

SIT040-07

会場:104

時間:5月23日 15:45-16:00

マントル深部での融解現象

Study of melting phenomena under the deep mantle conditions

西谷 尚也^{1*}, 大谷 栄治¹, 境 毅², 宮原 正明¹, 平尾 直久³, 大石 泰夫³, 西嶋 雅彦⁴, 村上 元彦¹

Naoya Nishitani^{1*}, Eiji Ohtani¹, Takeshi Sakai², Masaaki Miyahara¹, Naohisa Hirao³, Yasuo Ohishi³, Masahiko Nishijima⁴, Motohiko Murakami¹

¹ 東北大学大学院理学研究科地学専攻, ² 東北大学国際高等研究教育機構国際高等融合研, ³ 財団法人高輝度光科学研究センター, ⁴ 東北大金研

¹Tohoku Univ., ²IIAIR, Tohoku Univ., ³JASRI, ⁴Tohoku Univ. IMR

It is known that the subducting plate carry the Earth's surface materials (such as the basaltic crust) to the Earth's deep interior. As a result of this process, the mantle is highly heterogeneous in chemical composition. At the core-mantle boundary, there is a possibility that Mid Ocean Ridge Basalt (MORB) exists and it causes the seismic anomalies. Seismological studies indicate the presence of Ultra-Low Velocity Zone (ULVZ) above the core-mantle boundary (Williams and Garnero, 1996). This region exhibits reduction of seismic velocities at least 10% and the thickness of this region is about 5 - 40 km. The most probable cause of the seismic velocity reduction is partial melting of the lowermost mantle.

In this study, We carried out melting experiments of MORB using a laser heated diamond anvil cell to investigate the melting phase relations of MORB. The phase relations in MORB were investigated from 31 to 156 GPa and 1500 to 4400 K by in situ X-ray diffraction experiments and chemical analysis of the quenched samples using field emission-scanning electron microscope (FE-SEM) and transmission electron microscopy (TEM). In-situ X-ray diffraction experiments were performed at SPring-8 to determine the subsolidus phase assemblage. The MORB composition consists of MgSiO₃-perovskite, CaSiO₃-perovskite, stishovite, and Al-rich phase (likely CaFe₂O₄-type Al-phase) in the upper part of the lower mantle. Stishovite transforms to CaCl₂-type SiO₂ phase above 60 GPa and 2000 K and further to alpha-PbO₂-type phase above 110 GPa. Phase transition of CaSiO₃-perovskite from tetragonal to cubic was also observed with increasing temperature. At 37 GPa, the first consuming phase is likely to be stishovite and the melting temperature is 2700 K. At 118 GPa, the first consuming phase is also alpha-PbO₂-type SiO₂ phase and the temperature is 3700 K.

Keywords: MORB, lower mantle, melting