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Pore-scale Modelling of Salt and Hydrate Formation During CO2 Injection

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As a greenhouse gas, CO2 contributes significantly to the rise in global temperatures. The concentration of CO2 in the atmosphere has increased by 45\% since the First Industrial Revolution, as a result of continuous CO2 emissions. In order to reduce artificial emissions of CO2 into the atmosphere, measures must be taken. Currently, fossil fuels still dominate the energy market, and CO2 capture and storage is considered the most feasible and effective method of reducing CO2 emissions. However, injection of CO2 into the subsurface water presents significant challenges, especially near the well bore. During CO2 injection into saline aquifers, salt precipitation near the well and the formation of hydrates near the well are two significant challenges reported in the literature. These challenges can result in injectivity loss if not mitigated.

Understanding the fundamental physics of the problem, identifying the critical physical and chemical parameters that may affect salt precipitation requires pore-scale insight. Pore scale simulations in contrast to Darcy-scale simulations require less requirements about fluid dynamics and reactions and thus they provide more detailed insights into the processes, but these models cannot simulate physically a large system due to computational limitations. The objective of this study is to develop pore-scale models for non-isothermal, multicomponent multiphase flows along with a geochemical simulator that can simulate thermodynamic conditions. This study will also provide recommendations on designing and the required time scale for laboratory experiments, such as salt precipitation and hydrate formation. It is also the objective of this study to investigate how porous media properties can be upscaled for given thermodynamic conditions based on dynamic conditions.

Participation

In-Person

References

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Primary author: MOHAMMADREZAEI, Saleh

Co-authors: Dr FARAJZADEH, Rouhi (TU-Delft); NIASAR, Vahid (University of Manchester)

Presenter: MOHAMMADREZAEI, Saleh

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