

## **Novel Experimental Methods to Quantify the Adsorption Thickness of Ionic Surfactant at Hydrophilic-Hydrophobic Interfaces**

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In conventional energy production, the stability of liquid water or gas hydrate dispersions in the continuous hydrocarbon phase is determined by the energy bound at the hydrophilic-hydrophobic interface. Depending on the system's chemistry, surfactants may be injected into the production system to manipulate or minimise this free energy and improve the ability of the system to flow. Conventionally, the performance of these surfactants is validated qualitatively through single-concentration interfacial tension or emulsion stability measurements. In this study, we used two experimental methods to quantify the competition between surfactants at hydrophilic-hydrophobic interfaces. First, pendant drop interfacial tensiometry (IFT) was adapted to quantify a matrix of adsorbed surfactant densities via Gibbs isotherm analysis. Ionic surfactants were studied over ten orders of magnitude in concentration. The results illustrate that ionic surfactants with similar molecular weight compete for adsorption sites at the water-oil interface, resulting in a decrease in overall packing efficiency below the critical micelle concentration. Second, Raman spectroscopy methods were adapted to quantify the extent of surfactant adsorption at the gas hydrate-oil interface above the dissolved concentration in the continuous phase. Together, these experimental methods can be used to develop structure-function maps for the development of future pipeline injection chemicals.