

Polarization of Glass with Positive and Negative Charge Carriers

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Abstract : Polarization of glass, often referred to as thermal poling, is a well-known method to modify the glass physical and chemical properties, that manifest themselves in losing central symmetry of the medium, glass structure and refractive index modification. The usage of the poling for second optical harmonic generation, fabrication of optical waveguides and electrooptic modulators was also reported. Nevertheless, the detailed description of the poling of glasses, containing multiple charge carriers is still under discussion. In particular, the role of possible migration of electrons in the space charge formation usually remains out of the question. In this work, we performed the numerical simulation of thermal poling of a silicate glass, containing Na, K, Mg, and Ca. We took into consideration the contribution of electrons in the polarization process. The possible explanation of migration of electrons can be the break of non-bridging oxygen bonds. It was found, that the modeled depth of the space charge region is about 10 times higher if the migration of the negative charges is taken under consideration. The simulated profiles of cations, participating in the polarization process, are in a good agreement with the experimental data, obtained by glow discharge spectroscopy.

Keywords : glass poling, charge transport, modeling, concentration profiles

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