Research Summary

Bubble-Point Suppression Correlation

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Scope of Research

- Confirm/improve a correlation that is created by Firincioglu et al. (2013) for bubble point suppression which is applicable to black oil formulation using other fluid samples
- Re-model the impact of bubble point suppression on flow with different data sets using a black oil simulator

Application – Bubble Point Suppression

Unconventional-reservoir samples

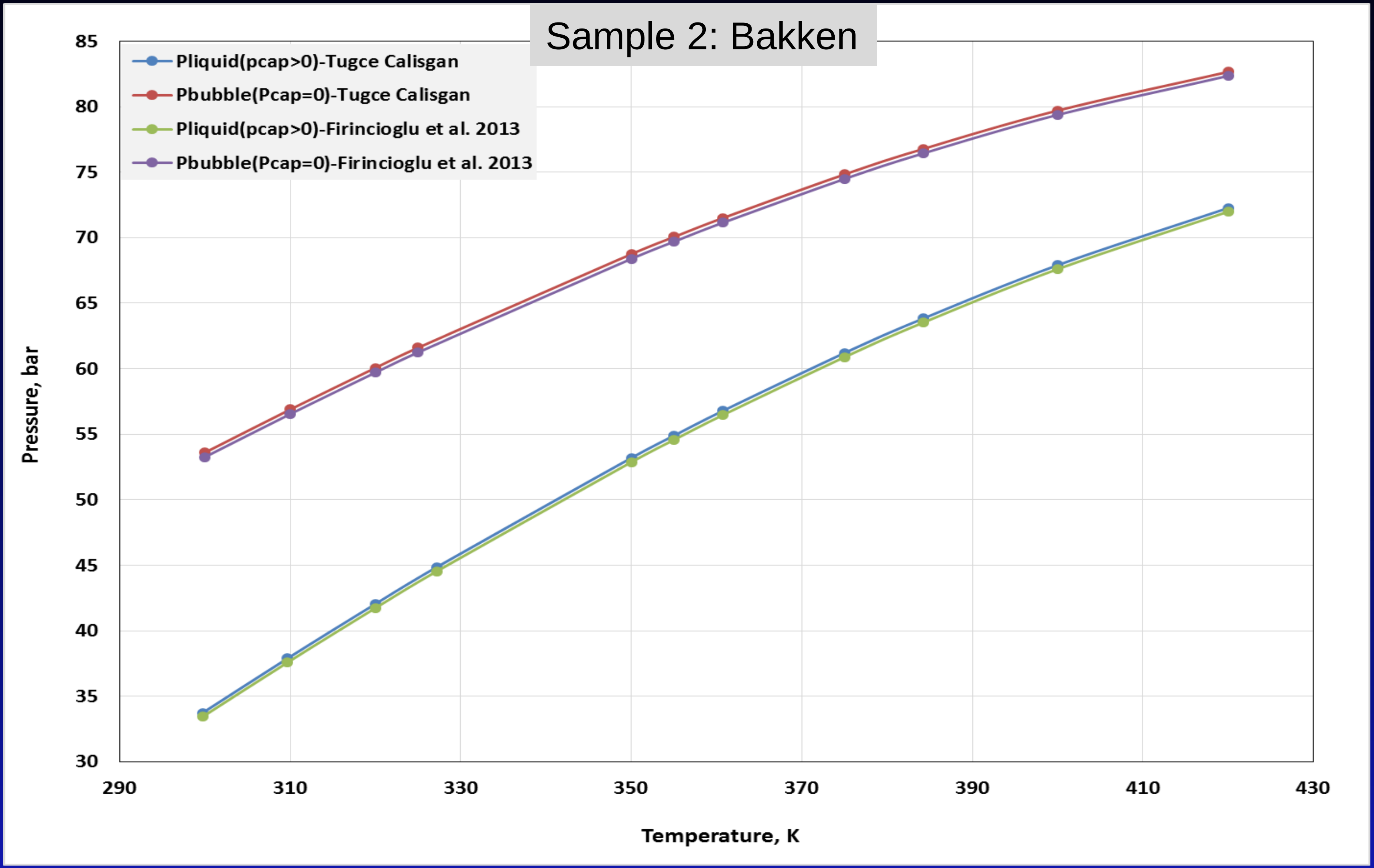
Sample 1: Monterey
Sample 2: Bakken
Sample 3: Eagle Ford

