[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT22]Interaction and Coevolution of the Core and Mantle in the Earth and Planets

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Recent observational and experimental investigations have significantly advanced our understanding of the structure and constituent materials of the deep Earth. Yet, even fundamental properties intimately linked with formation and evolution of the planet, such as details of the chemical heterogeneity in the mantle and light elements dissolved in the core, remained unclear. Seismological evidence has suggested a vigorous convection in the lower mantle, whereas geochemistry has suggested the presence of stable regions there that hold ancient chemical signatures. The amounts of radioactive isotopes that act as heat sources and drive dynamic behaviors of the deep Earth are also still largely unknown. We provide an opportunity to exchange the achievements and ideas, and encourage persons who try to elucidate these unsolved issues of the core-mantle evolution using various methods, including high-pressure and high-temperature experiments, high-precision geochemical and paleomagnetic analyses, high-resolution geophysical observations, geo-neutrino observations, and large-scale numerical simulations. Since this session is co-sponsored by geomagnetism, paleomagnetism and rock magnetism division of the SGEPSS, contributions in geomagnetism and geodynamo simulation are also encouraged.

[SIT22-P19]**High *P-T* electrical resistivity measurements on iron in an internally-heated diamond anvil cell**

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Dipole magnetic field of the Earth is generated by self-sustained dynamo action for geological timescales. Secular cooling of the Earth’s core induces growth of the solid inner core that contributes additional buoyant source for the core convection. The electrical and thermal conductivities of core are two key parameters needed to determine the fundamental timescale for heat diffusion and generation and sustainability of magnetic field in the Earth’s core.

A laser-heated diamond anvil cell (LHDAC) technique is commonly used for measurement of physical properties of deep Earth materials at high pressure (*P*) and temperature (*T*) conditions. However, the laser heating produces large temperature gradient in the heated area and is difficult to maintain stable heating. Direct measurements of the electrical and thermal conductivities of iron (Fe) in a LHDAC have been reported (Konôpková et al., 2016; Ohta et al., 2016). The reported electrical conductivity at 135 GPa and 3700 K corresponding to the Earth’s core-mantle boundary (CMB) condition (Ohta et al., 2016) is 3~4 times higher than the one estimated from thermal conductivity measurements (Konôpková et al., 2016). It is possible that a large temperature gradient in their Fe samples due to laser heating caused the discrepancy between the two studies.
Here we employed an internally-heated diamond anvil cell (IHDAC) technique to measure electrical resistivity (inverse of conductivity) of Fe at high *P-T* conditions. The experiments were carried out at 50 and 70 GPa

and up to ~2500 K. We found this heating method could achieve much lower temperature gradient in the sample than the laser heating. Our results show that the electrical resistivity of Fe at high *P-T* conditions is slightly higher than the value reported by Ohta et al. (2016). Our estimates of Fe conductivity at high *P-T* would give the new constraints on the transport properties of the Earth's core.

References

Ohta, K., Y. Kuwayama, K. Hirose, K. Shimizu, and Y. Ohishi (2016), Experimental determination of the electrical resistivity of iron at Earth’s core conditions, *Nature*, 534, 95–98, doi:10.1038/nature17957.
Konôpková, Z., R. McWilliams, N. Gómez-Pérez, and A. Goncharov (2016), Direct measurement of thermal conductivity in solid iron at planetary core conditions, *Nature*, 534, 99–101, doi:10.1038/nature18009.