Lattice thermal conductivity of (Mg,Fe)O magnesiowustite

*長谷川 暉[1]、太田 健二[1]、八木 貴志[2]、廣瀬 敬[3]、近藤 忠[4]
*Akira Hasegawa[1], Kenji Ohta[1], Takashi Yagi[2], Kei Hirose[3], Tadashi Kondo[4]

1. 東京工業大学大学院理工学研究科地球惑星科学専攻、2. 産業技術総合研究所、3. 東京工業大学地球生命研究所、4. 大阪大学大学院理学研究科宇宙地球科学専攻
1. Department of Earth and Planetary Sciences, Tokyo Institute of Technology, 2. Research Institute for Material and Chemical Measurement, National Institute of Advanced Industrial Science and Technology, 3. Earth-Life Science Institute, Tokyo Institute of Technology, 4. Department of Earth and Space Science, Osaka University

The Earth has been cooling since it was born about 4.6 billion years ago. To decipher the thermal history of the Earth, thermophysical properties of the lower mantle materials that constitute more than half the volume of the Earth is of great importance. A number of research has suggested the possibility that (Mg,Fe)O ferropericlase, one of the main constituent minerals of the lower mantle, exists with very iron-rich chemical composition at the Earth’s core-mantle boundary (CMB). Such iron-rich (Mg,Fe)O magnesiowustite at the CMB may cause regional variation of thermal conductivity of the lowermost mantle due to its distinct iron concentration, which potentially influences the mantle convection style, inner core age, inner core structure, geomagnetic field reversal frequency and so on [e.g. Olson, 2016]. However, there is no systematic study to examine the effect of iron on the thermal conductivity of (Mg,Fe)O solid solution under high pressure. In this study, we measured lattice thermal conductivity of (Mg,Fe)O magnesiowustite with various iron contents at high pressures, and evaluated its compositional dependence. Our results show much lower lattice conductivity of iron- rich magnesiowustite than that of MgO and FeO due to strong iron impurity phonon scattering, which would help to estimate the thermal conductivity of the expected iron- rich region in the lowermost mantle.

Reference: Olson, P. Mantle control of the geodynamo: Consequences of top-down regulation, *Geochem. Geophys. Geosys.* 17, 1935–1956, (2016).

キーワード：熱伝導率、下部マントル、フェロペリクレース、マグネシオウスタイト
Keywords: thermal conductivity, lower mantle, ferropericlase, magnesiowustite