Application – Bubble Point Suppression

- VLE was solved for two pressures (P_l and P_g) for the two phases
- Capillary K value (K_c) definition is used
- PR EOS was utilized
- EOS parameters for the fluid samples that were determined through regression to lab measurements were input

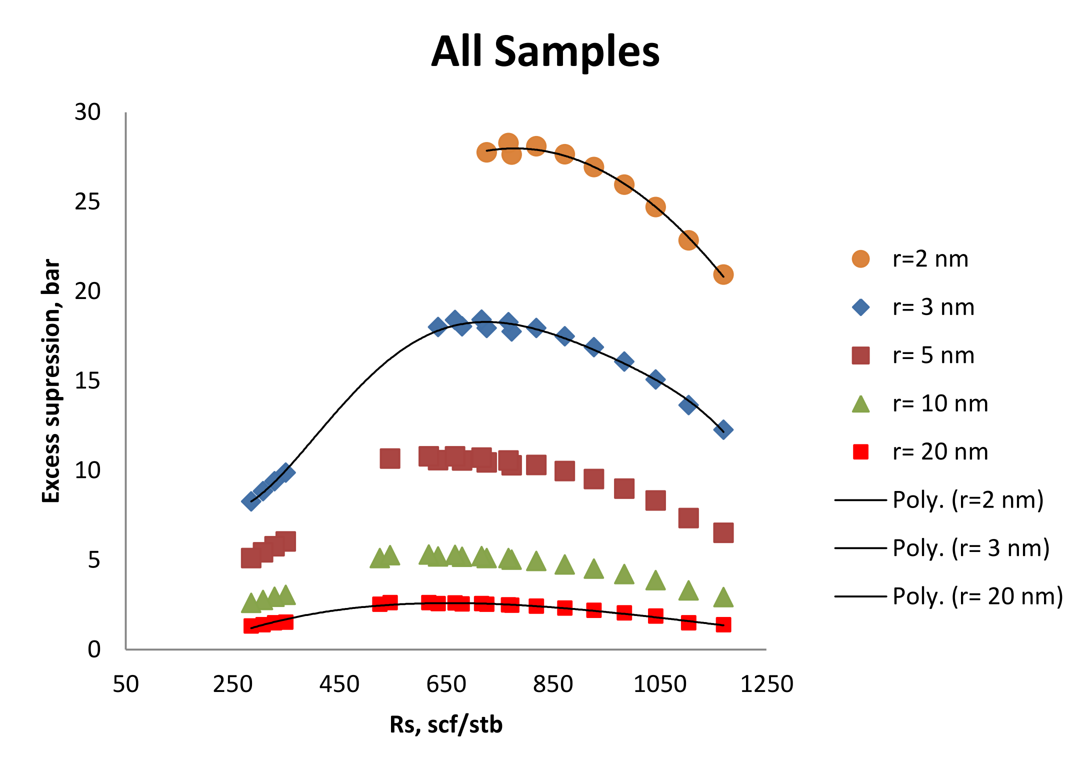
(Firincioglu, 2013)

