



UNCONVENTIONAL RESERVOIR ENGINEERING PROJECT
COLORADO SCHOOL OF MINES



Summary and Background

PHASE BEHAVIOR IN NANOPOROUS MEDIA

- UREP Research Tasks on Phase Behavior
- List of Presentations
- Plan for Integration



UNCONVENTIONAL RESERVOIR ENGINEERING PROJECT

Advisory Board Meeting, May 5, 2017, Golden, Colorado

UREP research tasks on phase behavior

PROJECT 1 Flow and Transport of Hydrocarbon Fluids in Nano-Porous Reservoirs	Phase 3 Tasks
	<ol style="list-style-type: none">1. Understand trends in field data2. Dew-point measurements in nanofluidic chips and comparison with models3. Effect of temperature on experiments4. Core measurements5. Upscaling experimental results6. Molecular simulations

In the process of receiving field data

} PVT in a chip

Capillary condensation in Niobrara

Three-phase equilibrium models

Molecular simulation of phase behavior



Phase behavior related presentations

- Younki Cho (PhD) – Vibrational gravimetric analysis of capillary condensation (T4)
- **Asm Kamruzzaman (PhD) – Pore size distribution in Niobrara**
- Ran Gao (visiting student) – Three-phase equilibrium calculations (T5)
- Kaia corporation – PVT-on-a-chip (T2 & T3)
- Yakup Coskuner (MS) – Molecular simulations (T6)



Research tasks on phase behavior (T2, T3)

T2

Phase behavior of nC_3 in nanofluidics

Comparison with Kelvin equation

Measure pressure change in the vicinity of phase change

Repeat experiments with mixtures and compare with model

T3

Design pressure / temperature enclosures

Conduct nanofluidic experiments at different temperatures

Green = Completed; Yellow = Current; White = Planned



Research tasks on phase behavior (T4, T5)

T4

Design and validation

Capillary condensation of nC_3 in Niobrara

Other rocks; dew points of gas mixtures

Compare with upscaled models (T5 – core level)

T5

Vapor-liquid phase behavior in a single pore

Vapor-liquid phase behavior in multiple pores (pore size distribution)

Vapor-liquid-adsorption phase behavior

Upscale to the core level, considering equilibrium among pores of different sizes but no variation in pressure and temperature

Coz-Sim

Upscale to the reservoir level, considering pressure variations due to flow, and explain and predict field data (T1)



Research tasks on phase behavior (T6, T1)

T6

Characterize bulk phase behavior of a pure substance

Characterize confined phase behavior of a pure substance

Characterize confined phase behavior of mixtures

Compare with model (T5 - pore) and experiments (T2 and T3)

T1

Aquire and analyze field data

Use Coz-Sim to simulate field cases and compare (T5 – reservoir)

Green = Completed; Yellow = Current; White = Planned



Phase behavior in nanopores – integration

