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Elastic and Inelastic Properties under Simulated Earth's Mantle Conditions in LVPs in Conjunction with Synchrotron Radiation

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The interpretation of highly resolved seismic data from Earth's deep interior require measurements of the physical properties of Earth's materials under experimental simulated Earth's mantle conditions. More than a decade ago seismic tomography clearly showed subduction of crustal material can reach the core mantle boundary under specific circumstances. That means there is no longer space for the assumption deep mantle rocks might be much less complex than deep crustal rocks known from exhumation processes. Viscosity data of melts measured under in situ high pressure conditions are crucial for the understanding of Earth's lower mantle and the interior of terrestrial and extrasolar Super-Earth planets. Consequently in situ data of the elastic and inelastic properties of complex Earth's materials are of extraordinary importance for the interpretation of geophysical data from great depths of planets. Recent large volume presses provide sample volumes of several cubic millimeters. Ultrasonic interferometry necessarily requires in situ sample deformation measurement by X-radiography. Time-resolved X-radiography makes in situ viscosimetry and even the measurement of elastic and inelastic properties in the seismic frequency range by using the recent deformation technique achievable. This way current geophysical high pressure research is more and more bridging the gap between indoor and outdoor seismology and supplies large ranges of engineering and other material sciences with excellent toolboxes to meet their demands. The paper presents recent techniques of geophysical and general material sciences high pressure LVP in situ conditions research and their results.

Keywords

high pressure, geophysics, LVP, synchrotron radiation, material properties,

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