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EFFECTS OF HIGH PRESSURES AND MAGNETIC FIELDS ON ELECTRIC PROPERTIES OF THE $(PbSe)_x(AgAsSe_2)_{1-x}$ (x = 0.5, 0.9) CHALCOGENIDES

One of the areas of research at the department of low-temperature physics of IEN UrFU is the study of properties of multi-component chalcogenides under extreme exposures. This article is devoted to the effect of high pressure on the electrical properties of the $(PbSe)_x(AgAsSe_2)_{1-x}$ (x = 0.5, 0.9) samples, which are ferroelectrics at normal pressure. Tests were carried out at the temperature of 300 K, pressures up to 48 GPa, the frequencies of 1–200 kHz, magnetic fields up to 1 T.

According to the X-ray structural analysis, the synthesized materials are mixtures of two phases, i.e. PbSe and $AgAsSe_2$. For generation of pressures up to 48 GPa, high-pressure chamber was used with anvils of the «rounded cone–plane» made of polycrystalline diamond «carbonado». Electrical properties of the samples were studied by means of measuring impedance-analyzer RLC-2010.

The studies identified regions of significant changes in the electrical properties of materials under high pressure, possible related to the existence of phase transitions in the samples.

Comparisons were made of the regions of significant changes of the electrical properties of the materials studied with other samples from the system $(PbSe)_x(AgAsSe_2)_{1-x}$.

As a result, the following conclusions are made:

In compounds $(PbSe)_x(AgAsSe_2)_{1-x}$ (x = 0.5, 0.9), there exist phase transitions at pressures of 24–26 GPa for x = 0.5 and 16–18 GPa for x = 0.9, respectively. As compared with the single phase $AgGeAsSe_3$ sample, the region of the phase transition is shifted to lower pressures (for $(PbSe)_{0.5}(AgAsSe_2)_{0.5}$). The increase in the share of PbSe phase reduces the pressure of the existence of the phase transition.

Keywords: high pressure, ferroelectrics, magnetic field, impedance spectroscopy

Fig. 1. Baric dependences of the relative change of resistance of $(PbSe)_x(AgAsSe_2)_{1-x}$ with x = 0.5 (*а*) and x = 0.9 (*б*) on *dc*: ♦ – under loading, △ – after unloading

Fig. 2. Baric dependences of the relative change of resistance of $(PbSe)_x(AgAsSe_2)_{1-x}$ (x = 0.9) at varied magnetic field H, T: □ – 0, ○ – 0.5, + – 1

Fig. 3. Magnetic field dependences of resistance of $(PbSe)_x(AgAsSe_2)_{1-x}$ (x = 0.9) at varied pressure P, GPa: ♦ – 17, □ – 18.6, △ – 21.1, ◇ – 24.7, • – 37

Fig. 4. Baric dependences of the relative change of resistance of $(PbSe)_x(AgAsSe_2)_{1-x}$ (x = 0.5) at varied magnetic field H, T: □ – 0, ■ – 0.5, △ – 1; frequency 200 kHz