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# Microscopic pore structure and macroscopic fluid flow-chemical transport in host rocks and barrier materials

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Fluid flow and chemical transport in porous media are the macroscopic consequences of pore structure, which integrates geometry (e.g., pore size and surface area, pore-size distribution) and topology (e.g., pore connectivity)[1]. Low-permeability geological media whose pores are poorly interconnected will exhibit the characteristics of anomalous diffusion and sample size-dependent effective porosity, which will strongly impact long-term net diffusion and retention of radionuclides in geological repository settings involving different host rocks and barrier materials. A suite of innovative and complementary experimental approaches is utilized to study the microscopic pore structure and macroscopic fluid flow & chemical transport for a range of natural rocks (such as clay/shale, crystalline rock, salt), in addition to standard clay minerals. With a particular focus on quantifying the presence and magnitude of "isolated" pores for a reduced effective porosity in low-permeability geomedia, the integrated methodologies for basic properties and pore structure characterization of these geomedia include X-ray diffraction, thin section petrography, grain size distribution, water immersion porosimetry after vacuum-pulling for full saturation, mercury intrusion porosimetry, nitrogen physisorption, scanning electron microscopy, X-ray computed tomography, and (ultra-)small angle neutron (X-ray) scattering. In addition, custom-designed gas diffusion, tracer recipe involving a range of anionic and cationic chemicals with subsequent analyses by laser ablation and inductively coupled plasma-mass spectrometry, along with batch sorption, column transport, and imbibition tests were conducted for coupled effects of pore structure and chemical retention/transport [2].

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