Seleno ir švino priemaišų įtaka $Sn_2P_2S_6$ kristalų dielektrinėms ir feroelektrinėms savybėms

Influence of selenium and lead impurities on dielectric and ferroelectric properties of $Sn_2P_2S_6$ crystals

Ilona Zamaraitė[1], Andrius Džiaugys[1], Yulian Vysochanskii[2], Jūras Banys[1]
[1]Vilniaus universitetas, Fizikos fakultetas, Saulėtekio al. 9, LT-10222 Vilnius
[2]Institute of Solid State Physics and Chemistry of Uzhgorod University, Užgorodas, Ukraina
ilona.zamaraite@ff.vu.lt

$Sn_2P_2S_6$ (SPS) crystal is ferroelectric-semiconductor exhibiting photorefractive, photovoltaic properties and strong piezoelectric effect [1]. This crystal attracts special attention, since it is considered as a promising material for a variety of applications.

At substitution of sulfur by selenium, in $Sn_2P_2Se_6$ (SPSe) compound, phase transition temperature decreases. At the same time, incomenssurate phase arises [2]. The substitution of tin by lead atoms in the cation sublattice of SPS also leads to a decrease of the phase transition temperature [3]. The replacement of S by Se or Sn by Pb could effectively change dielectric and ferroelectric properties of crystals. In this contribution, we present the effect of the Pb and Se on the dielectric, pyro- and ferroelectric properties of $Pb_{2y}Sn_{2(1-y)}P_2(Se_xS_{1-x})_6$ system.

$Pb_{2y}Sn_{2(1-y)}P_2(Se_xS_{1-x})_6$ system crystals were grown by vapour transport technique. In order to obtain a good electrical contact silver paste was painted on the top and bottom surfaces of the crystals. The measurements of dielectric permittivity were carried out using a LCR meter HP4284A, which operates in the frequency range from 20 Hz to 1 MHz. The measurements were performed on cooling. The cooling rate was 1 K/min. The samples were cooled using the liquid nitrogen. The pyrocurrent and ferroelectric hysteresis loops have been investigated by TF Analyzer 2000 aixACCT.

In summary, he phase transition temperature decreases with the increase in the tin or lead concentration in the $(Pb_ySn_{1-y})_2P_2(Se_xS_{1-x})_6$ system. With increasing concentration of the tin or lead the coercive field increases.

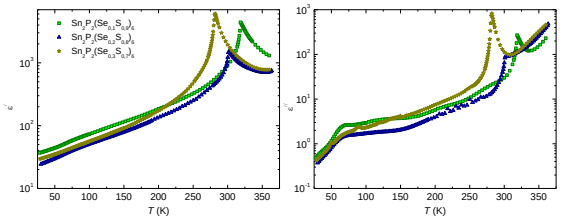

Fig. 1. Temperature dependences of the real and imaginary part of dielectric permitivity of $Sn_2P_2(Se_xS_{1-x})_6$ for concentrations x=0.1; 0.2; 0.3.

Keywords: phosphorous chalcogenide, dielectric spectroscopy, ferroelectric.

References

[1] Y. Vysochanskii, M. Medulych, A. Molnar, K. Glukhov, A. Dziaugys, J. Banys, R. Yevych, and M. Maior, Ferroelectrics **462**, 117 (2014).
[2] R. Yevych and Y. M. Vysochanskii, Condens. Matter Phys. **9**, 681 (2006).
[3] K. Rushchanskii, R. Bilanych, A. Molnar, R. Yevych, A. Kohutych, S. Perechinskii., V. Samulionis, J. Banys and Yu. Vysochanskii, Phys. Status Solidi B **253**, 384 (2016).