Study of the amorphous phase separation of sodium borosilicate glasses by impedance spectroscopy

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Abstract

In this work, the electrical properties of SiO2-B2O3-Na2O (SBN) oxide glasses have been characterized as a function of the temperature and composition. For low sodium content, these materials may undergo amorphous phase separation (APS) that can be thermally activated on the virgin glass above the glass transition temperature (Tg).
More precisely, we will study several compositions in the APS region of the SBN phase diagram. The goal is to achieve different type of APS (spinodal or nucleation/growth phase separations) modifying the composition and/or the heat treatment. Our main characterization technique will be impedance spectroscopy (IS) as function of the temperature and the frequency. Indeed, the analysis and interpretation of the electrical response of the samples (Nyquist plot, electrical modulus, ...) is likely to highlight APS phenomena in these glasses, even at really short distance scales.

We will conduct IS *ex* situ measurements on already phase separated samples, as well as *in situ* experiments on virgin glasses at constant temperature during from hours to days in order to follow the kinetic of phase separation as a function of temperature.
Additionally to IS, we will characterize our samples by X-Ray Diffraction (XRD - to ensure there is no crystallization during heat treatments), Scanning Electron Microscopy (SEM), and Differential Scanning Calorimetry (DSC).

Keywords: Amorphous phase separation, sodium borosilicate glass, impedance spectroscopy, temperature

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