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Abstract:

Hot isostatic compression can be used as a post treatment method to tune the properties of glass materials as well as to obtain improved understanding of the pressure-induced structural changes and densification mechanisms, e.g., during sharp contact loading. Here, we review the pressure-induced changes in density, structure, and indentation behavior of a range of oxide glasses, including silicates, borates, and phosphates. The effect of compression on the structure is analyzed through both Raman and NMR spectroscopy, while the mechanical properties are investigated using Vickers micro-indentation. The magnitude of the changes in all macroscopic properties (e.g., density, hardness, and crack resistance) is found to correlate well with the magnitude and type of structural change induced by hot compression. We show that the structural changes depend largely on the type of network former, the coordination number distribution of network formers, the number of non-bridging oxygens, and the packing efficiency in the glasses.