The 407th Geodynamics Seminar

Stability of phase H in the lower mantle

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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. At the lower mantle pressure conditions, Al and H-bearing SiO_2, δ-AlOOH, ε-FeOOH and phase H may be the candidate of the relevant hydrous phases in the subducting slabs. Interestingly, the crystal structure of these hydrous phases are almost same and have $CaCl_2$ type structure. This suggests that these hydrous phases may potentially be able to make the wide range of solid solution. Aluminous end-member of this system, δ-AlOOH is experimentally confirmed to be stable up to 130 GPa and 2300 K (Sano et al. 2008). 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 study, we report the high pressure behaviors, such as the structure, elasticity and the possibility of further phase transition of this new hydrous mineral using first principles calculation techniques and discuss the stability of this hydrous phase on the bottom of lower mantle.

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