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Electrical resistivitiy of hcp-Fe under Earth's core conditions

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Iron is the primary component of the Earth's core. Convection of the conductive liquid outer core generates the geomagnetic field, and secular cooling of the core induces growth of the solid inner core and dynamics in the Earth's inside. Synchrotron x-ray diffraction study suggests that iron crystallizes in the hexagonal close-packed structure at the inner core conditions (Tateno et al., 2010). Thus, the electrical resistivity of hexagonal close-packed iron (hcp-Fe) is a key piece of information for estimating the transport properties of the core. We report high temperature electrical resistivity for hcp-Fe to 185 GPa measured in a laser-heated diamond anvil cell. We observed resistivity saturation in hcp-Fe under high pressure and high temperature conditions as predicted in a recent laboratory-based model for the conductivity of the Earth's core (Gomi et al., 2013). The saturation effect is significant in estimating electrical and thermal conductivity of the core, which strongly affect the dynamics and thermal evolution of the Earth.

References
Gomi, H. et al. The high conductivity of iron and thermal evolution of the Earth's core. Phys. Earth Planet. Inter. 224, 88-103 (2013).
Tateno, S., Hirose, K., Ohishi, Y., & Tatsumi, Y. The structure of iron in Earth's inner core. Science 330, 359-361 (2010).

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