Transport properties in grain boundary water: estimation from electrokinetic phenomena

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Grain boundary water can significantly affect rheological properties of rocks through pressure-solution creep and/or fluid-assisted dynamic recrystallization (FADRX). The nature of very thin water films, which exist in grain boundaries, may be very different from that of bulk water. In order to understand rheology of water-saturated rocks, it is crucial to clarify its nature.

We are investigating transport properties in the electric double layer (EDL) through electrokinetic phenomena. EDL is formed at the solid-liquid interface. A water layer between solids is divided into three parts: two EDLs and a layer of bulk water between them. EDLs become dominant with the decrease in the thickness of the water layer. The surface conduction reflects the electric charge and the ion mobility in EDL. The streaming potential measurement provides us the information about the electric charge in EDL. We can estimate the diffusivity in EDL from the surface conduction and the streaming potential.

Experiments were conducted on brine-saturated glass-beads. When the thickness of EDL is of the order of 100 nm, the diffusivity in EDL is similar to that of bulk water. The thickness of EDL changes with the concentration of brine. We will present the relation between the diffusivity and the thickness of EDL.