A Multi-Scale Multi-Physics Framework to Study the Effect of Nano-pore Confinement on Phase Behavior and Transport Properties of Reservoir Fluids

Professor Bahareh Nojabaei
Assistant Professor, Geoenergy Engineering
Department of Mining and Minerals Engineering
Virginia Tech University

Abstract:
Nanopore confinement effects are proven to affect the transport and phase behavior of oil and gas in the shale nano-porous media. I use multi-scale multi-physics simulation tools to better understand the rock-fluids interactions and reservoir fluid phase behavior in nanopores, and to characterize fluid flow and mass transfer mechanisms in tight rocks. In the larger scale, the goal of my research is to propose methods to optimize the primary recovery, predict future production, and also to recommend scenarios to enhance the secondary recovery of unconventional resources, in a sustainable manner.

In my presentation, I plan to briefly go through my research work on the development of a field-scale black-oil type simulation, which includes the effect of nano-sized pores on fluid phase behavior and molecular diffusion, which can be used to model both primary recovery and EOR. Next I will explain about our fully compositional simulation tool to characterize the reservoir fluid phase behavior and mass transfer in heterogeneous shale rocks during gas injection EOR, which uses a modified phase behavior model to calculate molecular diffusion coefficients under confinement effects. I will conclude my presentation by explaining about our molecular dynamics framework to study the molecular behavior of hydrocarbons, water, and CO2 in shale nano-pores, and how we are going to extend our understanding from the nano-scale up to the larger scales (field and core scale).

Biography:
Bahareh Nojabaei is an Assistant Professor of geoenergy engineering at Virginia Tech. She is also an Affiliated Assistant Professor at the GeoEnergy Research Centre in The University of Nottingham. She joined the Department of Mining and Minerals Engineering at Virginia Tech in 2016, and prior to her current position, she served as an academic professional lecturer at the University of Wyoming. Her research interests lie in the field of multi-scale phase behavior analyses and reservoir simulations for oil and gas shale reservoirs. She also performs research on the complex geophysical and rock-fluid interaction properties of unconventional reservoirs through, molecular simulation and lab experiments. She currently serves as the faculty advisor of the SPE student chapter at Virginia Tech. Nojabaei holds BS and MS degrees in mechanical engineering from Iran University of Science and Technology and Amirkabir University of Technology respectively, and she earned her PhD in petroleum and natural gas engineering from Penn State.