DEPENDENCE OF DIELECTRIC PROPERTIES OF SbSI ON TEMPERATURE AND ON HYDROSTATIC PRESSURE

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The dielectric properties of ferroelectric SbSI at atmospheric pressure have previously been investigated in [1-3]. It was shown in [4] and later also in [5, 6] that, at atmospheric pressure, a low-temperature phase transition of the second order takes place in SbSI at T = −40°C, in addition to the ferroelectric phase transition of the first order which takes place at T = +20°C.

We undertook to study the influence of hydrostatic pressure on dielectric properties of SbSI. Of special interest to us was the investigation of the influence of the pressure on dielectric properties of SbSI near the temperature T = −40°C.

The measurements were made in a high-pressure apparatus equipped with a high-pressure chamber whose temperature could be controlled thermostatically. The SbSI single crystals grown from the gaseous phase were investigated. Silver electrodes were fastened onto the ends of the needles and the measurements were made along the c axis. The spontaneous polarization was measured at a frequency of 50 Hz in a field of 2.5 kV/cm. The dielectric permeability was measured with a RFT-1007 bridge at a frequency of 1 kHz in a weak alternating electric field.

From Fig. 1, which shows the isotherms for the dielectric permeability, it can be seen that with increasing pressure the ε near the phase transition decreases. Its relative change at the maximum at a pressure of 1500 atm is ∼10%. A further increase in the pressure does not result in significant changes in the value of ε. The decrease in dielectric permeability with increasing pressure near the phase transition is associated with the domain structure of the crystal [7]. The significant decrease in the influence of the pressure on ε within the pressure region in excess of 1400 atm is apparently associated with the presence in SbSI of a low-temperature phase transition. Figure 1 also shows the dependences of 1/ε on p(1′−4′), from which it can be seen that in the paraelectric phase the dielectric permeability, being a function of the pressure, follows a law which is similar to the Curie-Weiss law with constant p_0 and C*. As can be seen from Fig. 1, two pressure regions exist in the paraelectric phase in which the dependence of 1/ε on p is linear, and, therefore, the Curie-Weiss law is being fulfilled. However, the respective values for C* and p_0 for these two regions differ somewhat. Upon a decrease in temperature, both of these pressure regions decrease.

Figure 2 shows that increasing the pressure leads to a displacement of the $P_s(T)$ dependence along the temperature axis. The linear displacement of $P_s(T)$ is associated with the displacement of the Curie point with an increase in pressure [8].

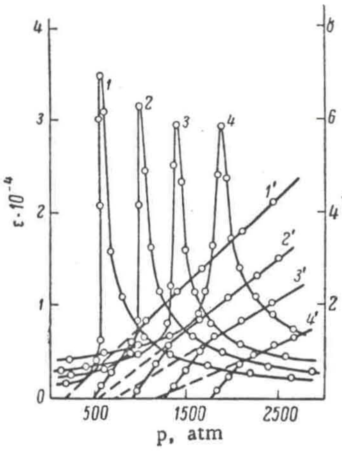

Fig. 1. Pressure dependence of the dielectric constant of SbSI single crystals, measured along the c axis, upon a change in temperature. T, °K: 1) 271; 2) 254; 3) 239; 4) 220.