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# Experimental Study of Dissolution Regimes in a Multiphase Flow Environment with Real-Rock Microfluidics

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Multiphase flow coupled with rock dissolution is prevalent in subsurface energy applications and natural phenomena, such as karst formation, acid stimulation, and CO<sub>2</sub> sequestration. The interplay between multiphase flow and rock dissolution will profoundly influence the geochemical and geophysical properties of reservoir formation. Despite its importance, we still lack a thorough understanding of the coupling of multiphase flow and rock dissolution. Here, microfluidics fabricated with the geo-materials are used to study the pore-scale mechanism of rock dissolution in a multiphase flow environment. Experimental findings reveal dissolution regimes contingent upon injection rates and the channel geometries. At lower injection rates and in more homogeneous geometries, the dissolution exhibits a uniform regime. In this regime, the evolution of the rock surface aligns with classical assumptions, facilitating the prediction of long-term dissolution rates. While under stronger flow and heterogeneous conditions, the dissolution exhibits a localized regime, and the dissolution rate deviates significantly from the classical assumptions. Experimental observations identify a pore-scale barrier mechanism that suppresses the overall dissolution rate and leads to this deviation. We also proposed a theoretical model for the regime transition, which offers guidance on the prediction of dissolution rate across various dissolution scenarios.

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## References

## Conference Proceedings

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