

Reactive transport through mesoporous media

Opportunity

One of the major challenges facing mankind is the capture and long-term storage of CO₂ from the burning of fossil fuels. We don't understand how to do this on a scale large enough to sequester the billion metric tons produced annually. Physical and chemical trapping of CO₂ are the two most promising options, but they are not fully developed.

Meso Challenge

What makes it meso? Physical trapping of CO₂ involves injecting it into saline aquifers, depleted oil/gas reservoirs, gas shale, and coal deposits. Understanding multi-scale fluid flow in porous rocks at the mesoscale is required. Achieving large-scale chemical trapping requires enhanced kinetics of mineral carbonation and how this process can increase the porosity and permeability of rocks at the mesoscale.

Approach

Element-sensitive mesoscale imaging of multiphase fluid flow through porous rocks and of reaction products (and their location) from mineral carbonation reactions are a major challenge that can be addressed using high-energy x-ray CT scanning at synchrotron light sources. New beamlines at the APS dedicated to this problem are needed.

Impact

Successful physical and/or chemical trapping of CO₂ will help solve one of the major environmental problems facing mankind.

