# Electrical conductivity of wadsleyite

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Electrical conductivity of wadsleyite was measured in its stability field in order to examine the conductivity variation associated with the olivine-wadsleyite transition. All high pressure experiments were carried out at 16 GPa using KAWAI-type multi-anvil press under controlled oxygen fugacity. Water-doped and -undoped samples were used to examine the effect of water on conductivity. All recovered samples from the water-undoped experiments show a few hundred ppm of water (maximum 910 ppm) incorporated into the sample. Two water-doped wadsleyite samples with initial water contents of 0.3+-0.01 and 1.2+-0.02 wt % were used for the conductivity measurements. The temperature ranges were 500-2000 K for water-undoped samples and 350-1000 K for water-doped samples. Above 1500 K, the electrical conductivity values of water-undoped wadsleyite show good agreement among different runs. The average activation enthalpy is about 1.7 eV. We consider that the small polaron conduction dominates above this temperature. Below 1000 K, the conductivity systematically increases with increasing water content, implying the proton conduction as a dominant conduction mechanism. Electrical conductivity of anhydrous wadsleyite in the mantle transition zone is about $3x10^{-2}$ S/m. Hydration enhances the conductivity of wadsleyite, by containing 0.01 % of water, the conductivity of wadsleyite increases by 0.3 log unit. At 0.1 and 1.0 wt % of water, the conductivity becomes $1x10^{-2}$ and $3x10^{-2}$ S/m, respectively. The conductivity jump associated with the dry olivine-wadsleyite transition is only 0.7 log units. The hydration of olivine and wadsleyite decreases conductivity jump if water is distributed homogeneously at the bottom of the upper mantle and top of the transition zone.