Solid Earth Physics Seminar, Harvard University

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Faculty Lounge, 4th Floor, Hoffman Lab, 20 Oxford Street

First Principles Investigation of the Hydrous Phases in the Earth's Interior

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Abstract:

Knowing the mechanism of global water circulation and determination of total budget of water in earth's interior is very important for investigating the evolutional history of our planet. It has been believed that water is carried into the deep Earth's interior by hydrous minerals such as the dense hydrous magnesium silicates (DHMSs) which are also known as alphabet phases (phase A, superhydrous phase B, and phase D etc.) in the descending cold plate. Recently, we have theoretically predicted the high pressure phase of phase D and experimentally confirmed the existence of this new DHMS in lower mantle pressure conditions (Tsuchiya 2013, Nishi et al. 2014). This phase has $MgSiO_4H_2$ chemical composition and named as phase H. This phase is now recognized as the highest pressure phase among the DHMSs. Some experimental studies already reported that Al preferentially partitioned into phase H and the stability of phase H drastically increased by incorporation of Al (Nishi et al. 2014, Ohira et al. 2014). The density of subducted MORB is reported to be denser than that of pyrolite in the lower mantle (e.g. Kawai et al. 2009). Therefore, there is a possibility that phase H containing Al and Fe in subducted MORB survive down to the bottom of lower mantle and the melting of phase H at the core mantle boundary may contribute to the cause of ultra-low velocity zones. In this seminar, I briefly introduce our research on hydrous phases in the earth's interior and then discuss the stability of high pressure hydrous phases at the bottom of lower mantle.