

ARMA Future Leader Webinar Series

Every Two Weeks on Fridays 9-10 am MT (11 am – 12 pm ET)

Full Lifecycle Cement Sheath Integrity of CCUS Wells

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<https://stonybrook.zoom.us/j/9539339965?omn=96069259795>

Abstract

CCUS (or CCS) serves as an effective strategy for reducing CO₂ emissions by storing it in geological formations such as depleted reservoirs and deep saline aquifers. A critical aspect of this process is understanding the failure mechanisms of the cement sheath under complex conditions. The analysis of cement sheath integrity is complicated by corrosion-induced stress and cracking, which are exacerbated by high stress levels, challenging failure prediction and necessitating comprehensive models that incorporate both corrosion effects and mechanical deformation. Effective modeling must consider the loading history of the cement sheath throughout the lifecycle of oil and gas wells, including initial conditions and cement shrinkage stress, complicating long-term performance predictions. Furthermore, accurately estimating the corrosion-mechanical coupling remains a significant challenge, as existing research often overlooks the effects of loads during corrosion, complicating the integration of mechanical and corrosion factors within a unified predictive model. Our analysis of corrosion test data shows that supercritical CO₂ leads to calcium loss, microstructural loosening, increased porosity, and reduced compressive strength in cement. We introduce a THMC model that considers these changes.

Biography

Xiaorong Li, an Associate Professor of Offshore Oil and Gas Engineering at China University of Petroleum (Beijing), she obtained her Ph.D. from the University of Texas at Austin in 2018. Her research focuses on petroleum-related rock mechanics, specifically wellbore stability and well integrity in complex oil and gas wells. She has published over 40 papers and holds more than 10 patents. She has received multiple awards, such as the Young Elite Scientists Sponsorship Program by CAST and the second prize of the Beijing Science and Technology Progress Award. She is also actively involved in various academic and professional activities, such as serving as a guest chief editor for *Rock Mechanics and Rock Engineering (RMRE)*. She was selected as one of the American Rock Mechanics Association's 'Future Leaders'.

