Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SIT04-P04 会場:コンベンションホール 時間:5 月 19 日 18:15-19:30

H/D interdiffusion in Wadsleyite
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Wadsleyite which is thought to be the dominant mineral in the upper half of the mantle transition zone, can incorporate large amount of H in its structure. Knowledge of relationship between hydrogen diffusion and proton conduction in wadsleyite is essential to accurately estimate the amount of water present in the transition zone. But so far, there is only hydrogen diffusion data obtained from polycrystalline wadsleyite (Hae et al. 2006), whose result showed one log unit higher than the hydrogen diffusion coeffcient expected from conductivity measurement data because of unavoidable grain boundary diffusion and low spatial resolution of FITR.

Shatskiy et al (2006) succeeded to synthesize big hydrous wadsleyite single crystals (>1mm and 3000ppm H2O) by Kawai-type multi-anvil press. Thus, we can currently measure the hydrogen self-diffusion and exclude the grain boundary effect. Recently, hydrogen-deuterium interdiffusion method was demonstrated in olivine to obtain more accurate hydrogen self-diffusion rate (Du Frane et al. 2006). We improved Shatskiy's method to synthetize big single crystal with different hydrogen and deuterium content (maximum 7000ppm) at 16 GPa by multi-anvil to do H/D interdiffusion experiments.

After determination of crystallographic orientation, a pair of hydrous wadsleyite and deurterium wadsleyite crystals was put together into gold capsule and fed a fine gold powder (1 micrometer) to the fill with the space. The polished surface was tightly contact each other. For every orientation, we did three diffusion experiments at different temperatures 1000K, 1200K, 1400K respectively. The preliminary results for D/H diffusion profile were obtained from micro Raman analysis using OD/OH peak ratio. The diffusion coefficient calculated by the Fick's second law indicates that single crystal experiments showed slower diffusion rates than Hae's polycrystalline results and more consistent with the electrical conductivity result. In order to obtain more accurate lattice D/H interdiffusion coefficient in wadsleyite, the diffusion profiles will be measured by SIMS. The SIMS results also will be introduced in this presentation.

キーワード: wadsleyite, mantle transition zone, hydrogen, deurterium, interdiffusion, conductivity
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