Comparison – Bubble Point Suppression



Correlation for Excess Suppression

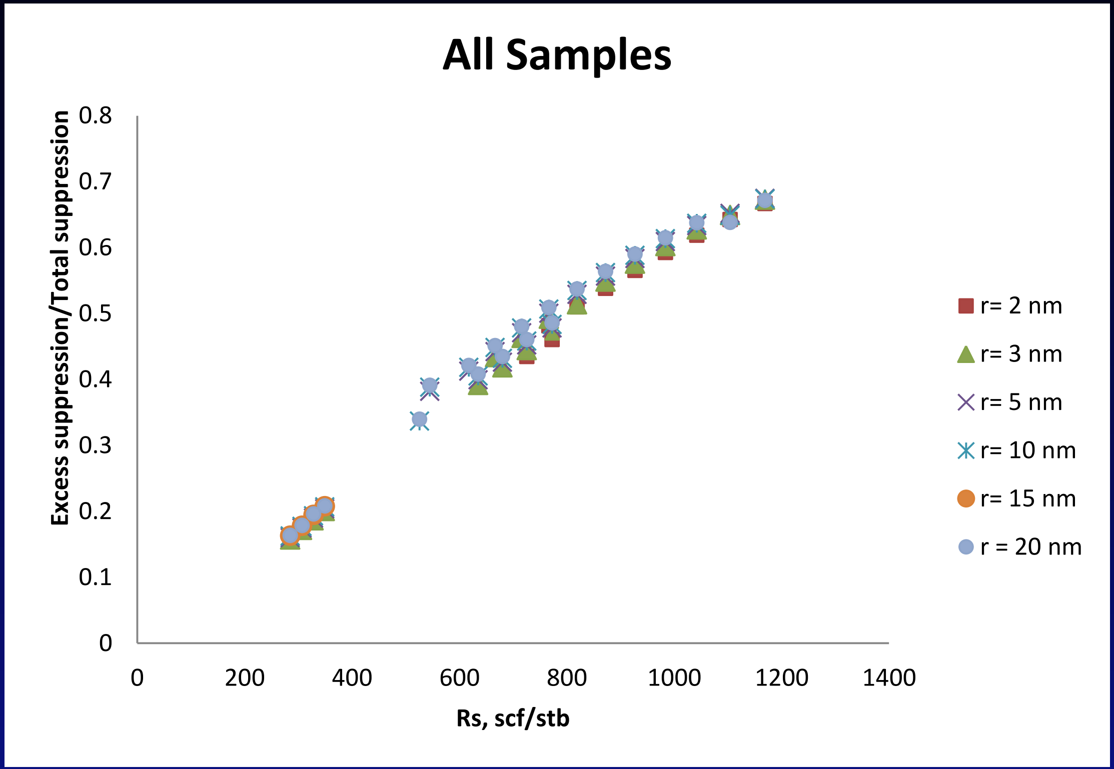
Excess suppression values as a function of Rs for 3 samples



(Firincioglu et al. 2013)

