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Velocity and conductivity measurements on synthetic wet halite rocks at high pressure and temperature

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Intercrystalline fluid can significantly affect rheological and transport properties of rocks. Its influences are strongly dependent on its distribution. The dihedral angle between solid and liquid phases has been widely accepted as a key parameter that controls solid-liquid textures. The liquid phase is not expected to be interconnected if the dihedral angle is larger than 60 degree. However, observations contradictory to dihedral angle values have been reported. Watanabe and Peach (2002) suggested the coexistence of grain boundary brine with a positive dihedral angle. For good understanding of fluid distribution, it is thus critical to study the nature of grain boundary fluid.

We have developed a high pressure and temperature apparatus for study of intercrystalline fluid distribution. It was specially designed for measurements of elastic wave velocities and electrical conductivity. Elastic wave velocities (Vp and Vs) and electrical impedance can be measured to constrain intercrystalline fluid distribution. The apparatus mainly consists of a conventional cold-seal vessel with an external heater. The pressure medium is silicon oil of the viscosity of 10 Pa s. The pressure and temperature can be controlled from 0 to 200 MPa and from 20 to 200 C, respectively. Dimensions of a sample are 9 mm in diameter, and 15 mm in length.

Halite-water system is used as an analog for crustal rocks. The dihedral angle has been studied systematically at various pressure and temperature conditions [Lewis and Holness, 1996]. The dihedral angle is larger than 60 degree at lower pressure and temperature. It decreases to smaller than 60 degree with increasing pressure and temperature. A sample is prepared by cold-pressing and annealing of wet NaCl powder. Optical examination has shown that synthesized samples are microstructurally homogeneous. Grains are polygonal and equidimensional with a mean diameter of 300 micrometer. Grain boundaries vary from straight to bowed and 120 degree triple junctions are common. Gas and fluid bearing inclusions are visible on the grain boundaries. There are spherical inclusions or isolated worm-like channels.

In this poster, we will report preliminary results of compressional wave velocity and electrical conductivity measurements.

Keywords: elastic wave velocity, electrical conductivity, halite, water