6^{th} *S E M I N A R*
Properties of ferroelectric and superionic systems

Program and abstracts

6-й С Е М І Н А Р
Властивості сегнетоелектричних і суперіонних систем

Програма і тези доповідей

17 - 18. XI. 2016

Ужгород – Україна

Uzhhorod – Ukraine

12. **Optimization of the functional parameters in chalcogenide system Tl_4SnSe_3–Tl_4PbSe_3**
M. J. Filep, T. O. Malakhovska, M. Yu. Sabov, A. A. Kohutych
Uzhgorod National University, Ukraine

13. **Interaction in the $TlSbP_2Se_6$–$Tl_4P_2Se_6$($Sb_4(P_2Se_6)_3$, $TlSbSe_2$, Sb_2Se_3) systems**
V. I. Sabov[1], A. I. Pogodin[1], M. V. Potorij[2], A. M. Solomon[3], I. V. Kityk[4], M. Yu. Sabov[2]
[1]*Research Institute of Solid State Chemistry and Physics, Uzhhorod National University, Ukraine*
[2]*Department of Inorganic Chemistry, Uzhhorod National University, Ukraine*
[3]*Institute of Electron Physics, National Academy of Science, Uzhhorod, Ukraine*
[4]*Faculty of Electrical Engineering, Czestochowa University Technology, Czestochowa, Poland*

14. **Кристалохімічні особливості проміжних сполук квазіпотрійної системи Tl_2Se–In_2Se_3–"P_2Se_4"**
В. О. Товт, А. О. Федорчук, І. Є. Барчій, М. П'ясецкі, І. В. Кітик
Ужгородський національний університет, Україна
Ченстоховський технологічний університет, Польща

15. **Tricritical Lifshitz behavior in chalcogenide ferroelectrics $Sn_2P_2(Se_xS_{1-x})_6$ with random field effects**
A. Oleaga[1], V. Shvalya[1,2], A. Salazar[1], A. A. Kohutych[2], I. M. Stoika[2], Yu. M. Vysochanskii[2]
[1] *Departamento de Física Aplicada I, Universidad del País Vasco, Bilbao, Spain*
[2] *Institute for Solid State Physics and Chemistry, Uzhgorod National University, Ukraine*

16. **Critical behavior and ferroelectric properties in $Sn_2P_2S_6$ crystal doped with Ge, Sb and Te**
V. Shvalya[1,2], A. Oleaga[1], A. Salazar[1], A. A. Kohutych[2], I.M. Stoika[2], Yu.M. Vysochanskii[2]
[1] *Departamento de Física Aplicada I, Universidad del País Vasco, Bilbao, Spain*
[2] *Institute for Solid State Physics and Chemistry, Uzhgorod National University, Ukraine*

17. **Domain walls peculiarities below *lock-in* phase transition in $Sn_2P_2Se_6$ single crystals**
Sh. B. Molnar, A. O. Shpenik
Uzhgorod National University, Faculty of Human and Natural Science, Ukraine

18. **Triboelectric-piezoelectric nanogenerator based on the internal motion of ferroelectric powder**
A. Molnar[1], V. Gerasimov[2], D. Gal[1]
[1]*Department of the Physics of Semiconductors, Uzhhorod National University, Uzhhorod, Ukraine*
[2]*Faculty of Economics, Management and Engineering, Mukachevo State University, Mukachevo, Ukraine*

19. **Influence of diffusion and variation of chemical composition on the dielectric properties of $Sn_2P_2S_6$ ferroelectric crystals**
A. Molnar, A. Grabar, A. Kohutych, Yu. Vysochanskii, D. Gal, A. Sovga
Department of the Physics of Semiconductors, Uzhgorod National University, Ukraine

