A new apparatus for measuring elastic wave velocity, electrical conductivity and permeability of fluid-saturated rocks at various confining and pore-fluid pressures

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Both conductivity and permeability of fluid-saturated rocks are sensitive to the structure of pores. Conductivity and permeability depend differently on the aperture of pores. Simultaneous measurements of conductivity and permeability thus impose strong constraints on inferring the structure of pores. A new apparatus has been made for measuring elastic wave velocity, electrical conductivity and permeability of fluid-saturated rocks at various confining and pore-fluid pressures. The apparatus is composed of a pressure vessel and a pore-fluid control system. The pressure vessel has 16 electrical feedthroughs for velocity and conductivity measurements. The pressure medium is silicone oil and the maximum pressure is 200 MPa. A piston-cylinder system (Watanabe and Higuchi, 2014; 2015) is used for the electrical insulation and pore-fluid pressure transmission. The pore-fluid is electrically isolated from the metal work to enable us to measured conductivity of a rock sample. The transient pulse method (e.g., Brace et al., 1968) is employed for permeability measurement. Pore-fluid pressure is uniformly set to be a prescribed value prior to a measurement. At the beginning of a measurement, a small pressure pulse is introduced in the upstream. The pressure in the upstream decays as the fluid flows through the sample. Permeability is determined from the pressure evolution in the upstream. Preliminary results will be presented in our poster.

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