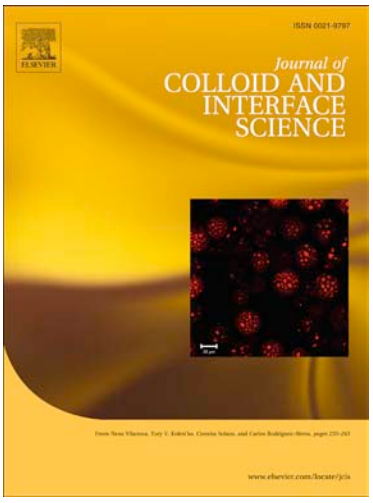

Regular Article

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Journal of Colloid and Interface Science

Ionic Liquids for Low-tension Oil Recovery Processes: Phase Behavior Tests

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Abstract

Chemical flooding with surfactants for reducing oil-brine interfacial tensions (IFTs) to mobilize residual oil trapped by capillary forces has a great potential for Enhanced Oil Recovery (EOR). Surface-active ionic liquids (SAILs) constitute a class of surfactants that has recently been proposed for this application. For the first time, SAILs or their blends with an anionic surfactant are studied by determining equilibrium phase behavior for systems of about unit water-oil ratio at various temperatures. The test fluids were model alkane and aromatic oils, NaCl brine, and synthetic hard seawater (SW). Patterns of microemulsions observed are those of classical phase behavior (Winsor I-III-II transition) known to correlate with low IFTs. The two anionic room-temperature SAILs tested were made from common anionic surfactants by substituting imidazolium or phosphonium cations for sodium. These two anionic and two cationic SAILs were found to have little potential for EOR when tested individually. Thus, also tested were blends of an anionic internal olefin sulfonate (IOS) surfactant with one of the anionic SAILs and both cationic SAILs. Most promising for EOR was the anionic/cationic surfactant blend of IOS with [C_{12}mim]Br in SW. A low equilibrium IFT of ~$2 \cdot 10^{-3}$ mN/m was measured between n-octane and an aqueous solution having the optimal blend ratio for this system at 25°C.

Keywords: surface active ionic liquid, phase behavior, surfactant blend, enhanced oil recovery