



Contribution ID: 307

Type: Oral Presentation

Pore-scale investigations of two-phase flow on mineral reaction rate

Tuesday, 23 May 2023 09:30 (15 minutes)

In various subsurface systems, the interactions between multi-phase flow and mineral reactions play an important role in controlling the evolution of porous media. These interactions - especially the impacts of multiphase flow dynamics on mineral reaction rates - are rarely accounted for in continuum scale models, or are simply corrected via reactive surface area and saturation of the aqueous phase. However, the relations (e.g., power laws between reactive surface area and water saturation), used for the correction are not based on pore-scale dynamics. Our previous study of a single channel with different levels of roughness showed that the mineral reaction rate in a gas bubble flow is significantly reduced compared to a single-phase flow system at the same flow rate. The extent of reduction in reaction rate follows a non-monotonic relationship with respect to water saturation, in contrast to the traditionally-used monotonic relationship (i.e., a power law relationship). In this study, we extend our investigations to pore-doublet geometries, to examine how two-phase flow dynamics arising from competing channels as would be expected in complex porous media affect mineral reaction rates. For our investigations, we control the two-phase flow dynamics by varying the air and water flow rates (i.e., capillary number) and the relative difference between the competing channels. Calcite dissolution rate in these channels is quantified for the two-phase flow cases with different saturations and the corresponding single-phase flow case. The relationships between the changes in dissolution rate in two-phase flow cases and the wetted surface area, the interfacial area, and water saturation are examined to provide insights on improving reaction rate descriptions in multiphase continuum scale models.

Participation

In-Person

References

MDPI Energies Student Poster Award

No, do not submit my presentation for the student posters award.

Country

China

Acceptance of the Terms & Conditions

[Click here to agree](#)

Energy Transition Focused Abstracts

Primary authors: Dr DENG, Hang (Peking University); Mr WANG, Xin (Peking University)

Presenter: Dr DENG, Hang (Peking University)

Session Classification: MS08

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