

## Prediction of gas injection effect on asphaltene precipitation using different thermodynamic models

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Gas injection is one of the main types of Enhanced Oil Recovery (EOR) techniques that can recover significant amounts of residual oil. One of the challenges of applying EOR gas injection in reservoirs is the potential of asphaltene precipitation and subsequent deposition. The probability of asphaltene precipitation increases dramatically when light gases are considered for miscible gas injection [1]. Proper predictions of the asphaltene onsets at these conditions represent a challenge for reservoir modeling and flow assurance applications.

Anadarko Petroleum Corporation, Ecopetrol S.A. and Schlumberger have jointly investigated the effects of gas addition to the phase behavior of oil, especially its effect on asphaltene precipitation.

In this work, the prediction of the asphaltene phase behavior in a live fluid and dead oil from deepwater GOM is investigated in a range of pressures and temperatures in the presence of carbon dioxide, nitrogen and methane using cubic-plus-association and statistical mechanics models such as the PC-SAFT equation of state [2]. The Asphaltene Instability Trend (ASIST) method was also used to predict the asphaltene precipitation onset at reservoir conditions. The model is based in a linear relationship observed between the refractive index (or solubility parameter) at the asphaltene precipitation onset (PRI) and the square root of molar volume of precipitant liquid n-paraffins. Asphaltene precipitation kinetic effect was also considered in this study [3].

The study compares PVT and Flow Assurance simulation results with experimental data recently obtained for a GOM live fluid and for additions of nitrogen, carbon dioxide, methane and n-heptane at high pressure and temperature conditions. Fluids from the field presented a compositional variation with a variety of asphaltene contents from 3 to 15%.

Results of simulation assessments revealed the black oil has high propensity for asphaltene precipitation due to addition of injected gas. The addition of nitrogen, carbon dioxide or methane significantly aggravates the asphaltene precipitation condition of reservoir fluids.

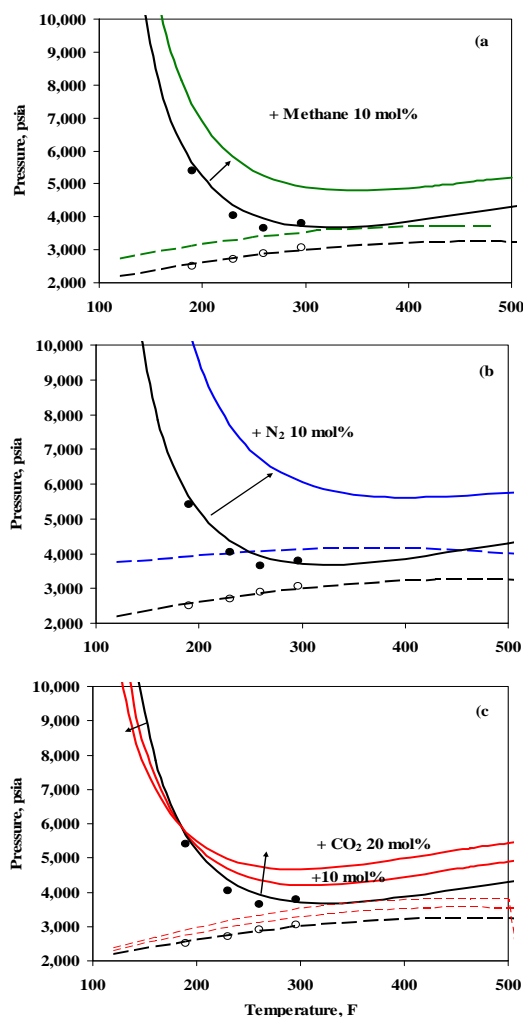


Fig. 1. GOM fluid phase behavior after the addition of methane, N2 and CO2.

### References

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