Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10034

Electrical conductivity of hydrous FeOOH and FeO_2Hx

QINGYANG HU

Center for High Pressure Science and Technology Advanced Research

Presenting Author: qingyang.hu@hpstar.ac.cn

Implied by recent advances in global geomagnetic data, the electrical structure of the lower mantle is heterogeneous. In depth between 900 and 1400 km, locations with high electrical conductivity are measured as several magnitudes higher than the average. Many factors have been taken into account for this heterogeneity. For example, the spin-pairing of iron under high pressure may induce abrupt changes of electrical transportation properties. Mineral hydration also boosts the electrical conductivity by orders of magnitude through ionic conduction. Here, we measured the electrical conductivity of ε-FeOOH and the pyrite-type FeO_2H_x up to the pressure-temperature at Earth's core mantle boundary. The combination of Fe, hydroxyl and H ions imposes profound effects on its electrical conductivity propeties. In bettween 45-50 GPa, high-low spin transition occurs in ε-FeOOH. The low-spin ε-FeOOH reaches $1.24\pm0.19 \times 10^3$ S/m at 61 GPa. In deep lower mantle, ε-FeOOH transits to the pyrite-type FeO_2Hx, whose electrical conductivity contines to soar in the high-temperature superionic state. Our results indicate FeOOH polymorphs contribute to the high electrical conductivity observed in some relatively cold mantle pockets. In turns, highly conductive regions in the lower mantle may help track the appearance of water reserviors in Earth's deep interiors.