Contribution ID: **1063** Type: **Poster Presentation**

Pore-scale insights into CO2-water two-phase flow and implications for benefits of geological carbon storage

Thursday, 16 May 2024 10:20 (1h 30m)

The overall benefits of geological carbon storage (GCS) depend primarily on CO2 storability and injectability, expressed as saturation and relative permeability, respectively. The effects of GCS schemes on these two properties, the macroscopic response indicators of a two-phase seepage system, are closely related to pore-scale two-phase behaviors. However, the comprehensive effects of capillary number (Ca) and wettability (θ) on saturation and relative permeability are poorly understood. Here we proposed a digital rock physics (DRP) technique workflow for the phase field method and systematically investigated that how these effects control two-phase seepage at pore scale through the high-resolution visualization results obtained. We created a Ca-θ phase diagram identifying by four pore-scale displacement mechanisms, including finger-like invasion, burst, cooperative filling and coexistence of concave and convex interfaces, to illustrate the comprehensive effects of Ca and θ. We found that the relative permeability of the defending phase (water in this work) is determined by the net effect of the direct driving and viscous coupling effects. We organized comprehensive Ca-θ diagrams and revealed that a higher Ca and higher θ condition favors CO2 injectability, and a lower Ca and weak water-wetting condition favors CO2 storability. Our results demonstrate that GCS schemes, mainly about capillary number and wettability, can significantly influence CO2 storage performance via the two-phase flow at pore scale, which should be considered carefully. This work provides valuable insights into the selection of an optimal GCS scheme and contributes to an in-depth understanding of multiphase seepage at pore scale.

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

Country

China

Porous Media & Biology Focused Abstracts

References

Conference Proceedings

I am not interested in having my paper published in the proceedings

Primary authors: Prof. DUAN, Kang (Shandong university); 刘, 景锐

Presenter: 刘, 景锐

Session Classification: Poster

Track Classification: (MS09) Pore-scale modelling