



SCHOOL OF
CHEMICAL ENGINEERING
College of Engineering, Architecture and Technology

PETE SEMINAR SERIES

Effect of CO₂ injection on the poromechanical and multiphase flow characteristics of subsurface rock

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Geologic carbon storage has a great potential in reducing the atmospheric CO₂ emission by permanently storing large volumes of carbon dioxide in reservoir formations sealed with tight rock. During CO₂ injection, multi-physical processes occur, affecting the mechanical stresses, pore pressures, temperatures, and chemistry of the participating subsurface rocks and pore fluids. These processes are coupled, meaning that changes in each aspect do impact the others mutually. Thus, the interdependent factors need to be understood as a combined system, while it should also incorporate the time-dependent response, as CO₂ is projected to be stored for thousands of years. Furthermore, to avoid CO₂ leakage through the sealing layers, their poromechanical and hydraulic properties need to be thoroughly addressed. Experimental techniques are introduced to characterize the poroviscoelastic and hydraulic behavior, including two-phase flow, with CO₂ treatment tests conducted under high-pressure conditions. Hydro-mechanical-chemical coupling constitutive model is adopted to address the chemo-poro-viscoelastic response of subsurface rock, with additional studies to explore the impact of the duration of CO₂ injection. Ultra-low permeability of the sealing formations is accurately measured in a few month-long experiments and is coupled to the mechanical and pore network characteristics of the rock. In summary, this presentation provides a comprehensive experimental work aimed at characterizing the poromechanical and hydraulic response during CO₂ injection, where the chemical effect is also investigated.

ENGINEERING NORTH 305

OCTOBER 16, 4:30 - 5:30PM

Dr. Kim investigates the rock-fluid interactions to the application of geoenery systems, leading research in his Geoenery Systems Laboratory. Employing a multiscale experimental approach, his work aims to understand the multiphysically coupled responses of these

systems under in-situ conditions. After completing his Bachelors and Masters degree from Korea University, Dr. Kim achieved his PhD degree from Civil Engineering – with a focus in rock mechanics, from the University of Illinois. In Fall 2023, he joined the Petroleum Engineering department at Texas A&M University.

