The 460th Geodynamics Seminar

Equation of state of Al-bearing hydrous bridgmanite: technical development for in situ X-ray closed system experiment

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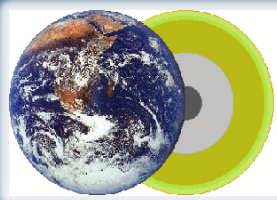

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Abstract

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, thermo-elastic properties, etc.). The nominally anhydrous minerals (NAMs) can contain small amount of water. 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 and temperature are unknown. In this study, the equation of state of Al-bearing hydrous bridgmanite was determined.

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. However, dehydration of Al-bearing hydrous bridgmanite was observed between 900 and 1500 K in open system. Therefore, we developed in situ X-ray closed system method. In addition, the room temperature compression curve 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). Dehydration was judged by comparing the compressions obtained from the experiments by in situ X-ray closed system method and quasi-hydrostatic pressure DAC.

The unit cell volume of Al-bearing hydrous bridgmanite decreased smoothly up to 52 GPa. This result indicated that symmetrization of hydrogen bond was 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. The small amount of water greatly affects the physical properties.

詳細は当センターホームページ: http://www.grc.ehime-u.ac.jp/をご覧ください
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