Electrical conductivity of pyrolitic and MORB materials at lowermost mantle condition

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The electrical conductivity is one of the observable physical properties of the Earth's mantle, and the joint analyses with laboratory-based electrical conductivity model provide more constraints on temperature and chemical composition in the Earth's interior (e.g., Xu et al., 2000; Yoshino et al., 2006). The electrical conductivity models for the Earth's lower mantle have been proposed by large extrapolation of laboratory data obtained below 40 GPa (Shankland et al., 1993; Xu et al., 2000). Recent two important discoveries of spin-pairing transition of iron and post-perovskite phase transition, which occurs above 60 GPa, suggest that the physical properties of the lower part of Earth's lower mantle may be different from those of overlaying mantle (Badro et al., 2003, 2004; Murakami et al., 2004). Indeed, we reported that spin transition both in (Mg,Fe)SiO_3 perovskite and (Mg,Fe)O ferropericlase reduce the electrical conductivity, while post-perovskite phase transition drastically increase the conductivity (Ohta et al., 2007, 2008). Here we measured the electrical conductivities of pyrolitic and MORB materials in a pressure range between 30 and 135 GPa at high-temperature using laser-heated diamond-anvil cell. Our results demonstrate that the conductivity in pyrolite is lower than that of $(Mg_{0.9}Fe_{0.1})SiO_3$ post-perovskite, while MORB shows highest electrical conductivity in these three compositions. We attempted to make a lower mantle electrical conductivity profile without extrapolation. Observed heterogeneity in the conductivity of the lowermost mantle could mainly derive from chemical anomaly.

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