I128-002 **Room: 302** **Time: May 23 11:00-11:15**

Electrical conductivity of mantle minerals

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Deep electrical conductivity profiles can provide constraints on the thermal and chemical state of the mantle. Especially, electrical conductivity is very sensitive to small amount of hydrogen and iron contents in minerals. Accurate knowledge of electrical conductivity of mantle minerals is needed to constrain water and/or iron contents in the mantle as a function of depth. We have investigated the electrical properties of olivine, wadsleyite and ringwoodite, which are main constituent minerals of the upper mantle by in situ electrical conductivity measurement using a Kawai-type multianvil apparatus. The starting materials were olivine (Fo91) for olivine, wadsleyite and ringwoodite. In most cases, molybdenum disk electrode connecting to the sample was used as an oxygen buffer media, whose oxygen fugacity is close to Fe-FeO buffer. The electrical conductivities of the samples were measured at various pressures from 3 and 20 GPa and temperatures up to 2000K at low frequencies ranging from 0.01 to 0.1 Hz. For all the dry samples, electrical conductivity displays Arrhenian behavior over the entire investigated temperature range. In the high temperature range above 1700K, activation energies (more than 1.5 eV) tend to be higher than those in the lower temperature range (less than 1.5 eV). The absolute values of electrical conductivity (S/m) increase in order of olivine, wadsleyite and ringwoodite. From these measurements we noted that the electrical conductivities of dry wadsleyite and ringwoodite (less than 100 wt. ppm of water) are much lower than those previously reported (e.g., Xu et al., 1998). While conductivities of samples with certain amounts of hydrogen are comparable to that of the dry one, conductivity increases with increasing hydrogen concentrations. Activation energies of hydrogen-bearing nominally anhydrous minerals we measured decreases with increasing hydrogen concentration from nearly 1 to 0.5 eV. Using our results, we can estimate the electrical conductivity profile of the upper mantle. Conductivity increases in nearly one order of magnitude at 410 and 520 km depth. Comparing the reference model of Utada et al. (2003), our modeling demonstrates that the electrical conductivity of the upper mantle up to 410km discontinuity (i.e. olivine stability field) is close to that of dry olivine, whereas the electrical conductivities of dry wadsleyite and ringwoodite are slightly lower than the reference model. Therefore, a presence of hydrogen in their minerals or the other factors (e.g. iron content) is required to explain the high conductivity in the transition zone.

References

Xu, Y., Poe, B. T., Shankland, T. J. & Rubie, D. C., Electrical conductivity of olivine, wadsleyite and ringwoodite under upper-mantle conditions. Science 280, 1415-1418 (1998).

Utada, H., Koyama, T., Shimizu, H. & Chave, A. D., A semi-global reference model for electrical conductivity in the mid-mantle beneath the north Pacific region. Geophys. Res. Lett. 30, 1194, doi:10.1029/2002GL016902 (2003).