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Radiation-induced effects in non-crystalline GeSe(S) films

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The complex investigations in respect to make clear the physical features of localized states forming in mobility gap GeSe(S) of amorphous films, caused by high-energy electromagnetic irradiation, were carried out. The thin films under investigation (thickness near 0.3-1.2 μm) were obtained using the method of discrete evaporation of fine-dispersive mixture on surface in vacuum (10^{-4} Pa) from fresh cleave NaCl, glass-ceramics and quarts at 293-450 K.

The temperature region of GeSe(S) amorphous structure existence was determined. The peculiarities of low order of amorphous thin films in dependences of technology preparation and influences of gamma-irradiation were studied. The topology and micro-local features of disordered structure GeSe(S) films formation process were established using the method of analysis of experimental scattering curves as well as model interpretation of radial distribution function of atomic density. It was established that γ-irradiation (1.25 MeV) with dose 10^4-10^5 Gy causes the changes of electro-physical properties of GeSe amorphous films, in particular, the decrease of specific resistance and appearance of jump mechanism of conductivity on localized states near Fermi level. The gamma-irradiation of GeSe films caused low-energetic shift of their fundamental optical absorption edge and increasing of refraction index, while the energy gap and steepness of Urbach edge were decreased. It was established, the form and position of main diffusion maximum, studied by X-ray method, does not change after γ-irradiation. It was shown that crystalline processes in irradiated amorphous condensates become more denominated in comparison with non-irradiated ones. Low-energy irradiation (non-focus electron beam with energy $35 \cdot 10^3$ eV) stimulated the more ordering structure GeSe(S) films with amorphous phase conservation, because leads to increasing the mobility gap and decreasing of electro-conductivity of films. The amorphous GeS films show the stability to influence of electron irradiation. It was shown that direction of physical properties changes in GeSe(S) films can leads to disordered processes as well as to decreasing of structures defects. Radiation-induced changes of physical properties in amorphous GeSe(S) thin film are explained in the framework of radiation defect-formation processes as results of destruction-polymerization transformations.

The main topological reactions of radiation defects centres formation were proposed as well as the model of energy gap transformation under irradiation with provision for peculiarities reconstruction spectra of localized states.