Correlation for Excess Suppression

Excess suppression ratios as a function of R_s for 3 samples



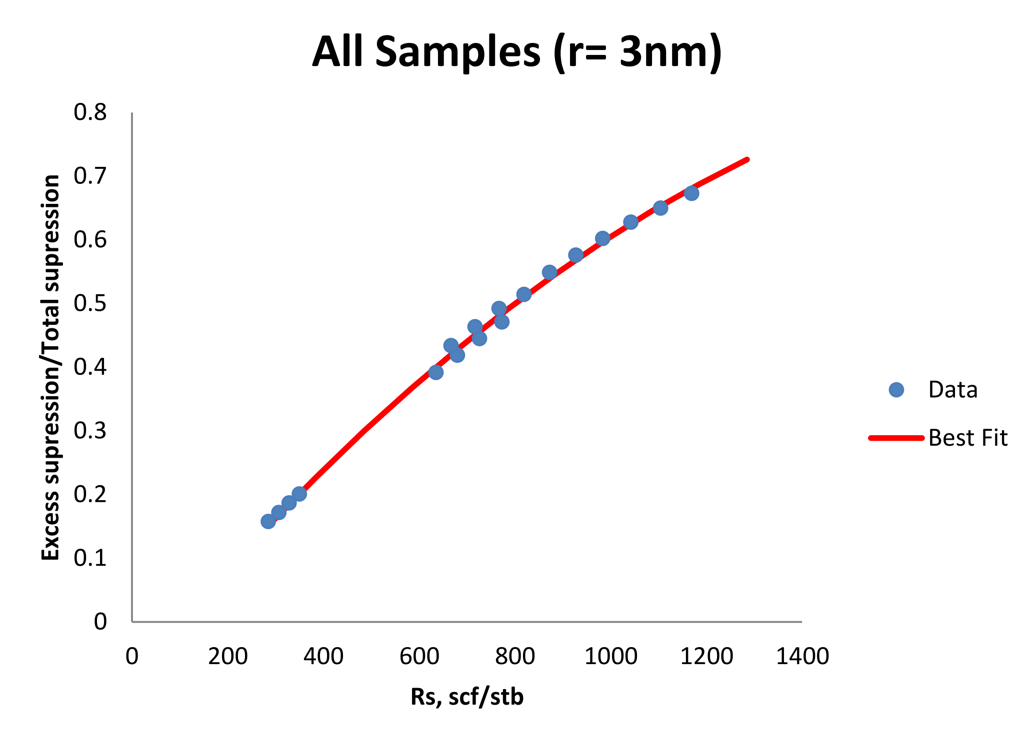
(Firincioglu et al. 2013)

Excess suppression ratio = Excess Suppr./Total Suppr.

Total Suppression = Excess Suppression + Pc

Correlation for Excess Suppression

Best fit for excess suppression ratio as a function of Rs for 3 samples



(Firincioglu et al. 2013)

Correlation:

$$\frac{Excess\ Suppr.}{Total\ Suppr.} = 2.1x10^{-7}{R_s}^2 + 0.0009R_s - 0.1022$$

Status

We need different black oil samples from unconventional, liquids-rich reservoirs to verify the excess suppression correlation and check the sensitivity

Sample data set

Data sets should include:

- Reservoir pressure & temperature
- Number of components
- P_c, T_c, Accentric factor, Molecular weight
- Overall composition, Shift parameter, Parachor
- Binary Interaction Coefficients

Sample data set

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%  Pmax (bar)    Pmin(bar)
   200.d0        0.d0
%
%  Reservoir Pressure, P (bar)
   150.d0
%
%  Reservoir Temperature, T(K)
    360.77d0
%
%  Bubble Radius, xrad()
   2.d0
%
%  Number of components, n
   11
%
%  Ratio of total numbers of liquid to the total numbers of moles, nL
   0.5d0
%
%  Peng-Robinson EOS Equation parameters,
%     u     w
   2.d0   -1.d0
%
%  Epsilon (for Newton Raphson-Molfrac)      Epsilon (for Fugacity-ITER)   Epsilon (for sum Z/K-Main)
   1.d-12                                     1.d-12                         1.d-12
%
%          Pc(bar)            Tc(K)            Accentric Fac.        Mol.Weight        Overall Comp.       Shift Par.          Parachor
        33.94376228d0     126.2000101d0        0.04d0                28.013d0          0.03062396d0      -0.131334239d0        41.d0
        73.8656797d0      304.7000244d0        0.225d0               44.01d0           0.00149509d0      -0.042730337d0        78.d0
        46.0419271d0      190.6000152d0        0.013d0               16.043d0          0.163514712d0     -0.144265619d0        77.d0
%
%   Binary Interaction Coefficients
        0.0d0           -0.012d0         0.1d0           0.1d0           0.1d0           0.1d0           0.1d0           0.1d0           0.1d0           0.1d0           0.0d0
       -0.012d0          0.d0            0.1d0           0.1d0           0.1d0           0.1d0           0.1d0           0.1d0           0.1d0           0.1d0           0.0d0
        0.1d0            0.1d0           0.0d0           0.0d0           0.0d0           0.0d0           0.0d0           0.0d0           0.0d0           0.0279d0        0.0d0
```

Questions?

Thank you