Contribution ID: **390** Type: **Oral Presentation**

Numerical Modeling of CO2 Solution Injection into Korean Basalt for Rapid Geological Carbon Storage through Mineralization

Monday 19 May 2025 12:10 (15 minutes)

CO2 storage in basaltic formations has emerged as a promising method for carbon sequestration due to its rapid mineralization rates, as demonstrated by several projects (e.g., CarbFix in Iceland, Wallula in the USA, and 44.01 in Oman). This study numerically investigates the efficacy of CO2 solution injection into basalt formations in the Republic of Korea. We implement geochemical reactions for basalt dissolution and carbonate precipitation, accounting for changes in porosity and permeability. The model's performance is validated by comparing core-scale simulation results with experimental data from CO2-ionized water injection into basalt outcrop samples from Cheorwon and Jeju Island, volcanic regions in Korea. Performance evaluation criteria include calcite precipitation, porosity, permeability, and pressure changes. Sensitivity analysis examines the effects of CO2 solution types (i.e., CO2-ionized water vs. CO2-dissolved water) and mineral compositions on carbon mineralization. Following the core-scale analysis, we conduct field-scale simulations of CO2 solution injection using geophysical data of basaltic formations near Jeju Island. The field-scale study examines the contributions of solubility trapping and mineral trapping mechanisms under various storage conditions, including depth, temperature, pressure, and fracture density. Furthermore, the effects of CO2 concentration in the injected fluid are analyzed to identify efficient and secure carbon sequestration strategies that minimize leakage risks. These modeling and simulation results provide insights into the potential of CO2 storage in Korean basaltic formations, contributing to the country's carbon capture and storage initiatives.

Country

Republic of Korea

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

Water & Porous Media Focused Abstracts

References

Authors: Ms YOON, Soeun (Ewha Womans University); Prof. MIN, Baehyun (Ewha Womans University)

Co-authors: Dr AHN, Youngbin (Ewha Womans University); Prof. KWON, Tae-Hyuk (Korea Advanced Institute of Science & Technology); Dr SEO, Jeonggyu (Korea National Oil Corporation); Mr PARK, Jaehan (Korea National Oil Corporation); Mr KIM, Jihyuk (Korea National Oil Corporation); Mr KIM, Hosang (Korea National Oil Corporation)

Presenter: Prof. MIN, Baehyun (Ewha Womans University)

Session Classification: MS07

Track Classification: (MS07) Mathematical and numerical methods for multi-scale multi-physics, nonlinear coupled processes