Formation of highly pure anorthite crust on the low-volatile astral bodies by low-viscous magma ocean

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Anorthite ($CaAl_2Si_2O_8$) is a Ca-endmember of plagioclase, and it is a main component of a crust on the astral bodies, such as Moon and 4 Vesta, Thick anorthite-rich crust has been formed through a process of magma ocean. Here we conduct high-pressure and high-temperature experiments and *in-situ* X-ray analysis to simultaneously assess the viscosity and structure of anorthite magmas under pressures of up to 6.6 GPa. We find contrasting behavior in the viscosity between liquid anorthite and albite ($NaAlSi_3O_8$), which is Na-endmember of plagioclase. The big difference in viscosity between anorthite and albite melts has important implications for planetary differentiation. Na-poor astral bodies (Moon, 4 Vesta, etc.) have been dominated by low-viscous magma ocean and, eventually caused an efficient differentiation between crystal and magma. This process prevented the melt from trapping in the grain boundaries of floating anorthites. This makes the highly pure anorthite crust on the Moon observed by the remote sensing.

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