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Bakı, Azərbaycan

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**INFLUENCE OF POLARIZATION ON EXCITON ABSORPTION  
SPECTRA OF TlInS<sub>2</sub> SINGLE CRYSTALS**

**MUSTAFAEVA S.N., GASANOV N.Z., KERIMOVA E.M.,  
AKHMEDOVA G.M., ABDINBEKOV S.S.**

*Institute of Physics, National Academy of Sciences of Azerbaijan  
Az.-1143, Baku, G. Javid av.33*

*E-mail: ekerimova@physics.ab.az*

Absorption spectra dependences of TlInS<sub>2</sub> single crystals on polarization angle have been investigated. Obtained polarization dependences of TlInS<sub>2</sub> at 5 and 10K show that observed close to fundamental absorption edge exciton lines are partially polarized.

Ternary layered semiconductor crystals TlInS<sub>2</sub> have been a subject for numerous studies [1-6]. Materials of this class have been actively investigated to reveal the features of the set phase transitions that control electrical and optical processes [3, 4, 6].

TlInS<sub>2</sub> single crystal is found to be remarkable in the fact of the existence of an exciton spectrum [1, 3, 6]. In [1] exciton absorption spectra of TlInS<sub>2</sub> have been investigated at T=5÷200K. The coefficient of temperature shift of exciton peak in TlInS<sub>2</sub> was equal:  $\partial E^{ex}/\partial T = -2.8 \cdot 10^{-4}$  eV/K at 20≤T≤60K and  $-5.8 \cdot 10^{-4}$  eV/K at 60≤T≤200K.

Near band edge optical absorption was investigated in TlInS<sub>2</sub> over the temperature region 20-300K [3]. In TlInS<sub>2</sub> the temperature dependence of the exciton energy is certainly mirrors the successive phase transitions taking place in the material and the description in terms of incommensurate phase transition is quite relevant to this case. Exciton structures in TlInS<sub>2</sub> were investigated also in [6] at 200-216K.

Of some interest is the study of influence of polarization on exciton absorption spectra of TlInS<sub>2</sub> single crystals. This is the aim of the given paper.

We grow single crystals TlInS<sub>2</sub> belonging to the class of laminated wide-band semiconductors by Bridgeman-Stockbarger method. X-ray analysis showed that TlInS<sub>2</sub> is crystallized in monoclinic syngony with elementary cell parameters  $a=7.76\text{Å}$ ;  $b=7.76\text{Å}$ ;  $c=50.01\text{Å}$ ;  $\beta=90.10^\circ$ .

Measurements of absorption spectra of single crystals TlInS<sub>2</sub> are carried out over the temperature range 5÷50K.

Polarized light flow under the investigation of absorption spectra is led perpendicularly to the natural layer of crystal containing axis "b" of second order. On absorption spectra of single crystal TlInS<sub>2</sub> close to intrinsic absorption edge there have been observed distinct absorption band related to transitions into direct exciton state and having negative temperature coefficient. At 5≤T≤50 K  $\partial E^{ex}/\partial T = -2.8 \cdot 10^{-4}$  eV/K. Along with the main exciton band there have been observed the second band corresponding to n=2 that enables bond energy of excitons in TlInS<sub>2</sub> to be determined. For non-polarized light bond energy of exciton is 23meV at 5K. Using bond energy value we determine band gap: at 5K  $E_g = 2.5865$ eV, at 50K  $E_g = 2.5681$ eV.

For studies of polarization peculiarities there have been carried out investigation of absorption spectrum dependence of TlInS<sub>2</sub> on polarization angle  $\varphi$  ( $\varphi$  is angle between electric vector  $\vec{E}$  of incident light and axis "b"). Obtained polarization dependences of absorption spectra of TlInS<sub>2</sub> at 5 and 10K (Figure, curves 1-6) show that observed close to fundamental absorption edge exciton lines are partially polarized. Obtained results are given in As it is shown from Table, bond energies of exciton with the increase of polarization angle from 0° up to 90° are decreased as at 5K as at 10K.

Table Exciton characteristics of TlInS<sub>2</sub> single crystal

T, K	E <sup>ex</sup> , eV (n=1)			E <sup>ex</sup> , eV (n=2)			bond energy of exciton E <sub>b</sub> <sup>ex</sup> , meV		
	φ=0°	φ=45°	φ=90°	φ=0°	φ=45°	φ=90°	φ=0°	φ=45°	φ=90°
5	2.5641	2.5650	2.5611	2.5813	2.5819	2.5779	23	22.5	22
10	2.5631	2.5662	2.5670	2.5803	2.5833	2.5819	23	22.8	20

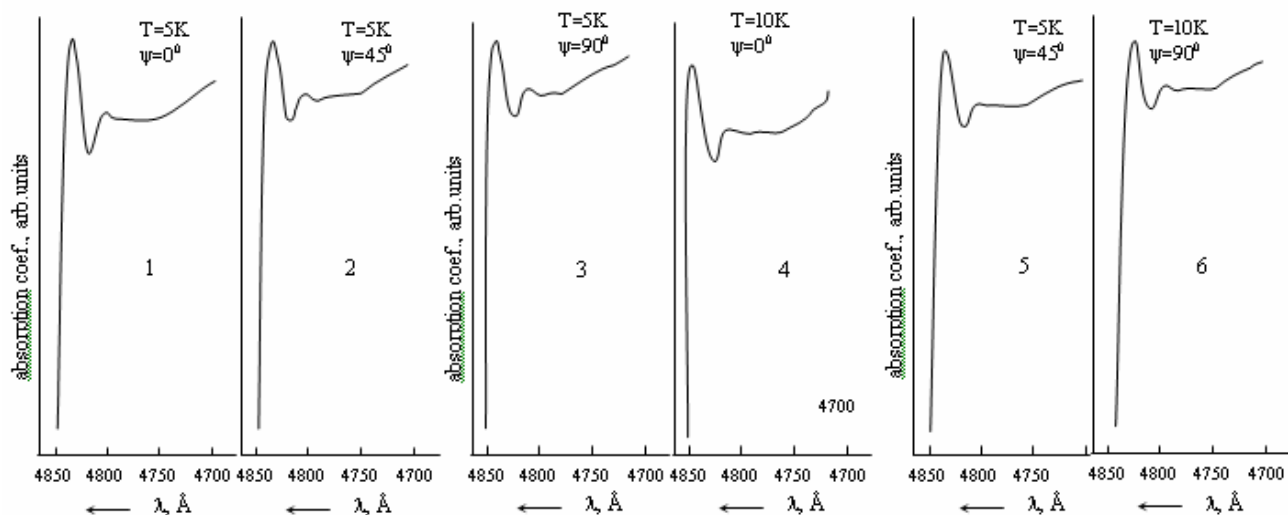


Fig. Polarization dependences of absorption spectra of TlInS<sub>2</sub> at 5 (curves 1-3) and 10K (curves 4-6). Curves 1 and 4 correspond to φ=0°; 2 and 5 – to φ=45°, 3 and 6 – to φ=90°.

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