Geophysical Research Abstracts, Vol. 7, 02912, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02912

Sound velocities in minerals under mantle conditions

R. C. Liebermann (1,2), J. Kung (2), and B. Li (1,2)

(1) Department of Geosciences, Stony Brook University, Stony Brook, NY 11794-2100, USA
(2) Mineral Physics Institute, Stony Brook University, Stony Brook, NY 11794-2100, USA

Robert.Liebermann@stonybrook.edu

Sound velocity measurements on mantle minerals and rocks provide the data for direct comparison with seismic observations and deductions about the structure and composition of the Earth's interior. In the last decade, considerable progress has been made in our laboratory in conducting acoustic velocity measurements at high pressures and temperatures using multi-anvil, high-pressure apparatus. By combining synchrotron X-radiation and ultrasonic velocity measurements, we have extended the experimental capabilities in multi-dimensions, thereby enabling more complete characterization of solid and liquid materials to pressures of $P>22$ GPa and temperatures $T>1600$K. These expanded facilities now allow us to conduct simultaneous measurements of sound velocities using ultrasonic interferometry, crystal structure and unit cell parameters using X-ray diffraction, and sample length using X-radiographic imaging, all at high P & T. Experiments using these new techniques have been conducted on many mantle minerals in the form of polycrystalline and single crystal specimens, including San Carlos olivine [$(Mg, Fe)_2SiO_4$], ortho- and high-pressure clinopyroxene [$MgSiO_3$], pyrope [$Mg_3Al_2Si_3O_{12}$], -majorite [$MgSiO_3$] garnets, wadsleyite [Mg_2SiO_4], and ferropericlase [(Mg,Fe)O]. The successful application of these techniques to the unquenchable high-pressure clinopyroxene opens new opportunities for the study of elastic properties of materials undergoing phase transformations. These techniques are also applicable studies of melting and/or plastic deformation, multi-phase aggregate (mantle rocks), and liquids at high P & T; in all of these cases, the sample length cannot be determined by other methods. Moreover, the utilization of digital equipment provides fast data collection, enabling us to capture rapid variation or the time dependence of the elastic properties under the above circumstances. All of these new developments will bring us high-quality elasticity data for mantle phases at

the conditions of the Earth's deep mantle, making the interpretation of seismic data less ambiguous.