Compressibility of Al-bearing hydrous bridgmanite

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Water is the most important volatile component on the Earth, because it has significant influences on the chemical and physical properties of mantle minerals (e.g., melting temperature, 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 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). The dominant substitution mechanism was suggested to be $Si^{4+} \rightarrow Al^{3+} + H^{+}$. However, the physical properties of Al-bearing hydrous bridgmanite under high pressure are unknown. In this report, the compressibility of Al-bearing bridgmanite is tried to determine.

In situ P-V-T experiments of Al-bearing hydrous bridgmanite were conducted up to 50 GPa and 900 or 1500 K, using multi-anvil high pressure apparatus (SPEED-Mk.II) with sintered diamond 2nd stage anvil at SPring-8 BL04B1. Al-bearing hydrous bridgmanite was softer than $MgSiO_3$ bridgmanite below 27 GPa. Then with increasing pressure up to 40 GPa from 27 GPa, The drastic softening was observed. Above 40 GPa, it become the steady state as below 27 GPa. This phenomenon looked like the symmetrization of hydrogen bond in the case of iceVII - iceX transformation (Sugimura et al., 2008). In this presentation, we will report the compressibility of Al-bearing hydrous bridgmanite in detail.

Keywords: lower mantle, bridgmanite, water, compressibility

