,K \leq T < 300\,K$ and a range of the Urbach behaviour of the absorption edge at $T \geq 300\,K$, in which the dependence of absorption coefficient on the photon energy and temperature is given by the Urbach rule. The parallel red shift of the optical absorption edge in $(Ag_2S)_{0.05}(As_2S_3)_{0.95}$ and, consequently, the temperature invariance of the Urbach energy $E_U$ are explained by the lack of medium-range order in the atomic distribution within a certain temperature range [1].

Temperature studies of the optical absorption edge in $(Ag_2S)_{0.1}(As_2S_3)_{0.9}$ and $(Ag_2S)_{0.15}(As_2S_3)_{0.85}$ glasses showed that in the temperature interval $77\,K \leq T \leq 390\,K$ a red shift of the absorption edge is observed with the temperature increase. The Urbach energy for $(Ag_2S)_{0.1}(As_2S_3)_{0.9}$ glass in the temperature interval $77\,K \leq T < 300\,K$ decreases, while at $T \geq 300\,K$ remaining unchanged; the Urbach energy for $(Ag_2S)_{0.15}(As_2S_3)_{0.85}$ glass in the temperature interval under investigation is a constant value. The non-Urbach behaviour of the optical absorption edge in $(Ag_2S)_{0.1}(As_2S_3)_{0.9}$ and $(Ag_2S)_{0.15}(As_2S_3)_{0.85}$ glasses can be explained using the formalism of separation of the contributions from static and dynamical structural disordering types. It is shown that in the temperature interval under investigation only the short-range order in the atomic arrangement $(Ag_2S)_{0.1}(As_2S_3)_{0.9}$ and $(Ag_2S)_{0.15}(As_2S_3)_{0.85}$ glasses is present. With the temperature increase, the medium-range order is gradually established, resulting in a decrease of dynamic structural disordering contribution $(E_U)_{X,dyn}$. The decrease of $(E_U)_{X,dyn}$ along with the increasing contribution of the temperature-related disordering $(E_U)_T$ at the constant contribution of static structural disordering contribution $(E_U)_{X,stat}$ results in a temperature independence of the Urbach energy $E_U$ in the $(Ag_2S)_{0.1}(As_2S_3)_{0.9}$ and $(Ag_2S)_{0.15}(As_2S_3)_{0.85}$ glasses.

[1] M. Kranjčec, I.P. Studenyak, M.V. Kurik, "On the Urbach rule in non-crystalline solids", J. Non-Cryst. Solids, vol. 355, pp. 54-57, 2009.