

Ionic Conductance in Multiphase Lithium-Germanium Oxides

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Electrical properties of amorphous, nano- and microcrystalline phases of the $\text{Li}_2\text{O}-x(\text{GeO}_2)$ ($x=2.7, 7, 11.5$ and 18) compounds were studied. It was shown that on heating $\text{Li}_2\text{O}-x(\text{GeO}_2)$ amorphous phases crystallize in several stages through intermediate nanocrystalline state with high electroconductivity σ [1, 2]. Mechanism of charge transfer in amorphous and multiphase $\text{Li}_2\text{O}-x(\text{GeO}_2)$ compounds was investigated by spectroscopy of complex impedance $\rho^*(\omega)$ (Fig.1) [3].

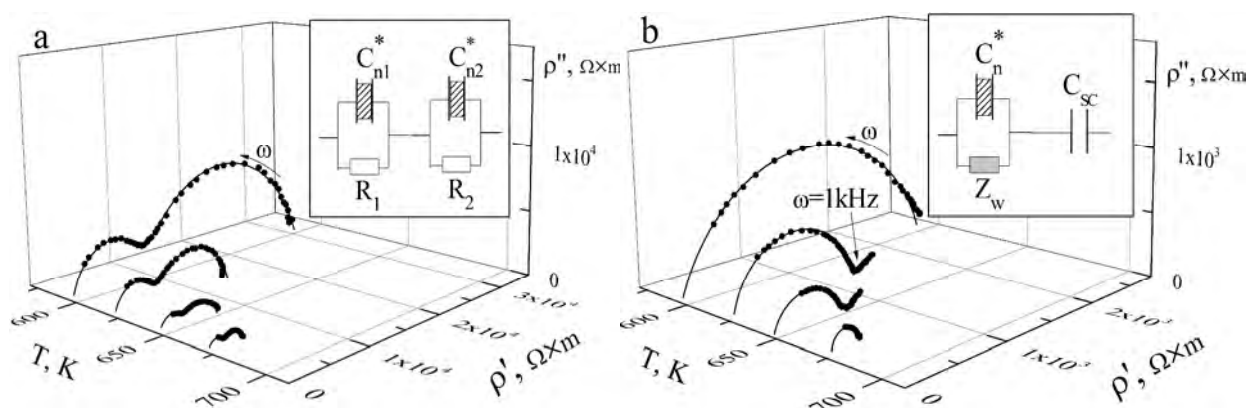


Fig.1. Hodographs ($\rho'-\rho''$) for intermediate nanocrystalline phases of $\text{Li}_2\text{O}-x(\text{GeO}_2)$, $x=7$ (a) and $x=11.5$ (b). Circles represent experimental data, solid lines were calculated by using equivalent circuits approach (see the insets).

It was shown that high conductivity of the intermediate state was the result of Li ions high mobility which caused by nanometer size of crystalline nuclei. On subsequent thermal treating the nuclei size increased to micrometer range that led to sharp decrease of carrier mobility and conductivity. It was demonstrated that creating nano-dispersed media can be an effective approach to increase ionic conductance in dielectrics.

- [1] M. Volnyanskii, O. Nesterov, M. Trubitsyn, Devitrification of the $\text{Li}_2\text{O}-x(\text{GeO}_2)$ glass, *Ferroelectrics* **462** (2014) 126-130.
- [2] O. Nesterov, M. Trubitsyn, D. Volnyanskii, 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* **57** (2015) 683-688.
- [3] O. Nesterov, M. Trubitsyn, S. Plyaka, D. Volnyanskii, Spectra of complex impedance of $\text{Li}_2\text{O}-11.5\text{GeO}_2$ glass and glass ceramics, *Phys. of the Solid State* **57** (2015) 1715-1719.