

Phase relations in the system $\text{MgSiO}_3\text{-Al}_2\text{O}_3$ to 52 GPa and 2000 K

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The chemical composition, structure, mineralogy and dynamics of the Earth's lower mantle can be studied by phase relations in the simplified system in $\text{MgSiO}_3 - \text{Al}_2\text{O}_3$ at high pressure and high temperature [1-2]. In this study, phase relations in the system $\text{MgSiO}_3\text{-Al}_2\text{O}_3$ have been determined at pressures of 15-52 GPa and at a temperature of 2000 K using in situ synchrotron X-ray diffraction measurements with sintered diamond anvils in a multi-anvil apparatus. A wide two-phase region of garnet and corundum is found to exist up to 27 GPa, while a phase assemblage of aluminous bridgmanite and corundum is stabilized at higher pressures. The Al_2O_3 solubility in bridgmanite and the MgSiO_3 solubility in corundum are highly dependent on pressure: the Al_2O_3 content in bridgmanite increases from 12 mol% at 27 GPa to 29 mol% at 52 GPa, forming bridgmanite with the pyrope composition (25 mol% Al_2O_3) at about 45 GPa. The new phase diagram in the system $\text{MgSiO}_3\text{-Al}_2\text{O}_3$ confirms that bridgmanite is the dominant host mineral for Al_2O_3 in the Earth's lower mantle.

[1] T. Irifune, T. Koizumi, J. Ando, 1996. *Phys. Earth Planet Inter.* 96, 147-157.

[2] T. Irifune, and T. Tsuchiya, 2007. *Treatise on Geophysics*, vol. 2 Elsevier, pp. 33-62.