P-V-T equation of state of Al-bearing hydrous bridgmanite

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Water is the most abundant volatile component on the Earth. It has significant influences on the chemical and physical properties of mantle minerals (e.g., melting temperature, elastic properties, electrical conductivity, and so on.). The nominally anhydrous minerals(NAMs) can contain small amount of water. In particular, wadsleyite and ringwoodite which are the major constituent minerals in the Earth's mantle transition zone can contain ~2-3 wt% water (e.g., Inoue et al., 1995; Kohlstedt et al., 1996). Recently, hydrous ringwoodite contained ~1.5 wt% water was discovered by Pearson et al. (2014) as inclusion in ultra-deep diamond. This observation implies that the mantle transition zone contains some water at least locally. On the other hand, water solubility of bridgmanite which is the most abundant mineral in the lower mantle, is a matter of debate (e.g., Bolfan-Casanova et al., 2000, 2003; Murakami et al., 2002; Litasov et al., 2003). In this situation, Al-bearing hydrous bridgmanite contained ~0.8 wt % water with 4.7 wt% Al_2O_3 was synthesized by Inoue et al., (in prep). However, the physical properties of Al-bearing hydrous bridgmanite under high pressure are unknown. Therefore, we clarified P-V-T equation of state of Al-bearing hydrous bridgmanite will be reported.
In situ P-V-T experiments of Al-bearing hydrous bridgmanite were conducted using multi-anvil high pressure apparatus (SPEED-Mk.II) with sintered diamond 2nd stage anvil at SPring-8 BL04B1. As we observed the dehydration of Al-bearing hydrous bridgmanite between 900 and 1500 K in our in situ open system experiment, we developed in situ closed system experimental method using Ag capsule. The experimental conditions were 35-45 GPa and 300-1500 K. In addition, the room temperature compression data of Al-bearing hydrous bridgmanite was obtained using diamond anvil cell (DAC) with He pressure medium at PF BL18C up to ~55 GPa in quasi-hydrostatic condition (Takemura, 2001).
The unit cell volume of Al-bearing hydrous bridgmanite decreased smoothly up to 52 GPa. This result indicated that the hydrogen bond symmetrization is not occurred at least up to 52 GPa at room temperature. The bulk modulus of Al-bearing hydrous bridgmanite is much smaller than that of Al-bearing anhydrous bridgmanite. In this presentation, we will report the thermo-elastic properties of Al-bearing bridgmanite in detail. Moreover, the water affect to physical properties will be discussed.

Keywords: bridgmanite, water, lower mantle, equation of state

