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Structure of multi-component oxide glasses under static and shock compression

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The structures of multi-component oxide glasses (quaternary and beyond) under both static and dynamic compression have not been well understood as most of the previous studies focused on the pressure-induced bonding transition in rather simple model melts (e.g., from single-component, to ternary) that are subjected to less inhomogeneous broadening. Recent advances in element-specific experimental probe of local structures including non-resonant synchrotron inelastic x-ray scattering (IXS) and multi-dimensional solid-state NMR unveil previously unknown structural details of the structural changes in the diverse multi-component oxide glasses under static and dynamic compression. Here, we provide an overview of the recent progress and insights by IXS and NMR into electronic structures of oxide glasses at high pressure. Contrary to an expected complexity in densification for multi-component oxide glasses, experimental results for multi-component amorphous oxide at high pressure demonstrate that the pressure-induced changes in melt structures show a simplicity where the effect composition can be somewhat predicted and quantified [1, 2]. The pronounced simplicity in the melt-densification provides useful atomistic link between the macroscopic properties and the nature of changes in the melt structure at high pressures, such as those deep within the magma ocean [3].

[1] Lee, Proc. Nat. Aca. Sci. (2011), 108, 6847; Sol. St. NMR. (2010), 38, 45

[2] Lee, Park, Kim, Tschauner, Asimow, Bai, Xiao, & Chow, Geophys. Res. Letts. (2012) 39 5306

[2] Lee, Mosenfelder, Park, Asimow (2013) in preparation