Electrical conductivity measurement of water-bearing bridgmanite using an externally heated diamond anvil cell

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The presence of water strongly affects the structure, phase relation and physical properties of the Earth's deep mantle minerals (Chen et al., 2020; Chang et al., 2017). Since electrical conductivity is sensitive to the water content of minerals, the electrical conductivity inferred from the analysis of electromagnetic induction brings the spatial distribution of water in the Earth's interior. Previous studies have estimated the actual water content of the Earth's upper mantle and the mantle transition zones by comparing the geophysically inferred electrical conductivity with the experimentally measured water content dependence of the electrical conductivity of mantle minerals (e.g., Karato, 2011). However, so far, the water content dependence of the electrical conductivity of lower mantle minerals have never been reported. Bridgmanite is the most abundant mineral in the Earth's lower mantle. Its water solubility is yet controversial, which varies from 5~4000 ppm (Litasov et al., 2003; Murakami et al., 2002), implying that studies on water solubility of bridgmanite is not sufficient to constrain the actual water distribution in the lower mantle. Here we measured the electrical conductivity of $Mg_{0.88}Fe_{0.14}Al_{0.11}Si_{0.91}O_3$ bridgmanite containing 500 ppm H_2O at high *P-T* conditions using an externally heated diamond anvil cell. We used a quasi-four terminal method for electrical conductivity measurements. Water content of our sample was estimated by Fourier transform infrared spectrometer (FTIR). From our results, we will discuss the water content of the Earth's lower mantle.

References

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