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ENHANCED STABILITY OF SODA LIME BORATE GLASSES AGAINST CRYSTALLIZATION BY REDUCTION OF THE FICTIVE TEMPERATURE

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In this paper we report our recent findings regarding correlations among composition, structure, fragility, fictive temperature, and stability against crystallization for a series of bioactive soda lime borate liquids with various $[Na_2O]/[B_2O_3]$ ratios. We have characterized glass stability against crystallization using differential scanning calorimetry (DSC) and x-ray diffraction (XRD). The results show that the glass stability against the crystallization decreases with increasing $[Na_2O]/[B_2O_3]$ ratio and that there is no direct link between the kinetic fragility and the glass stability. Interestingly, we have found a fictive temperature dependence of the glass stability for some of the glass compositions under study. For example, the two glasses containing 20 and 25 Na_2O mol% do not exhibit crystallization exotherms during the second DSC upscan at 10 and 20 K/min after prior slow cooling (e.g. 10 and 20 K/min) during glass formation, but they do after prior fast quenching (up to 10^5 K/min). This means that the stability of these glass compositions can be enhanced by decreasing the cooling rate during glass formation, i.e., lowering the fictive temperature of the glass. The origin of the enhancement is attributed to the temperature dependence of boron speciation.