

The 483rd Geodynamics Seminar

Experimental study on the stability of magnesite in the presence of H₂O-rich C-H-O fluid under high pressure and high temperature

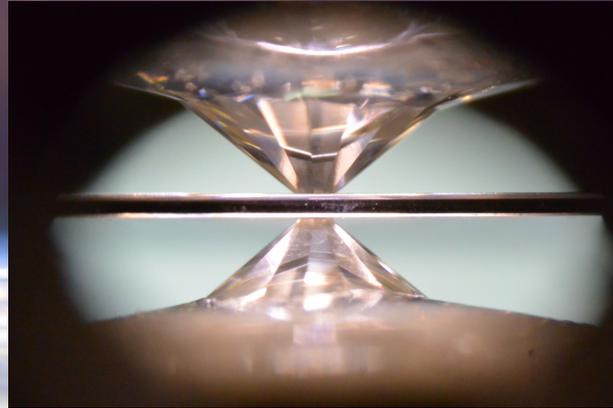
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Carbonaceous materials subducted from the Earth's surface to the deep mantle are believed to be cycled back to the surface over geological time. This process is called "Deep Carbon Cycle" and has attracted much attention of Earth scientists in recent years. Magnesite is the most dominant carbonate carried to the deep mantle along with the subducting slab and is reported to be stable up to the pressure-temperature conditions of the bottom of the lower mantle in the dry system (Isshiki *et al.*, 2003). However, our earlier studies showed that the stability of magnesite significantly changes in the presence of reduced C-H-O fluid (CH₄:H₂O=4:1) and magnesite decomposes to diamond and brucite/periclase as a result of the reaction.

In this study, we further investigated the stability of magnesite in the presence of H₂O-rich less-reduced fluid at pressures and temperatures corresponding to the mantle transition zone to lower mantle condition (18-30 GPa, 1800-2000 K) by using laser-heated diamond anvil cell (DAC). Methane hydrate (CH₄:H₂O≈1:6) and pure H₂O were used as starting fluid sources. In-situ XRD observation and SEM-TEM analysis of the recovered samples showed that magnesite decomposed into periclase (MgO) and/or brucite (Mg(OH)₂) and diamond in the presence of H₂O-rich C-H-O fluid, while it showed a dissolution feature when using pure H₂O as a fluid source. This suggests that the stability of magnesite is largely influenced by the presence of C-H-O fluid even if it contains only a small portion of CH₄.

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