

عنوان مقاله:

An Experimental Investigation of Water Effects on Asphaltene Surface Behavior through Interfacial Tension Measurements

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خلاصه مقاله:

As a physiochemical property, asphaltenes are known to be one the most surface active compounds in crude oil. Due to such property, their behavior is most probably influenced by fluid-fluid interactions at the contact surface (interface). Potentially and naturally, in most cases, water is in contact with crude oil and is co-produced with it as well. Considering that asphaltene molecules are polar compounds similar to water molecules, asphaltenes are interfacially affected by water while they are absorbed to the interface. Such effects could be investigated by interfacial tension (IFT) changes when de-ionized water is used and dead-crude oil does not contain other surface active impurities like metallic compounds. In this study, extensive IFT experiments were conducted between three different oil samples and distilled water in a wide range of pressure from 2000 to 0 psia. The reversibility of asphaltene absorbance to the interface was also investigated by reversing the pressure path from 0 to 2000 psia. The results show that oil/water IFT changes with pressure, but upward/downward oscillations were detected. Such an oscillating behavior of IFT trends was related to asphaltenes surface activity as the oil samples used did not contain other impurities. Oscillations were reduced as resin to asphaltene ratio was increased, suggesting the non-absorbable behavior of the asphaltenes stabilized by resins. A microscopic surface experiment on one of the samples showed that at a certain concentration and particle size, a rigid film of absorbed asphaltenes was created at the interface instantaneously. The high rigidity of such a film gives rise to a hypothesis, which states that water affects asphaltene surface behavior possibly through strong hydrogen bonding (H-bond). Reversing the pressure path revealed that asphaltene surface absorbance is partially irreversible. The experiments were conducted three times, and each data set was presented along with an average of three sets for each sample.

کلمات کلیدی:

Asphaltenes, Surface Activity, Surface Absorbance, Water Injection, EOR

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