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Influence of micro-fabric heterogeneity on fracture alterations during shear

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Because of the low permeability of shale, fractures typically act as the primary flow conduits in these formations. It is therefore imperative to understand the fundamental processes that influence fracture properties in shale to accurately predict unconventional resource production as well as ensure sequestered CO2 does not migrate out of a storage reservoir. In this study, a novel shearing apparatus was used in conjunction with a Hassler-style core holder to incrementally shear various shale cores while maintaining various confining pressures to simulate a fracture subjected to shearing forces. Intermittent computed tomography scans performed after each shearing event were used to obtain information on evolving fracture morphology. Transmissivity of the fracture was measured after each shearing event to better understand the hydrodynamic response to the evolving fracture morphology.
Two distinct shales were sheared using this process: a relatively homogeneous section of black Marcellus shale and heterogeneous subcores of Eau Claire shale. The heterogeneous Eau Claire shale exhibited more complex fracturing behavior with multiple secondary fractures. Fracture intensity throughout the samples was measured as a function of sheared differences and the relationship between micro-fabric complexity and fracture evolution is presented for these samples.

References

Crandall, D., Moore, J., Gill, M, and Stadelman, M. (2017) "CT Scanning and flow measurement of shale fractures after multiple shearing events"International Journal of Rock Mechanics and Mining Sciences 100, 177-187.

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