Influence of H2 fluid on the stability of MgSiO3 enstatite in the upper mantle condition

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C-O-H fluids affect the phase relation and melting of silicate minerals in the mantle of the Earth. The mantle is expected to become progressively reduced with increasing depth, so that H2 fluid is considered to exist in the deep mantle with H2O fluids. In this study, influence of H2 fluid on stability and phase relation of enstatite, which was the secondary most abundant mineral in the upper mantle, was examined using a laser heated diamond anvil cell.

In this presentation, we will report the results of MgSiO3-H2 system, which is non-iron-bearing system. After heating at 3.1-13.8 GPa and about 1500-2000 K, decomposition of enstatite and formation of forsterite (Mg2SiO4), periclase (MgO) and coesite/stishovite (SiO2) were observed from XRD measurements. The presence of H2 fluid were observed from Raman spectra even after the heating. Since the studied P-T range is in the stability field of orthoenstatite and high pressure clinoenstatite under dry condition, the decomposition reaction observed in the present study was presumably induced by H2 fluid. Formation process of these silicate phases were evaluated by observation of quench texture of the recovered samples using SEM and TEM.

Keywords: enstatite, H2 fluid, upper mantle, laser heated diamond anvil cell