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Enhanced oil recovery using ionic liquids: Phase behavior

Iria Rodríguez-Escontrela and **Raquel Corchero**
University of Santiago de Compostela, Spain

There are several methods to improve oil extraction from reservoirs. Among them, chemical flooding with surfactants is a promising alternative for Enhanced Oil Recovery (EOR). These compounds reduce oil-water interfacial tension and therefore capillary forces that entrap petroleum into reservoir pores. Surface active ionic liquids (SAILs) are promising candidates to improve surfactant EOR methods because of their capacity to solubilize water and oil and to reduce the interfacial tension between them. In addition, they can be functionalized according to be tailored for a specific oil reservoir. Moreover, at room temperature ionic liquids (RTILs) could be shipped in neat form to the field, the Krafft temperature for SAILs is lower than similar common surfactants and co-surfactants are unnecessary because SAILs form stable micelles without the need of additional chemicals. Finding a surfactant or a surfactant blend able to generate microemulsions with good oil solubilization, meaning ultralow interfacial tension (IFT), is crucial for surfactant EOR. Another challenge is finding formulations tolerant to divalent ions. Surfactant phase behavior, from test results of salinity or surfactant-blend scans, is a powerful tool to quickly accomplish such an objective before carrying out more expensive and time-consuming experiments. In this work, the potential of a set of SAILs alone or blended has been studied, by means of phase behavior tests in sealed pipettes, for their application in EOR. Based on the individual salinity scan results, surfactant-blend scans combining different SAILs or a SAIL with a well-known EOR surfactant have been carried out focusing in finding a classical Winsor I-III-II transition (Figure 1) with high oil solubilization and likewise being tolerant to divalent ions.

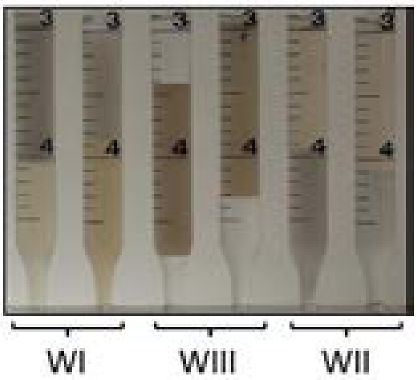

Figure 1: Classical Winsor I-III-II transition.

Biography

Iria Rodríguez Escontrela is a 4th year PhD student in Chemical Engineering at University of Santiago de Compostela (Spain) studying under the supervision of Professor Soto. She received a BEng in Industrial Engineering specializing in Industrial Chemistry, and a MEng in Chemical and Environmental Process Engineering. She was awarded with a FPI fellowship to study her PhD. Currently she has authored six papers in the field of liquid-liquid equilibrium and enhanced oil recovery with ionic liquids. Recently, she has done a research stay under the supervision of Maura Puerto, a Research Scientist in Professor Hirasaki and Profesor Miller Research Group at the Department of Biomolecular and Chemical Engineering of Rice University (Houston-Texas-USA).

iria.rodriguez@usc.es

Biography

Raquel Corchero Morais is a first year doctoral student in Chemical Engineering at University of Santiago de Compostela (Spain) studying under the supervision of Professor Soto. She received a B. Eng. in Chemical Engineering. Before starting the PhD, she completed a postgraduate program in Chemical and Bioprocess Engineering. She has expertise in applied nanotechnology, specifically, using nanoparticles synthesized in ionic liquids as a catalyst in photodegradation of industrial dyes and pharmaceutical products. She currently has a FPI scholarship and the topic of her PhD research is: “Enhanced oil recovery using surfactant ionic liquids”

raquel.corchero@usc.es