Melting experiments on the $MgO–MgSiO_3$ system to lowermost mantle pressures

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Melting experiments on the $MgO–MgSiO_3$ binary system were performed to lowermost mantle pressures using laser-heated diamond-anvil cell techniques. We employed synthetic forsterite and gel starting materials with a wide range of MgO/SiO_2 ratios. A gold foil was used as a laser absorber. Quenched molten samples were recovered from high pressure, and their cross-sections at a laser-heated zone were prepared using a focused ion beam (FIB). Melting texture and the compositions of coexisting melt and solid (liquidus phase) were then examined with a scanning electron microscope (SEM) and energy dispersive X-ray spectrometry (EDS). The results demonstrate that eutectic composition becomes more MgO-rich with increasing pressure. While our data are consistent with previous experimental results to 26 GPa by Liebske and Frost (2012 EPSL) and to 70 GPa by Ohnishi et al. (2017 PCM), the eutectic melt at 135 GPa exhibits the MgO/SiO_2 ratio greater than those obtained by extrapolations in these earlier studies. Based on these new experimental results, we will discuss the large-scale compositional differentiation in a solidifying deep magma ocean.

Keywords: lower mantle, melting, MgO-MgSiO3, high pressure

