

Structure and Dielectric Properties of Glasses and Nanocomposites in $\text{As}_2\text{Se}_3\text{--SbSI}$ System

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Chalcohalogenide glasses on the basis of ferroelectrics SbSI which are the well-known ferroelectric-semiconductors, are of considerable interest.

In the present report the results of investigation of the structure and dielectric properties of $(\text{As}_2\text{Se}_3)_{100-x}(\text{SbSI})_x$ glasses ($x=10\text{--}70$) and their change during the heat treatment are given.

Glassy alloys were prepared by vacuum melting method in quartz ampules. The homogenization temperatures and melting times were 780-850 K and 36-48 hours, respectively. The process of melts cooling was carried out in ice water.

Dielectric permittivity ε and tangent of dielectric loss angle $\text{tg}\delta$ of glasses were measured at the frequency of 1 MHz in the range of temperature 300-550 K and the heating rate 10 K/min. The parameter of ε was obtained within the accuracy of $\pm 3\%$, $\text{tg}\delta$ – of $\pm 10\%$.

Investigations of X-ray powder diffraction patterns for glassy, crystallized and crystalline materials were carried out on DRON-3 X-ray apparatus ($\lambda=1,5418 \text{ \AA}$). It was established that in the studied glasses in conditions of

continuous heating prevails the mechanism of crystallization with the separation of SbSI stable phase in the range of $T_g\text{--}T_c$ (T_g and T_c are the glass-forming and crystallization temperatures). Formations in the glass matrix upon heating the nanocrystals of SbSI and their growth are accompanied by anomalies on the temperature dependences of ε (Fig.1). Glass crystallization is also accompanied by a sharp increase of dielectric parameters.

The influence of annealing times and temperatures on the structure and the dielectric properties of $(\text{As}_2\text{Se}_3)_{100-x}(\text{SbSI})_x$ glasses are studied.

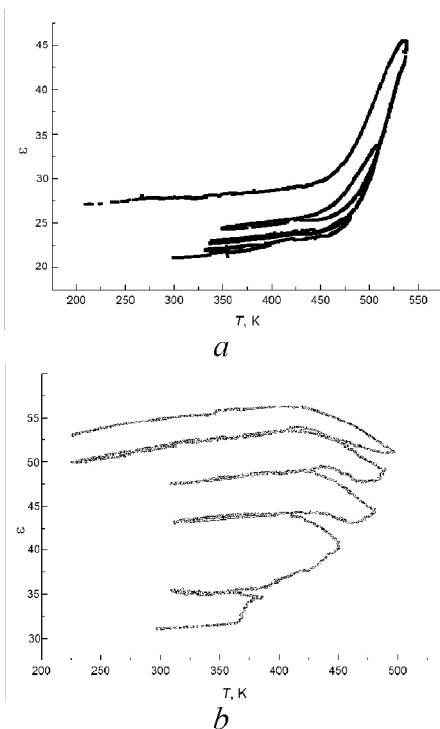


Fig.1 Temperature dependences of ε for $(\text{As}_2\text{Se}_3)_{30}(\text{SbSI})_{70}$ (a) and $(\text{As}_2\text{Se}_3)_{50}(\text{SbSI})_{50}$ (b) glasses measured in continuous regime