Intermediate-Range Order and vibrational dynamics in Permanently Densified B2O3 Glasses

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Large-sized densified boron oxide glasses and crystal were fabricated at high pressure (up to 5 GPa) and high temperatures (so-called hot compression).
Information about the structure and the vibration dynamics of these systems have been obtained from elastic and inelastic neutron measurements. Densification gives rise to a reduction in the length scale of the intermediate range order (IRO). The vibrational density of states also shows important changes when the density increases, with the gradual suppression of the glass-specific excess of vibrational states.
Our results are consistent with the hypothesis that the intermediate range order in glasses is related to the periodicity of the boundaries of voids in a random network of basic structural units. The compaction results in a reduction of the volume of these voids and of the distortion of buckled sites in the voids. We discuss the difference observed in the excess of vibrational states in relation to the changes of the void puckering frequency induced by the densification.