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Equation of State of Antigorite

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Serpentines play key roles in subduction zone processes including transport of water and seismogenesis. There are three major froms of serpentine: antigorite, lizardite and chrysotile. Antigorite can persist to higher temperatures than other serpentines. The equation of state (EoS) of antigorite is critical for understanding of its stability field and for interpretation of geophysical observations. Although a few compression tests have been conducted at room temperatures, EoS is still poorly understood at high temperatures.

We have investigated EoS of antigorite by in-situ synchrotron X-Ray diffraction. Measurements were conducted at a beamline NE5 of Photon Factory ? Advanced Ring (KEK, Tsukuba). The sample was a natural antigorite collected from Oheyama ophiolite (Miyadu, Kyoto pref.). It was finely ground and mixed with NaCl, and pressurized in a multi-anvil type high-pressure apparatus (MAX80). Measurements were made at pressures of 1~5 GPa and temperatures of 20~400 C. The pressure was estimated from the compression of NaCl. Lattice parameters were refined with the aid of previously reported lattice parameters and unit cell atomic positions (Uehara, 1998).

Reflecting the sheet structure of antigorite, linear compressibility and expansivity are significantly anisotropic. Linear isothermal compressibility in the c-axis ($1x10^{-2}$ 1/GPa) is 2-3 times as large as in a- and b- axes. It slightly increases with increasing temperature. The b-axis is least compressible. Linear expansivity is also large in c-axis ($3x10^{-5}$ 1/K) and small in b-axis. It decreases with increasing pressure. The volumetric thermal expansivity is $5x10^{-5}$(1/K) at 1GPa and decreases with increasing pressure.

Keywords: Equation of state, antigorite, X-ray diffraction, water, mantle wedge