# Thermal conductivity measurements on iron and MgO periclase at high pressure and high temperature similar to the Earth’ s mid-lower mantle conditions

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The thermal transport properties of the Earth’ s constituents are important information to constrain the thermal evolution and the heat budget of the Earth. In particular, the thermal conductivity of the core, the largest heat source of the Earth, and the lower mantle, occupying more than half the volume of the whole Earth, are indispensable.

In recent years, thermal conductivity measurement on the sample inside the diamond anvil cell has been carried out utilizing the thermoreflectance phenomenon, the reflectance of metal changes slightly due to the temperature perturbation of several kelvin (e.g. Hsieh et al., 2009 Phys Rev B; Yagi et al., 2011 Meas Sci Technol). However, the reported temperature condition is far from that in Earth’ s interior.

In this study, we combined the pulsed light heating thermoreflectance method with high power CW laser heating to obtain the thermal conductivity of material *in-situ* at high pressures and temperatures. As a result of test measurement for Pt, we obtained thermal conductivities of Pt up to 60 GPa and 2000 K, which is in good agreement with the measured values using flash heating method in a laser heated diamond anvil cell (McWilliams et al., 2015 Phys Earth Planet In).

The thermal conductivities of iron and MgO periclase were measured up to 60 GPa and 1700 K with this developed system. We found that the obtained thermal conductivities of iron and MgO have negative temperature dependence, and are consistent with the literatures (Fe: Konôpková et al., 2016 Nature; Ohta et al., 2016 Nature, MgO; Manthilake et al., 2011 Proc National Acad Sci; Dekura and Tsuchiya, 2017 Phys Rev B). The newly developed system here would be a powerful tool to examine the thermal conductivity of Earth’ s deep interior.

Keywords: thermal conductivity, laser heated diamond anvil cell, pulsed light heating thermoreflectance method, lower mantle, core