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Chemical reaction between Iron and (Mg0.99,Fe0.01)SiO3 Perovskite at high-temperature and high-pressure

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Chemical reaction between lower mantle and core materials is very important to understand nature of the core-mantle boundary of the Earth. Interaction between the core and mantle materials were investigated and reported by various researchers previously. In all of the past investigations, orthtopyroxene (enstatite) or olivine (forsterite) containing about 0.1 wt.% of iron was used for the starting material, therefore there is a possibility that iron and silicate reacted outside the stability field of perovskite.

In this study, we synthesized perovskite from (Mg0.99,Fe0.01)SiO3 enstatite at 1300 C and 23 GPa for 1 hour using a multianvil apparatus at Tohoku University. The run product was confirmed to be a perovskite phase by micro focused X-ray microdiffractometer, laser Raman spectrometer and electron probe microanalyser. We performed high temperature and pressure experiments using a laser heating diamond anvil cell in the pressure range of 30 - 90 GPa using 99.99 % pure iron foil and the synthesized perovskite as the starting material. Pressures ware measured by the ruby fluorescence method. The samples ware heated with the Nd:YAG laser, and temperatures ware measured by radiation from the heating spot.

The results of X-ray diffraction and EPMA analyses of recovered samples at 30-90 GPa indicate a possibility of reaction between liquid iron and perovskite.

We will report the result of and in situ X-ray diffraction experiments and TEM observation of the recovered samples.