Compositional and Pressure-Temperature dependence of the thermal conductivity of bridgmanite

Yoshiyuki Okuda*[1], Kenji Ohta[2,3], Takashi Yagi[4], Ryosuke Sinmyo[5], Tatsuya Wakamatsu[1], and Kei Hirose[6]

[1]Department of Earth and Planetary Sciences, Tokyo Institute of Technology – Japan
[2]Department of Earth and Planetary Sciences, Tokyo Institute of Technology – Japan
[3]Tokyo Institute of Technology – Japan
[4]National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology – Japan
[5]Earth-Life Science Institute, Tokyo Institute of Technology (ELSI/Titech) – 2-12-1-IE-1 Ookayama, Meguro-ku, Tokyo, 152-8550, Japan
[6]Earth-Life Science Institute, Tokyo Institute of Technology – Japan

Abstract

The amount of heat flow from the Earth's core to mantle critically determines the thermochemical evolution both of the core and the mantle. Bridgmanite, iron and aluminum bearing MgSiO3 perovskite, is the most abundant mineral in the Earth's lower mantle, and thus its thermal transport property mainly controls heat transport in the lower mantle. Here we measured lattice thermal diffusivity of bridgmanite with 5 different chemical composition up to 180 GPa at ambient temperature, and also at high temperature up to 600 K using the pulsed light heating thermoreflectance technique in a diamond anvil cell. Our results indicate that the lattice thermal conductivity of the bridgmanite sample is slightly lower than that of iron and aluminum free bridgmanite determined by using the same experimental technique (Ohta et al., 2012) and ab initio calculation (Dekura et al., 2013). Our results exhibit moderate effect of iron and aluminum incorporation into bridgmanite on its thermal conductivity, which imply temperature variation in the lower mantle tends to easily induce heterogeneity of thermal conductivity and core heat flux there that could drive large scale dynamics both in the core and mantle.

*Speaker