Ionic Conductance in Multiphase Lithium-Germanium Oxides

O.O. Nesterov\textsuperscript{1}, M.P. Trubitsyn\textsuperscript{1}, S.G. Nedilko\textsuperscript{2}, M.D. Volnianskii\textsuperscript{1}, S.M. Plyaka\textsuperscript{1}, Ya.O. Rybak\textsuperscript{2}

\textsuperscript{1}Solid state physics and optoelectronics dept., Oles’ Honchar Dnipropetrovsk National University, 72 prosp. Gagarina, 49010 Dnipro, Ukraine

\textsuperscript{2}Faculty of Physics, Taras Shevchenko National University of Kyiv, 4 Acad. Glushkov Ave., 01360 Kyiv, Ukraine

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

![Hodographs (\(\rho^\prime-\rho^\prime\prime\)) for intermediate nanocrystalline phases of Li\textsubscript{2}O-x(GeO\textsubscript{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).](image)

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.