Contribution ID: **959** Type: **Oral Presentation**

Dissolution of trapped CO2 in carbonates rock at high pressure and high temperature conditions using X-ray micro-tomography

Wednesday, 24 May 2023 14:30 (15 minutes)

Capillary trapping is an effective and rapid mechanism for CO2 storage in underground formation, which has been studied by many researchers. However, the long-term storage of trapped CO2 can be affected due to its dissolution into non-CO2 equilibrated brine. Understanding the mass transfer of CO2 into formation brine both qualitatively and quantitively is crucial for improving the security of geologic carbon storage. The aim of this project is to develop an understanding of the trapped CO2 dissolution behavior in carbonate rocks using X-ray micro-tomography. In this project, CO2-brine flow experiments were performed using a unique X-ray transparent flow apparatus, specifically designed for 120 ℃ and 200 bar. After establishing the residual saturation of supercritical CO2 (i.e., trapped CO2) using CO2-equilibrated brine, the sample was scanned after injecting pre-determined pore volumes (e.g., 0.5 PV, 1.0 PV) of non-CO2 equilibrated brine. The results shows that CO2 saturation decreases from 17.34% to 7.5% with 1 PV injection of non-CO2 equilibrated brine. In spite of slow injection rate, two unique pore-scale processes were observed, i.e., CO2 dissolution and CO2 re-mobilisation. This study will be extended to 4D (i.e., time-resolved 3D) synchrotron imaging to obtain a better understanding of these interlinked dynamics.

Participation

In-Person

References

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Primary author: MAZELI, Abdul Hakim

Co-authors: MENKE, Hannah (Heriot-Watt University); MAES, Julien (Heriot-Watt University); SINGH, Kamaljit (Heriot-Watt University)

Presenter: MAZELI, Abdul Hakim

Session Classification: MS06-A

Track Classification: (MS06-A) Physics of multiphase flow in diverse porous media