Contribution ID: **42** Type: **Oral Presentation**

Impact of hydrodynamics on accessible mineral surface area

Monday 19 May 2025 17:25 (15 minutes)

Predicting mineral reaction rates in porous media is challenging, in part due to the difficulty of accurately quantifying mineral reactive surface area. Mineral accessible surface area, the surface area of mineral phases in contact with reactive fluids, is an improved means of estimating mineral reactive surface area in multi-mineralic systems. Accessible mineral surface areas can be obtained from multi-scale imaging analysis and integrated into reactive transport simulations. However, variations in hydrodynamics at the pore scale may restrict the interaction of accessible mineral surfaces with the reactive fluid. Here, we aim to characterize the impact of hydrodynamics on mineral accessibility for varied flow conditions using direct numerical simulations carried out in OpenFOAM. A series of simulations considering transport of a solute through varied porous media domains, from simple to more complex geometries, are carried out considering a range of typical flow conditions captured by varied Peclet numbers. For each simulation, the impact of hydrodynamics on mineral reactivity is considered by tracking the evolution of the solute concentration at the particle surfaces over time. Simulation results reveal the conditions under which hydrodynamics must be considered to accurate capture mineral reactivity.

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References

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Session Classification: MS08

Track Classification: (MS08) Mixing, dispersion and reaction processes across scales in heterogeneous and fractured media