Karlsruhe Institute of Technology

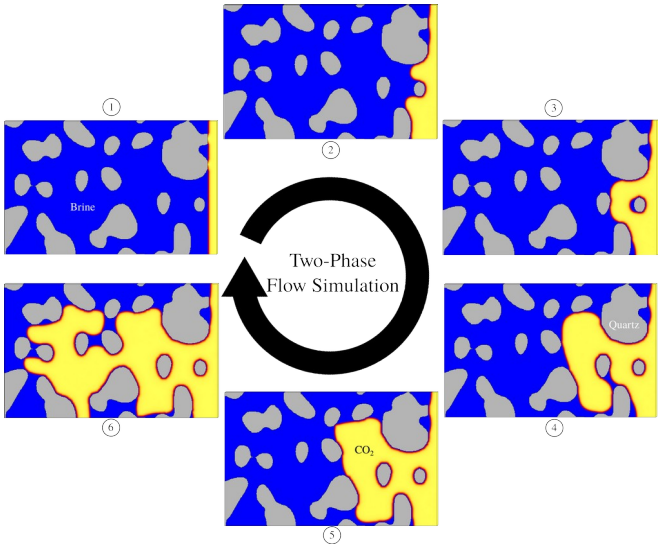
Bachelor/Master Thesis

IAM Institute for Applied Materials

Modeling Two-Phase Flow and Salt Crystallization in Sandstone

Background:

Understanding two-phase flow in porous geological storage sites is crucial for predicting their long-term behavior and safety for CO_2 storage. At the pore scale, CO_2-brine interactions, including interface migration, capillary-driven displacement, and evaporation-induced salt crystallization, governs pore clogging, permeability reduction, and ultimately storage efficiency. Using multiphysics modeling, these coupled processes can be simulated at the microscale, providing insights into these pore-scale processes, essential for assessing storage integrity and reservoir sustainability.



Your tasks:

Perform simulations using a two-phase-flow phase-field model to simulate for CO_2–brine interface dynamics in realistic digital grain-structures Extend the simulations to include evaporation-driven salt crystallization and pore clogging. Perform systematic studies on pore geometry, wettability, and flow rates, and documentation of research outcomes.

Qualifications:

Applicants should have a basic understanding of fluid dynamics and/or materials science, with a strong interest in numerical simulations and learning new modeling approaches. Motivation for independent scientific work is essential. Programming experience in C and Python is advantageous but not mandatory, and familiarity with Linux environments is considered a plus.

We offer:

- Intensive support
- Modern workstations and high-performance computers as working environment
- Cooperation with international research groups
- Possibility to extend work into a publication or research position
- Career perspectives as young scientist

Interested?

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