

Chemical reaction between Iron and (Mg_{0.99},Fe_{0.01})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, orthopyroxene (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 (Mg_{0.99},Fe_{0.01})SiO₃ enstatite at 23 GPa and 1300 C for 1 hour using a multianvil apparatus at Tohoku University. The run product was confirmed to be a perovskite phase by X-ray microdiffractometer, laser Raman spectrometer and electron probe microanalyser. We performed high temperature and pressure experiments using a double sided laser heating diamond anvil cell in the pressure range of 30 - 50 GPa using 99.99 % pure iron foil and the synthesized perovskite as the starting material. Pressure was measured by the ruby fluorescence method. Sample was heated with the Nd:YAG laser, and temperature was measured by radiation from the heating sample.

X-ray diffraction analyses of quenched sample at 30 GPa 2300 K indicate a possibility of reaction between liquid iron and perovskite. SEM observations of the recovered sample show that liquid iron percolated into the grain boundaries of perovskite.