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Synthesis of wet halite rock for the study on brine morphology via physical property measurement

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Intercrystalline fluid can significantly affect rheological and transport properties of rocks. Its influences are strongly dependent on its distribution. Fluid distribution is mainly controlled by the dihedral angle between solid and liquid phase. The liquid phase is not expected to be interconnected when the dihedral angle is larger than 60 degrees. However, cryo-SEM observations (Schenk et al., 2006) and electrical impedance measurement (Watanabe, 2010) of synthetic halite rocks have indicated the coexistence of grain boundary brine with a positive dihedral angle. Similar thin fluid films might exist at grain boundaries in crustal materials. In order to understand the nature of grain boundary brine, we study the distribution of brine in halite rocks via measurements of electrical conductivity and elastic wave velocity.

A wet halite rock sample is prepared by cold-pressing (140MPa, 40 min.) of wet NaCl powder and annealing (180C and 180MPa). A sample must meet the following requirements: (1) Halite grains must be sufficiently grown to see clearly the morphological change of brine. (2) Pores must be eliminated to infer the brine distribution from elastic wave velocities. This is also required by the evaluation of water content via FTIR measurement. In order to see how long time is required for annealing to make a requisite sample, we examined halite samples annealed for 40, 80, 120, 160 hours.

The mean grain size increases by 20% as the annealing time increases from 40 to 80 hours. No significant difference can be seen in the mean grain size among samples annealed for 80, 120 and 160 hours. On the other hand, it took 150 hours for the electrical conductivity to be a stationary value. This suggests that some structural change still continues by 150 hours. Longer time of annealing diminishes porosity, and makes a sample more transparent. FTIR measurement have shown that water content is fairly uniform in the sample annealed for 160 hours. At least 150 hours is required for annealing to make a requisite sample.