Transportation of hydrogen by iron oxide-hydroxide in the Earth's interior

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Water (hydrogen) plays important roles in dynamics in the Earth's interior. It is expected that hydrogen is transported from the surface to the interior by the subducting slab. Hydrogen is also a candidate of the light element of outer core. Therefore, the study of the hydrogen in the Earth's interior is quite important. Terasaki et al. (2012) investigated the reaction between Fe-Ni alloy and delta-AlOOH up to the pressure of core-mantle boundary. They showed that hydrogen is partitioned into Fe-Ni alloy and suggested that the core was hydrogenated by the subducting delta-AlOOH. (Dobson and Brodholt (2005) proposed that the banded iron formation subducted to the core-mantle boundary and stagnated there. The banded iron formation contains iron oxide-hydroxide. Therefore, it is important to study the stability and properties of iron oxide-hydroxide under high pressures and high temperatures to discuss the transportation of hydrogen in the Earth's interior. We carried out X-ray diffraction study and X-ray absorption measurement in the Photon Factory, Tsukuba, Japan. Goethite (alpha-FeOOH) is stable at ambient condition. However, it transformed to epsilon-FeOOH at 7.8+-0.5 GPa and 873K. Our previous study showed that epsilon-FeOOH was stable under the condition of the lower mantle. We suggest that epsilon-FeOOH can transport hydrogen to the core-mantle boundary and supply hydrogen to the outer core.

Keywords: hydrous phase, slab, mantle, banded iron formation, outer core

