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Neutron Diffraction of Materials at Extreme Conditions on GLAD: Applications to Geophysics

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Understanding of the formation of the interior of the earth requires accurate knowledge of the structures and properties of geological minerals at extreme conditions. Recent developments in high temperature levitators (up to 3000^{o}C), and high pressure piston anvil cells (up to 5 GPa) on the Glass, Liquids and Amorphous materials Diffractometer (GLAD) of the Intense Pulsed Neutron Source are allowing studies of materials under realistic temperatures of volcanic magmas or pressures in the upper mantle. This talk will highlight several recent results utilizing these capabilities. We will present data showing the negative thermal expansion of zirconia near melting and the structure of levitated liquid oxides. High pressure results for germania and arsenic oxide will be presented showing the changes of tetrahedral and trigonal networks under compression. These results show the versatility of neutron diffraction as a probe of both local and intermediate structure in liquids and glasses as well as determining the structure of highly disordered crystal structures. They also point the way toward the future of sample environments for new instruments.