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Multiphase flow towards coupled solid-liquid interactions in 2D heterogeneous porous micromodels: a fluorescent microscopy and micro-PIV measurement at pore scale[1] YAOFA LI, University of Notre Dame, FARZAN KAZEMIFAR , California State University, Sacramento, GIANLUCA BLOIS, University of Notre Dame, KENNETH CHRISTENSEN, University of Notre Dame, Kyushu University, KENNETH CHRISTENSEN, NOTRE DAME TEAM —
Multiphase flow in porous media is relevant to a range of applications in the energy and environmental sectors. Recently, the interest has been renewed by geological storage of CO_2 within saline aquifers. Central to this goal is predicting the fidelity of candidate sites pre-injection of CO_2 and its post-injection migration. Moreover, local pressure buildup may cause micro-seismic events, which could prove disastrous, and possibly compromise seal integrity. Evidence shows that the large-scale events are coupled with pore-scale phenomena, necessitating the understanding of pore-scale stress, strain, and flow processes and their representation in large-scale modeling. To this end, the pore-scale flow of water and supercritical CO_2 is investigated under reservoir-relevant conditions over a range of wettability conditions in 2D heterogeneous micromodels that reflect the complexity of real sandstone. High-speed fluorescent microscopy, complemented by a fast differential pressure transmitter, allows for simultaneous measurement of the flow field within and the instantaneous pressure drop across the micromodels. A flexible micromodel is also designed, to be used in conjunction with the micro-PIV technique, enabling the quantification of coupled solid-liquid interactions.

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