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Other - Enabling Process Innovation through Computation (EPIC) Seminar Series

### Multiscale Discussions on Gas Storage and Transport in Organic-rich Shale

I. Yucel Akkutlu, Texas A&M University

Patrick F. Taylor Hall 1502  
January 16, 2015 - 03:30 pm

#### Abstract:

One important idea that will be taken away from this lecture is the observation that fluid molecules in nanopores influence hydrocarbon recoveries from resource shale.

It is now well-documented that the organic-rich resource shales consist of pores with small volumes contributing to the storage of hydrocarbon fluids. These volumes are not much larger than the fluid molecules they store. Physical chemistry of fluids under confinement in such a small space is different and could lead to various equilibrium thermodynamic states under subsurface conditions; consequently, phases could change and critical properties shift unpredictably.

This presentation will discuss equilibrium and transport behavior of confined hydrocarbon fluids using atomistic modeling and molecular simulations and will be compared to the classical fluids. The behavior is different due to pore-wall dominated inter-molecular forces, mainly London dispersion and permanent dipole-dipole forces. The molecular forces also play a significant role on the fluid transport and could lead to potential non-Darcian flow effects during the production. The molecular transport effects on flow will be introduced to the audience analyzing steady-state flow of pure and binary fluids in single-wall carbon tubes using molecular simulations and analyzing the pressure pulse decay data for the permeability of core plugs under effective stress.

The presentation will conclude with an expression for single-phase "apparent" shale permeability and a demonstration of the impact of the observed fluid behavior on the hydrocarbon in-place calculations and, using a new-generation reservoir flow simulations, on the reserves.

Watch this seminar online at: <https://connect.lsu.edu/EPIC-Seminars>

#### Speaker's Bio:

Dr. I. Yucel Akkutlu is associate professor of petroleum engineering at Texas A&M University. He is the holder of George & Joan Voneiff Development Professorship in Unconventional Resources. He is a chemical engineer and holding a Ph.D. in petroleum engineering from the University of Southern California in Los Angeles. His main research interest is fluid flow, heat/mass transport and reactions in porous media. His work finds applications in reservoir engineering, particularly in the areas of IOR/EOR and unconventional oil and gas recovery. Dr. Akkutlu has begun his academic career at the University of Alberta in Edmonton, Canada, teaching reservoir engineering classes focusing on reservoir simulation and enhanced oil recovery techniques. In 2007, he moved to the University of Oklahoma. He played active role in development of shale gas research at OU. He worked on fundamental problems of gas storage and transport in organic-rich shales in the laboratory, in particular the Barnett, and developed the first multi-scale reservoir simulation models for shale gas production. He was awarded tenure in 2011. He accepted an invitation to join the Texas A&M University Petroleum Engineering Faculty and moved to College Station in January 2013. He participated in the efforts to develop W.D. Von Gonten Laboratories at the Texas A&M University Research Park for the unconventional resources research. His current research deals with the scaling-up and homogenization of coupled transport (viscous and diffusive) and reaction processes in low-permeability geological formations exhibiting multi-scale pore structures. In addition, he works on projects related to atomistic modeling and development of new complex nano-fluids for enhanced recovery of shale oil.

