Behavior of Al-bearing hydrous bridgmanite at high pressure

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Water is the most important volatile component in the Earth, because it has significant influences on the chemical and physical properties of mantle minerals (e.g., melting temperature, theromo-elastic prioerties). 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 [1,2]. Recently, hydrous ringwoodite contained ~1.5 wt% water was discovered as inclusion in ultra deep diamond [3]. 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., 4,5] In this situation, Al-bearing hydrous bridgmanite contained ~0.8 wt % water was synthesized by Inoue et al., (in prep). The dominant substitution mechanism was suggested to be $Si^{4+} \rightleftarrows Al^{3+} + H^{+}$. 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 looks like the symmetrization of hydrogen bond in the case of iceVII - iceX transformation [6]. In this presentation, we will report the compressibility of Al-bearing hydrous bridgmanite in detail.

[1] Inoue *et al*. (1995) GRL **22**, 117-120. [2] Kohlstedt *et al*. (1996) Contrib Mineral Petrol **207**, 345-357. [3] Pearson *et al*. (2014) Nature **507**, 221-224. [4]Bolfan-Casanova *et al*. (2004) GRL **30**, 1905. [5]Murakami *et al*. (2003) Science **295**, 1885-1887. [6] Sigimura *et al*. (2008) PRB **77**, 214103.