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Experimental investigation of the infiltration of liquid CO2 into water-saturated, two-dimensional porous micro-models using micro-PIV
F. KAZEMIFAR, G. BLOIS, D.C. KYRITSIS, K.T. CHRISTENSEN, Univ. of Illinois — A novel experimental apparatus has been developed to study the interaction of two immiscible fluids in a two-dimensional porous micro-model. The two fluids considered are liquid CO_2 and water. This flow process is relevant to many engineering applications such as sequestration of CO_2 in geological formations as well as enhanced oil recovery operations. Saline aquifers have very high potential for geological sequestration of CO_2 based on several factors, including high capacity, economics and minimum environmental impact. In such a process, CO_2 must displace the resident fluid of the porous structure; i.e. brine. The lower viscosity and density of CO_2 compared to brine results in complex mechanisms of brine displacement. While early studies focused on qualitative observations of fluid–fluid interactions, in this study, the microscopic particle image velocimetry technique is employed to simultaneously quantify the flow fields within each fluid phase. The interface dynamics, migration and trapping mechanisms are of particular interest. In such flows, viscosity and interfacial tension are the controlling parameters which, in the vicinity of the critical point, become very sensitive to changes in pressure and temperature.

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