

The 20th Global-COE International Frontier Seminar

Feb 23rd, 2011, from 16:30, at the room#486 meeting room 4F

The Elasticity of Synthetic Polycrystalline Almandine, Grossular and CMNF Garnet at High Pressures and High Temperatures

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Acoustic wave velocities for synthetic polycrystalline almandine $[\text{Fe}_3\text{Al}_2(\text{SiO}_4)_3]$ grossular $[\text{Ca}_3\text{Al}_2(\text{SiO}_4)_3]$ and CMNF $[0.2 \text{ NaAlSi}_3\text{O}_8 + 0.3 \text{ Mg}_2\text{Si}_2\text{O}_7 + 0.4 \text{ CaMgSi}_2\text{O}_6 + 0.1 \text{ Fe}_2\text{Si}_2\text{O}_7]$ garnet were measured up to 8 GPa and temperatures up to 1000 K by ultrasonic interferometry technique, in conjunction with energy-dispersive synchrotron X-ray diffraction in a cubic anvil DIA-type apparatus (D-DIA). Travel times of compressional (P) and shear (S) waves and X-ray diffraction data were collected after heating and cooling at high pressures to minimize effect of non-hydrostatic stress on the measurements. Elastic bulk (K_s) and shear (G) moduli data obtained at the end of the cooling cycles were fitted to functions of Eulerian strain to third order, yielding pressure derivatives of the elastic moduli $(\partial K_s / \partial P)_T = 4.3$ (1); $(\partial G / \partial P)_T = 1.13$ (3) for almandine, $(\partial K_s / \partial P)_T = 4.4$ (2); $(\partial G / \partial P)_T = 1.28$ (5) for grossular and $(\partial K_s / \partial P)_T = 4.4$ (4); $(\partial G / \partial P)_T = 1.36$ (6) for the CMNF garnet. Both $(\partial K_s / \partial P)_T$ and $(\partial G / \partial P)_T$ are identical within mutual experimental uncertainties for all three garnet compositions. Moreover, the new pressure derivatives of the elastic moduli are also equal within experimental uncertainties, to those of end-member pyrope garnet Py_{100} (Gwanmesia *et al.*, 2006), and of $\text{Py}_{60}\text{Mg}_{40}$ and $\text{Py}_{50}\text{Mg}_{50}$ (Gwanmesia *et al.*, 2009), from previous ultrasonic studies, thus indicating that the effect on the pressure derivatives of the elastic moduli due to cation (Ca, Na, Fe) substitutions in the garnet structure, observed in this study is minimal or insignificant. Furthermore, these derivatives are also similar to those of other major mantle phases..

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