

## Study of the phase transition and compressional behavior of phase D under the lower mantle condition

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Water affects the mineral constitution, melting temperature, rheological properties and seismic wave velocity structure of the mantle. The existence of water and its forms in the subducting slabs hence have been the focus of interest in many previous investigations. Many experiments have shown that water could be transported from the surface to deep earth's interior via subducting slabs through hydrous or nominally anhydrous minerals such as wadsleyite and ringwoodite (Inoue et al. 1995; Kohlstedt et al. 1996; Irifune et al. 1998; Frost and Fei 1998; Shieh et al. 1998; Ohtani et al. 2001, 2004; Litasov and Ohtani 2003 Komabayashi et al. 2004, etc.). In hydrous minerals, dense hydrous magnesium silicate (DHMS) phases would be important water carriers because these phases are stable under the mantle transition zone conditions.

It has been experimentally reported that phase D is stable under upper part of the lower mantle conditions along cold slab geotherms and the highest pressure mineral in the DHMS phases. Therefore, phase D is the most important candidate to transport water into the lower mantle.

Recently, possibility of the phase transition of Phase D was reported and large change of the compressibility was predicted by first-principles study (Tsuchiya et al. 2005). In order to clarify the phase transition and compressional behavior of phase D under high pressure conditions, we have conducted in situ X-ray diffraction experiments using a combination of multianvil apparatus and synchrotron radiation at SPring-8.

Phase D was synthesized at 20 GPa and 1173 K from a mixture of reagent grade  $\text{Mg}(\text{OH})_2$  and  $\text{SiO}_2$  in 2:3 molar ratio. The starting material and Au pressure marker were loaded in a AgPd capsule. In some runs, starting sample was directly put into a semi-sintered MgO. Sintered-diamond cubes with truncated edge length of 1.5 mm were used as second stage anvils. Generated pressure was basically determined from the refined unit-cell volume of Au using the equation of state proposed by Anderson et al. (1989). WC plus diamond was used as a heater and temperature was measured by a W97Re3-W75Re25 thermocouple. X-ray diffraction experiments were made by the energy dispersive method using a white X-ray and a Ge solid-state detector.

Sample was first compressed at room temperature and then heated to remove the deviatoric stress stored in the sample during room temperature compression. X-ray diffraction profiles were collected at 25-40 GPa so far. The obvious evidence for phase transition of phase D was not observed in the present experimental conditions.