

Nanocomposites and nanomaterials Impedance spectroscopy of multiphase

lithium germano-germanates

O.O.Nesterov, M.P.Trubitsyn, S.M.Plyaka, M.D.Volnianskii

*Solid state physics and optoelectronics dept, Oles' Honchar Dnipropetrovsk National University, prosp. Gagarina 72, Dnipro, 49010, Ukraine.
E-mail: trubitsyn_m@ua.fm*

Glasses of $\text{Li}_2\text{O}-x(\text{GeO}_2)$ ($x=2.7, 7, 11.5, 18$) compositions were heat treated to nano- and microcrystalline states. It was shown that nanocrystalline state is characterized by increased electrical conductivity as compared with amorphous phase and microcrystalline state [1,2]. The mechanism of charge transfer in multiphase $\text{Li}_2\text{O}-x(\text{GeO}_2)$ samples was investigated by complex impedance spectroscopy. It was shown that hodographs for nanocrystalline compound with lithium heptagermanate stoichiometry $x=7$ consisted of two arcs whereas for composition with $x=11.5$ there were only single arcs (Fig.1).

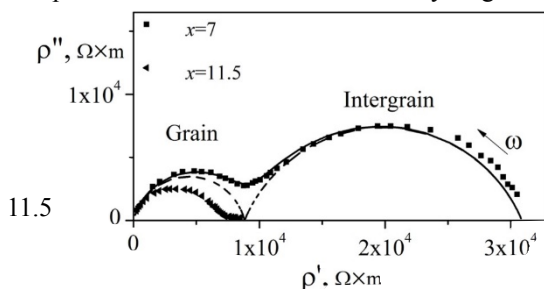


Fig.1. Comparison of the impedance spectra for nanocrystalline phase of $x=7$, compounds. $T=600\text{ K}$

This discrepancy reflects different Li ions distribution in nanocrystalline states of the compositions studied. It was concluded that high frequency arcs in the hodographs ($x=7$ and 11.5) can be attributed to Li ions hopping within ordered phases nuclei. Low frequency arc, visible only in the hodograph for $x=7$ composition, corresponds to charge transfer within amorphous inter-nuclei medium.

1. Volnianskii M., Nesterov O., Trubitsyn M. Devitrification of the $\text{Li}_2\text{O}-x(\text{GeO}_2)$ glass // *Ferroelectrics*.- 2014.- **462**.- P. 126-130.
2. Nesterov O., Trubitsyn M., Volnyanskii D. Metastable state of the $\text{Li}_2\text{O}-11.5\text{GeO}_2$ glass-ceramics with a high electrical conductivity // *Phys. of the Solid State*.- 2015.- **57**.- P.683–688.