Material Characterization for Intermediate Scale Testing to Develop Strategies for Geologic Sequestration of CO_2

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Abstract. In order to develop effective strategies for safely storing CO_2 in deep geological formations, it is necessary to understand the fundamental processes that contribute to stable entrapment in naturally heterogeneous subsurface formations. Because controlled experiments to generate data at all scales of interest are not feasible to perform in field settings, the use of intermediate scale laboratory test systems was pursued to generate comprehensive data sets. Due to the nature of the CO_2 geological sequestration where supercritical CO_2 is injected under high pressure of > 8 MPa, one of the challenges in conducting such experiments under "ambient laboratory conditions" is the selection of test fluids that can be used as surrogates for supercritical CO_2. In this study, a mixture of Glycerol-water (8:2 by weight) and Soltrol 220 was selected as the surrogate fluids for the brine and supercritical CO_2, respectively, based on the fluid properties such as density and viscosity. The study focuses on the methodology to identify the capillary pressure – saturation relationships and the relative permeability of the test sands for the above-mentioned fluids. A 50 cm tall column equipped with a couple of capacitance sensors for phase saturation measurement was used to measure the retention curves. The experimental data were compared with the retention curves which were obtained from scaling factors of entry pressure and Leverett scaling. A slight difference between the experimental and scaled residual saturations was observed. Another series of tests are underway using a long column to measure the relative permeability. These hydraulic properties will be used as the fundamental material properties when simulating the intermediate tank experiments.

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