Measurement of thermophysical properties of mantle materials under pressure

Masahiro Osako[1]; Eiji Ito[2]; Akira Yoneda[3]

[1] Div.Astro.Geophys.,Natl.Sci.Mus.; [2] ISEI; [3] ISEI, Okayama Univ.

http://research.kahaku.go.jp/department/

Thermal conductivity and thermal diffusivity have been measured simultaneously for mantle materials up to 8.3 GPa and 1100 K by using a pulse heating method. Anisotropy of thermal conduction is investigated along the three crystallographic axes, [100], [010], and [001] in olivine. The pressure dependence of thermal conductivity is determined to be 3-4 % per 1 GPa for the three crystallographic direction in olivine and 3 % per 1 GPa for garnet, thermal diffusivity is determined to be ~4 % per 1 GPa for olivine and 3 % per 1 GPa for garnet. The anisotropy in thermal diffusivity or thermal conductivity of olivine is clearly observed in the present experimental range of pressure and temperature. It is likely that the anisotropy in thermal conduction would be maintained throughout the olivine stability field in the mantle down to 410 km depth.

Heat capacities of olivine and garnet are calculated from the present thermal conductivity and thermal diffusivity. Both the present heat capacities of olivine and garnet are consistent with the previously reported values within 5 %. Those obtained for the three crystallographic direction in olivine are also consistent with each other within 6 %.