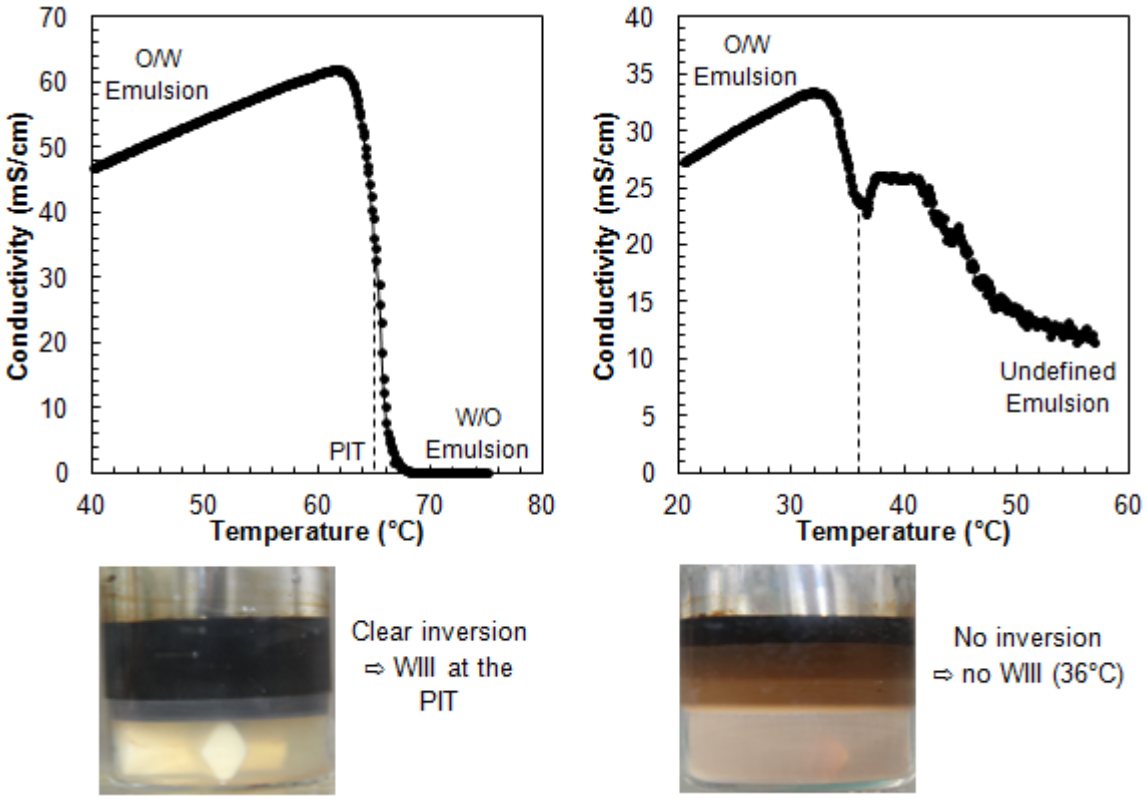
Crude oil based WIII microemulsions of anionic/non-ionic surfactants determined by dynamic phase inversion scanning

Guillaume LEMAHIEU[1], Jesús F. ONTIVEROS[1], Valérie MOLINIER[2], Jean-Marie AUBRY[1]
1 Univ. Lille, CNRS, Centrale Lille, ENSCL, Univ. Artois, UMR 8181– UCCS– Unité de Catalyse et Chimie du Solide, F-59000 Lille, France
2 Total Exploration Production, Pôle d'Etudes et de Recherche de Lacq, B.P. 47, 64170, Lacq, France
Contact Email: guillaume.lemahieu@univ-lille.fr

Since the introduction of the term "microemulsion" by Schulman in 1959, its formulation has become a promising area of interest for academics and industrials. Microemulsions are macroscopically anisotropic systems composed at least of oil, water and surfactant which are stable thermodynamically[1]. Besides of being stable, they have also an ultra-low interfacial tension (10^{-3} mN/m) when they form three phase behavior (WIII systems) and can be applied to different fields such as cosmetics, catalysis or enhanced oil recovery. Obtaining these systems, also called "optimal" formulation, is not trivial due to the large number of formulation parameters to consider. It depends not only of the amount and nature of surfactants added, but also of the aqueous phase salinity, the oil nature (EACN), temperature and pressure. "Optimal" formulations can be accurately predicted for pure oils from the semi-empirical HLD equation[2] but the prediction is much less reliable for more complicated oils such as crude oils. The attainment of the optimal formulation is traditionally carried out by time-consuming salinity scans with equilibrated formulations at a defined temperature to identify the best surfactant system for a given crude oil. This work highlights a new and fast method to determine these key parameters by detecting the "dynamic" Phase Inversion Temperature (PIT) of surfactant/crude oil/water systems. Considering the PIT shifts as well as the shape of conductivity-temperature profiles, it is possible to infer useful information such as precise crude oil EACN, Winsor III relation between salinity and temperature as well as the presence or not of WIII microemulsion related to the surfactant system used. The PIT allows also classifying pure and technical surfactants regarding their hydrophilic behavior using the PIT-slope method[3], which can be a useful tool to adapt the surfactant system to the crude oil considered.



(1) Danielsson, I.; Lindman, B. Colloids Surf. **1981**, 3 (4), 391–392.
(2) Salager, J.-L.; Marquez, N.; Graciaa, A.; Lachaise, J.. Langmuir **2000**, 16 (13), 5534–5539.
(3) Ontiveros, J. F.; Pierlot, C.; Catté, M.; Molinier, V.; Salager, J.-L.; Aubry, J.-M. Colloids Surf. Physicochem. Eng. Asp. **2014**, 458, 32–39.

Back to Programme