Contribution ID: **8** Type: **Oral Presentation**

Design of viscosified CO2 for carbon storage in saline aquifers by continuum-scale imaging and modeling

Thursday, 16 May 2024 11:50 (15 minutes)

Carbon capture, utilization, and storage (CCUS) is expected to play an essential role in global decarbonization. Safe and efficient storage of CO2 in saline aquifers requires mobility control to prevent CO2 from exposure and accumulation at the formation top. An effective agent for CO2 mobility control should be carefully tailored with low adsorption in rock surfaces, low injection pressure, and high capacity of carbon storage. Here, we develop and utilize engineered oligomers at very low concentrations to directly viscosify the sc-CO2 and demonstrate their effectiveness for improving CO2 storage in saline aquifers with layered formation. We also present results from X-ray CT imaging to advance the understanding of two-phase CO2-brine flow in layered cores and firmly establish the transport mechanisms.
X-ray CT imaging of displacement experiments is conducted to quantify the in-situ sc-CO2 saturation spatiotemporally in the brine-saturated porous media with homogeneity and heterogeneity. In neat CO2 injection, the large mobility contrast between the CO2 and brine results in the channeling of CO2 through the high permeability zone, leading to an early breakthrough and low brine production. Direct measurement and in-situ saturation measurement show that there is around 10% difference for cumulative brine production in neat CO2 injection. The difference between the two is attributed to the solubility of the produced water in the produced CO¬2 at atmospheric pressure which has been neglected in the past. We show that when the forgotten effect is accounted for, there is a good agreement between direct measurements and in-situ saturation results. The X-ray imaging demonstrates that the large effect of improved carbon sequestration is attributed to reduction of residual brine saturation from increase in interfacial elasticity from the addition of the oligomers. The combination of mobility control and residual brine saturation reduction is expected to improve CO2 storage in layered formation by effective viscosification at very low concentrations of oligomers. We also develop a model coupled with hydrodynamics and thermodynamics to compare, identify and analyze with the experimental observations from X-ray CT imaging. The model sheds light on understanding the CO2 flow in saline aquifers.

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

Country

China

Porous Media & Biology Focused Abstracts

References

Primary authors: Prof. FIROOZABADI, Abbas (Rice University); Dr DING, Boxin (Peking University Shenzhen Graduate School)

Co-author: Prof. KANTZAS, Apostolos (University of Calgary)

Presenter: Dr DING, Boxin (Peking University Shenzhen Graduate School)

Session Classification: MS01

Track Classification: (MS01) Porous Media for a Green World: Energy & Climate