20. **Influence of the electron and gamma-irradiation on dielectric properties of $Sn_2P_2S_6$**
A. A. Molnar[1], H. V. Vasylyeva[2], I. I. Haysak[2], M. T. Sabolchiy[2], I. M. Stoika[1], A. A. Grabar[1]
[1]*Department of the Physics of Semiconductors, Uzhgorod National University, Ukraine*
[2]*Department of the Nuclear Physics, Uzhgorod National University, Ukraine*

21. **Heterodyne schemes of the dynamic interferometers on the base of $Sn_2P_2S_6$:Sb photorefractive crystal**
M. Tsyhyka, A. Grabar, I. Stoika
Department of the Physics of Semiconductors, Uzhgorod National University, Ukraine

22. **Energy transfer at two-wave interaction in photorefractive $Sn_2P_2S_6$: effect of the electro-optic coefficients on the gain polarization dependence**
V. V. Shepelevich[1], A. A. Grabar[2], V. N. Naunyka[1], A. V. Makarevich[1]
[1]*Mozyr State Pedagogical University named after I. P. Shamyakin, Belarus*
[2]*Uzhgorod National University, Ukraine*

23. **Structural properties of the fibers based on the chalcogenide glassy materials**
O. Kondrat[1], R. Holomb[1], A. Csik[2], M. Veres[3], I. Culeac[4], M. Iovu[4], V. Mitsa[1]
[1]*Uzhhorod National University, Ukraine*
[2]*Institute for Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary*
[3]*Wigner Research Centre for Physics, Hungarian Academy of Sciences, Budapest, Hungary*
[4]*Institute of the Applied Physics of the Academy of Sciences of Moldova*

24. **Structural disorder and optical properties of electon-irradiated $As_2S_3(Se_3)$ chalcogenide glasses**
A. I. Shpak, I. I. Shpak
Uzhgorod National University, Ukraine

STRUCTURAL DISORDER AND OPTICAL PROPERTIES OF ELECTON-IRRADIATED $As_2S_3(Se_3)$ CHALCOGENIDE GLASSES

A. I. Shpak, I. I Shpak

Uzhgorod National University, 46 Pidhirna Str, 88000 Uzhgorod, Ukraine

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.

The samples radiation was carried out in usual conditions at room temperature with electrons of an average energy ~ 0.6 MeV; the radiation sourse was SrY-16 of 12,2 Curi activity and the flux density 10^7 electrons/(sm^2.s). The absorbed dose was calculated starting with the expositional dose and the radiation time in a definite point of the source channel. The absorbed dose value was choosed according to a well-known results of dose dependences of radiationally-induced effects in glassy chalcogenide glasses of As_2S_3 type.

Gody et al. [1] were the first to determine experimentally the proportionality $E_g^*(T,X)$ and $W\ (T,X)$ for a- Si:H, which was realized in the whole range of W values studied till now. 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 analyze our experimental results in the frameworks of this model. In Fig.1 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.

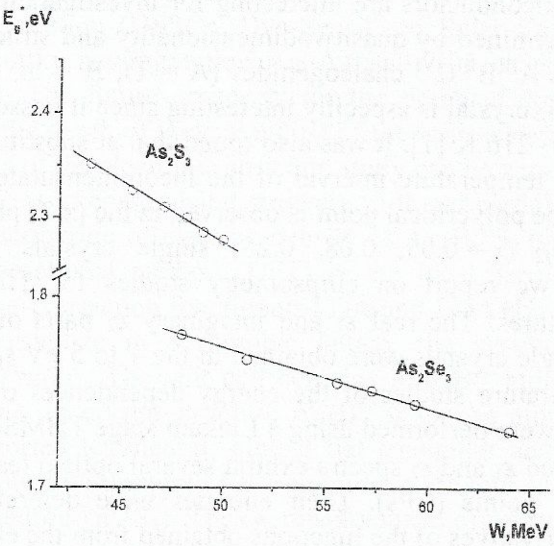

Fig.1. The dependence of optical pseudogap E_g^* on the slope of the exponencial Urbach tail *W*.

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.