Experimental evaluation of the asphaltene stability prediction based on dead oil properties

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Asphaltene content effect on crude oil properties was investigated for a series of deepwater GOM fluids with asphaltene contents varying from 4 to 15wt%.

The objective of the study was to conduct flow assurance screening tests on GOM samples collected from different sands and determine properties of the dead oil and the asphaltene stability.

Densities, Refractive indices and Viscosities were measured at different temperatures in crude oils with three different asphaltene contents. The properties showed defined correlations with the asphaltene content and with temperature.

The application of the One-Third rule [1] in the calculation of properties such as solubility parameter and viscosity of crude oil systems, as a function of the mass density, is evaluated. This approach also provides an alternative to calculate the refractive index based on densities obtained from an equation of state.

The analysis also shows the important role that the asphaltene content plays in determining the viscosity of crude oil [2] and evaluates the possibility of predicting viscosity from refractive index as proposed in Ref. [3]

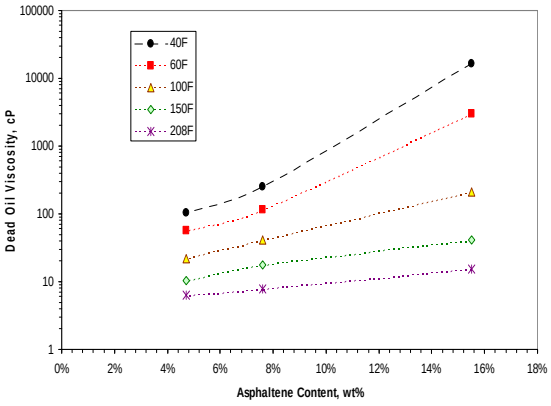

Fig. 1. Viscosity behaviour of the crude oils as function of the asphaltene content at different temperatures.

Another important aspect to evaluate is the prediction of the asphaltene stability in the crude oil by measuring basic crude oil properties such as density and refractive index [4]. In this analysis, the asphaltene stability was studied on the heaviest and lightest samples (high and low asphaltene content) by determine the minimum quantity of precipitant required to initiate asphaltene flocculation followed by measurement of the refractive index of the mixture at the onset conditions.

The Asphaltene Instability Trend (ASIST) method was 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 [5].

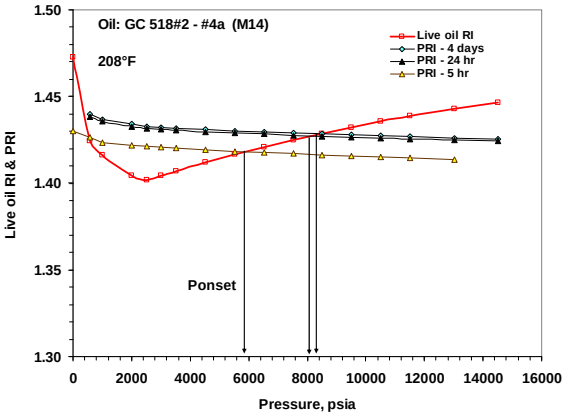

Fig. 2. Asphaltene precipitation onset predicted using ASIST at different flocculation times.

References

[1] Vargas, F., Chapman, W. (2010) Fluid Phase Equlibria, 290, 103-108.
[2] Peng L., Yongan G. (2007) Fuel, 86, 1069-1078.
[3] Riazi, M. R., Al-Otaibi, G. N. (2001) Fuel, 80, 27-32
[4] Wang, J.X., Buckley, J.S., Burke, N.E. and Creek, J.L., (2004), SPE Production and Facilities.
[5] Creek, J., Wang, J. X., Buckley, J. (2009) SPE Production and Operations, 360–367.