Experimental Determination of the MgO-FeO-SiO_2 Liquidus Phase Diagram up to CMB Pressure

KEISUKE OZAWA[1]*, KEI HIROSE[1,2] AND SHIGEHIKO TATENO[2]

[1]Department of Earth and Planetary Science, The University of Tokyo, Tokyo 113-0033, Japan. (*correspondence: keisuke-ozawa996@g.ecc.u-tokyo.ac.jp)

[2]Earth-Life Science Institute, Tokyo Institute of Technology, Tokyo 152-8550, Japan.

SiO_2, MgO, and FeO are main oxide components in the Earth's mantle, and the determination of this ternary liquidus phase diagram is important in order to understand melting and crystallization in the mantle. We have performed melting experiments on the MgO–FeO–SiO_2 ternary system at ~40 GPa and ~140 GPa using laser-heated diamond-anvil cell (DAC) techniques. Quenched partially molten samples were recovered from a DAC, and their cross-sections at a laser-heated hot spot were prepared using a focus ion beam (FIB) and analysed with a field-emission-type SEM and EDS. We obtained a wide range of partial melt compositions from a variety of starting materials, which coexisted with $(Mg,Fe)SiO_3$, (Mg,Fe)O, or SiO_2. Based on these results together with binary liquidus phase relations previously reported in SiO_2–MgO [1], $(Mg,Fe)_2SiO_4$ [2], and SiO_2–FeO [3], we determined the liquidus phase relations in MgO–FeO–SiO_2 under shallow and deep lower mantle conditions. We will discuss the compositional evolution of a deep magma ocean and the nature of the ultralow velocity zone at the bottom of the mantle.

[1] Ozawa *et al.* (2018) *Geophys. Res. Lett.*
[2] Nomura *et al.* (2011) *Nature*
[3] Kato *et al.* (2016) *Earth. Planet. Sci. Lett.*