

Electro-Aggregation of Asphaltene Particles

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Formation and deposition of heavy organic compounds of petroleum fluids including, but not limited to, asphaltene particles in oil well columns and production systems, are important flow assurance problems in both onshore and offshore operations. Therefore, preventive actions to control asphaltene deposition and remediation of such heavy organic deposit, which leads inevitably to reduction or cessation in oil production, has been always one of the main concern for oil producers. In this work, the effect of electrostatic field on the aggregation rate and aggregate size of asphaltene particles precipitated out from crude oil samples suspended in the mixture of toluene and n-heptane has been investigated. Electrode embedded glass micro-model equipped with high resolution optical microscope and high voltage direct current power supply has been utilized to perform the experiments. The asphaltene particle size and the rate of aggregation under the electric field has been monitored using a high resolution microscope and the average aggregate size for asphaltene particles have been measured using image processing software. It has been concluded that the asphaltene aggregation rate and the average diameter of asphaltene aggregates not only depend on the molecular structure and the number of hetero-atoms on asphaltene molecules but also can be significantly affected by the electric field strength, exposure time, asphaltene concentration and the amount of precipitant i.e., n-heptane. As a matter of fact, under the electrostatic field, asphaltene particles tend to become highly polarized and oriented, and thus, to aggregate more quickly. Such kinetic behavior, in turn, may result in asphaltene deposition. The application of the electrostatic technique to control asphaltene deposition in a pipeline has been also discussed.