$Ag_{0.92}Li_{0.08}NbO_3$ keramikos dielektrinė ir IR spektroskopija

DIELECTRIC INVESTIGATIONS AND PHONONIC MODE DYNAMICS OF AG0.92LI0.08NBO3 CERAMICS

Edita Palaimiene[1], Jan Macutkevic[1], Juras Banys[1], Irena Gruszka[2], Janusz Koperski[2], Antoni Kania[2]
[1] Institute of Applied Electrodynamics and Telecommunications, Vilnius University, LT-10257 Vilnius, Lithuania
[2]Institute of Physics, University of Silesia in Katowice, Ul. 75 Pułku Piechoty 1, PL-41-500, Chorz´ow, Poland

edita.palaimiene@ff.vu.lt

The substitution of Ag by Li ions in mixed $A1_{1-x}Li_xNbO_3$ (ALN) is commonly accepted method to improve ferroelectric and piezoelectric properties of materials, particularly huge piezoelectric properties of $Ag1_{1-x}Li_xNbO_3$ are observed close to the morphotropic boundary (MPB) (i. e. for x=0.065) [1]. The dielectric properties of ALN were investigated mainly at low frequencies (i. e. below 1 MHz) [2].

The aim of the work is to investigate phase transition dynamics and electrical properties of $Ag_{0.92}Li_{0.08}NbO_3$ (ALN8) ceramics via broadband (20 Hz – 750 THz) spectroscopy.

IR reflectivity spectra of ALN8 ceramics measured at different temperatures are presented in Fig. 1.

The dielectric spectra of ALN8 ceramics mainly are impacted by the electrical conductivity at higher temperatures (above 500 K) and low frequencies (below 1 MHz) and the contribution of the soft mode, which frequency is below 50 cm-1. The electrical conductivity has two anomalies close to antiferroelectric and ferroelectric phase transition temperatures, respectively. The most pronounced decrease of the activation energy is observed close to the ferroelectric phase transition temperature. The values of activation energies are typical for oxygen vacancies transport. All phononic modes are slightly temperature dependent confirm the influence of Ag and O ions dynamics on the phase transitions. However, the most important contribution to phase transition dynamics appears due to Nb ions.

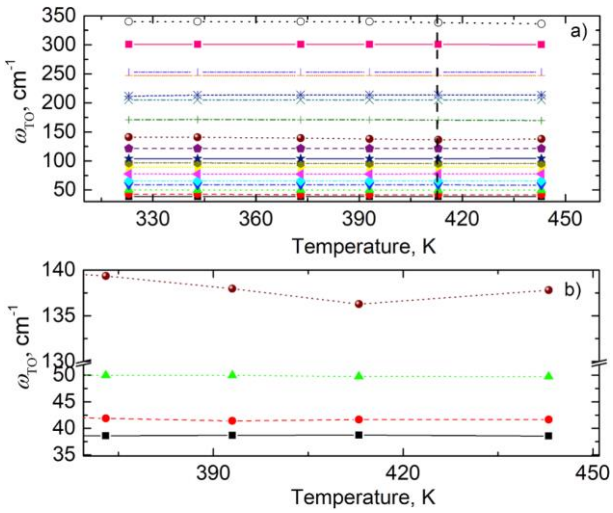

FIGURE 1. Temperature dependences of polar phonon frequencies of ALN8 ceramics.

Keywords: dielectric, activation energy, phononic modes.

References

[1] D. Fu, M. Endo, H. Tsniguchi, T. Taniyama, S. Koshihara, M. Itoh, Appl. Phys. Lett. 92, 172905 (2008).
[2] A. Kania, S. Miga, Materials Science and Engineering B 86, 128-133 (2001).