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Laboratory experiment of rock's hydraulic conductivity evaluation using EK (Electro Kinetic) phenomenon

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It is very important to evaluate engineering properties of rock by using geophysical exploration methods. Especially, hydraulic conductivity is one of the most important engineering properties to investigate geological structure for high level radioactive waste disposal or carbon dioxide (CO_2) geological storage. However, measurement of hydraulic conductivity requires huge consumption times. So if hydraulic conductivity is estimated by geophysical methods cost-effectively, the measurement time will be reduced.

When elastic wave is propagated into rocks, small streaming potential is generated. This is called EK (Electro Kinetic) potential, which may have a correlation with hydraulic conductivity. Hydraulic conductivity can be estimated easily by measuring the potential of rock during propagation of elastic wave.

To verify the relationship between EK potential and hydraulic conductivity, we constructed the equipments to measure the EK potential of soil and rock samples, and conducted laboratory measurements. As a result, hydraulic conductivity was related to phase delay of EK potential by the measurements of soil samples. This suggests that hydraulic conductivity can be estimated by measuring the phase delay of EK potential.

Keywords: Hydraulic conductivity, Electro Kinetic phenomenon, Geophysical Exploration, Elastic wave, Phase velocity