Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SIT039-05 Room: 101 Time: May 26 10:00-10:15

Equations of state of antigorite under high pressure and high temperature determined by in situ X-ray diffraction (XRD)

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Many phase equilibrium experiments were conducted to clarify the dehydration phase boundary of antigorite; however, the results are inconsistent with each other. The unit-cell volume under high temperature and pressure (i.e. P-V-T equations of state (P-V-T EoS)) is one of the most important thermodynamic parameters of mineral to calculate the stability field using thermodynamic based calculation, in addition to discuss the density of serpentine-bearing subducted slab under high pressure and high temperature. But the existed EoS data of antigorite are few, and most of them were obtained by experiments at room temperature. Recently, Hilairet et al. (2006) conducted an in situ X-ray diffraction experiment under room temperature and high pressure to calculate the bulk modulus of antigorite. Their result is quite different from previous researches' (Bose and Navrotsky, 1998; Holland and Powell, 1998), so the stability field calculated by the thermodynamic is also different. The stability field of antigorite from Hilairet et al. (2006) is consistent with the result of the phase equilibrium experiment by Komabayashi et al. (2005). In this study, we have conducted in situ X-ray diffraction experiments under high pressure and high temperature up to about 8 GPa, 500 degree C to obtain the P-V-T EoS of antigorite, using 6-6 type multi-anvil (Nishiyama et al., 2008) in photon factory-advanced ring (PF-AR), Tsukuba, Japan. Our antigorite was stable during the whole pressure and temperature range in our experiments; the P-V-T data were fitted by 2nd order of Birch-Murnaghan EoS (fixed K_0'=4), and the obtained bulk modulus under different temperatures were: $K_{0,300K}$=68.2(17), $K_{0,373K}$=62.9(17), $K_{0,473K}$=61.4(17), $K_{0,573K}$=63.0(17), $K_{0,673K}$=61.4(16), and $K_{0,773K}$=61.6(25), respectively; the bulk modulus under room temperature was consistent with Hilairet et al. (2006). The c axis was more compressible compared to the other axes, a axis had the smallest compressibility, but the difference between a and b axes was small. The thermal expansion parameter of antigorite (a_0=1.80E-5/K) was comparable with chlorite (2.5E-5/K) (Pawley et al., 2002). Further details will be presented in the session.

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Keywords: serpentine, antigorite, equation of state, in situ X-ray diffraction, bulk modulus, thermal expansion