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XVII МІЖНАРОДНА ФРЕЇКІВСЬКА КОНФЕРЕНЦІЯ З ФІЗИКИ І ТЕХНОЛОГІЇ ТОНКИХ ПЛІВОК ТА НАНОСИСТЕМ

Збірник тез

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Abstract book

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Structural Transformations and Optical Properties of Electon-Irradiated Glasses and Thin-Films of the As-S-Se System

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Glassy chalcogenides of arsenium are characterized by high transparency in a near and middle infrared and belong to a class of materials which are used as active or passive elements in optical engineering]. Experimental studies of the influence of radiation load (gamma radiation, X-radiation or electron radiation) enable to determine the character and change of physical properties of these materials, boundary doses of radiation, to learn the nature and mechanisms of radiational defect – formation, reveal conditions of renewing the initial parameters.

Gody et al. [1] were the first to determine experimentally the proportionality $E_g^*(T,X)$ and *(T,X)* for a- Si:H. By using the Tauc's concept of "freezed" phonons he spread the idea of the equivalency of the effect of a structural *Ws* and thermal *Wt* of disorder onto the band width E_g^* and got a linear relation between E_g^* and *W*:

$$E_g^*(T,X) = E_g^*(0,0) + D\cdot\langle W^2\rangle_0 - \frac{D}{K}W(T,X),$$

where *D* is a deformation potential, $\langle W^2\rangle_0$ – mean-square shift due to zero oscillations. According to this model the optical pseudogap E_g^*(T,X) is determined by the degree of disordering of a glass lattice which is described by $\langle W^2\rangle_S$ parameter, ie. By changing it by sources of different nature it is possible to influence the E_g^* value indirectly. Let us analyse our experimental results in the frameworks of this model. In the correlation between E_g^* and W for glassy $As_2S_3(Se_3)$ in dependence of the nature of disorder due to various external factors. This correlation shows that the optical pseudogap E_g^* and – this being more important – the slope of an exponential portion of the edge are changing in dependence of the disorder degree. A linear relation between E_g^* and W for chalcogenide glasses $As_2S_3(Se_3)$ is fulfilled practically in the whole range of the values of W energies which was studied up to this time. Thus it can be stated that in this case for these materials the contribution of the structural ("intrinsic" and induced) and the thermal contributions into a change of disorder potential is adequate, and the change of the slope probably reflects the change of the distribution of the states in the tails of zones.

Conclusions

Dose dependences of energy parameters of the intrinsic absorption edge testify to an electron-induced creation of new defects which change the disorder potential. A characteristic energy of the exponential absorption tail W(T,X) shows not only the temperature but also the structural disordering of other kinds:

a) intrinsic structural disorder of an "ideal" glass;

b) induced structural disorder due to external factors (of radiation or technological nature).

1. Gody G.D., Tiedje T., Abeles B., Brooks B., Goldstain Y. Phys. Rev. Letters **47** (1981) 1480.