
Mechanical Characteristics of Aluminosilicate Glasses With Various Thermal Histories

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Abstract

As glasses are thermodynamically non-equilibrated states of matter, their physical properties do not only depend on their chemical composition, but also on the specific conditions present during processing. In particular, the cooling process from the liquid phase to the solidified glassy state is controlling the degree of relaxation which can happen, before internal relaxation times become larger than the cooling rates imposed by the process conditions. The resulting, frozen-in structure of the glass is therefore tied to the cooling conditions experienced in the glass transition region, even at temperatures way below the glass transition. Here we report on the cooling rate dependence of physical properties of aluminosilicate glass with same chemical composition but varying thermal histories. For that, homogeneous glass samples were heat treated and cooled with rates varying over a range of ~ 7 orders of magnitude. The resulting glasses show clear property changes as a result of the imposed treatment conditions, with frozen-in structures corresponding to equilibrium states from $\sim 0.9 T_g$ to $1.15 T_g$.

Keywords: mechanical, cooling rate, thermal history, indentation, aluminosilicate, glass

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