Electrical conductivity of lawsonite and dehydrating fluids at high-pressures and temperatures

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Lawosnite is calcium-aluminum hydrous silicate mineral with $CaAl_2Si_2O_7(OH)_2.H_2O$ stoichiometry. It is thermodynamically stable in the hydrated oceanic crust. Low velocity anomalies observed in cold subducted slabs have been related with the unusual shear wave velocities of lawsonite eclogite [1]. However, electrical conductivity of lawsonite at high pressure and temeperstures remains unknown. In this study, the electrical conductivity of lawsonite was investigated at 7 GPa, both before and after its dehydration temperature. At 1173 k, the electrical conductivity of lawsonite was around 0.1 S/m and the experimental data indicate several conduction mechanisms operated in the sample below this temperature. At temperature below 573 K activation enthalpy is significantly low (0.21 eV). The activation enthalpy in the temperature range 573 and 973 K is about 0.62 eV and increased to 0.98 eV before the dehydration (1023-1173 K). A sharp increase of electrical conductivity was observed beyond 1173 K where lawsonite dehydrates to grossular, and releases fluid. The high electrical conductivity observed in our experiments is due to the presence of fluid in the sample.

The breakdown of lawsonite was also confirmed with detailed electron probe analysis.

[1]Chanel, J., Mookherjee, M., Frost, D. J., (2012) The elasticity of lawsonite at high pressure and the origin of low velocity layers in subduction zones, *Earth Planet Sci. Lett.*, **349**, 116-125.