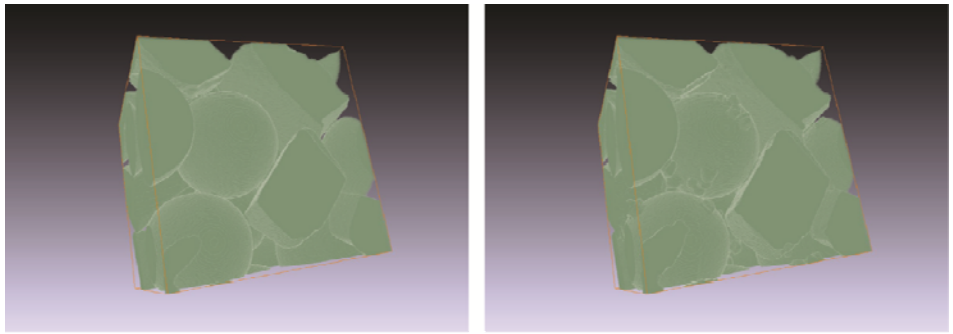
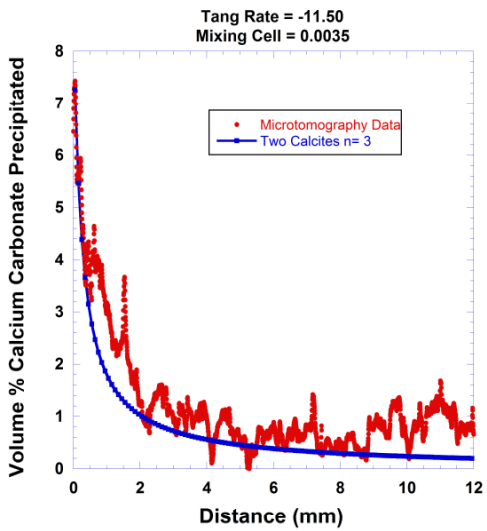
Upscaling Calcium Carbonate Precipitation Rates from Pore to Continuum Scale



X-ray microtomographic images of calcite and glass beads from flowthrough column experiment.
Left: Before reaction. Right: After 28 days of reaction



X-ray sychrotron microtomography of calcite precipitation (red) and continuum reactive transport modeling (blue)

Scientific Achievement

Demonstrated applicability of experimentally-determined rate laws by combining X-ray synchrotron mapping of mineral precipitation with kinetic experiments and modeling at the larger porous medium scale.

Significance and Impact

This is the first reconciliation of micron-scale observation of mineral precipitation and continuum-scale reactive transport modeling. In this case, there is no discrepancy between results at different scales.

Research Details

- X-ray synchrotron microtomography used to quantify integrated precipitation rates at the micron scale.
- Stirred reactor kinetic data used to constrain intrinsic rates in absence of porous medium
- Demonstrated importance of modeling reactive surface area evolution in case of mineral precipitation

C. Noiriel, C. Steefel, L. Yang, J. Ajo-Franklin (2012) *Chemical Geology* **318-319**, 60-74.