Viscosity and Stability Measurement of CO_2-in-Water Foam with Anionic Polypropoxylate Surfactants

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For CO2EOR (enhanced oil recovery utilizing CO_2) application, a series of polypropoxylated sulfate surfactants was synthesized from dodecanol, and CO_2-in-Water foams prepared with the surfactants were characterized by a set of high-pressure recirculation apparatus. Stability and apparent viscosity of CO_2-in-water foam were measured for experimental conditions from 35 to 55 °C up to the pressure of 3,600 psi. The effects of temperature and pressure were systematically analyzed for foams consisting of 1 wt.% of the anionic surfactant, water and CO_2 with 50:50 weight ratio. Stability of the foam was measured by observing the foam layer thickness over time as seen in a 8 cm-long macroscopic view tube. The apparent viscosity was calculated from the pressure drop measured in a length of capillary tubes with known inner diameters by using Hagen-Poiseuille equation. With varying shear rate, the CO_2-in-water foams exhibited a pseudoplastic (shear-thinning) behavior of decreasing apparent viscosities with increasing flow rate. The foam also showed an increasing stability with increases in the pressure and the temperature, as the solvent quality of CO_2 increased with increasing pressure and temperature.