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Characteristics of acoustic emissions during fluid front displacement in porous media

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Recent studies have shown that displacement of fluid fronts in porous media produce measurable acoustic events. The aim of this work is to quantify influence of displacement process and pore space characteristics on the pattern of amplitude and frequency of acoustic signals. Acoustic emission events, amplitudes and waveforms induced by drainage and imbibition experiments in porous media-filled Hele-Shaw cells under different displacement rates (imposed by a syringe pump) and pore sizes were recorded and analyzed. Experiments were performed at flow rates ranging from 0.1 ml min^{-1} to 10 ml min^{-1} to evaluate effects of displacement rate on interfacial energy release generating acoustic emissions. We repeated the experimental sequence with various sands and uniform glass beads with particle diameters ranging from 0.1 mm to 1 mm. High spatial and temporal resolution observations of single pore filling and emptying events are recorded visually and acoustically to identify attributes associated with the interfacial configuration process giving rise to particular acoustic emission signatures. Comparisons with simple theoretical bubble models and sequences of interfacial configuration envelopes provide a rudimentary basis for constraining and generalization of experimental results.