Stabilizing Temporary Emulsions with Switchable Wetting Particles

C. Liang, Q. Liu and Z. Xu
Department of Chemical and Materials Engineering, University of Alberta, Edmonton, AB, Canada

Emulsions require stabilization in order to delay phase separation. The increased interfacial surface area of an emulsion may be stabilized by the amphiphilic nature of surfactant molecules. Fine bi-wetting particles are also capable of stabilizing emulsions. The type of emulsion stabilized by a particle is influenced by the nature of its surface which may be hydrophobic, hydrophilic, or bi-wetting. Particles prepared by functionalizing silica with CO_2-responsive surface groups could be used to stabilize and destabilize an emulsion by removing or adding CO_2. Tuning the wettability of the stabilizer particle is possible by adjusting the coverage of different functional groups on its surface. Tuning the range of wettability is possible by adjusting the coverage of CO_2-responsive surface groups. Triggered phase separation is achieved by using a particle which possesses adequate wettability to stabilize an emulsion in the absence of CO_2, but loses this ability in the presence of CO_2 due to the change it particle wettability. To this end, responsive particles were prepared by functionalizing silica particles with different ratios of hydrophobic and responsive surface groups. The ability by the switchable wetting particles to stabilize various emulsions (*e.g.* toluene and water; diluted bitumen and water) was examined. The critical volume ratio was determined for different particles in both the presence and absence of CO_2.