

Measurement and Correlation of Phase Behaviors of Supercritical Carbon Dioxide Including Pentadecafluorooctanoic Acid Surfactant and Water

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Phase behavior of carbon dioxide + pentadecafluorooctanoic acid binary system and carbon dioxide + pentadecafluorooctanoic acid + water ternary system was investigated at temperature from 313.2 to 353.2 K. Pentadecafluorooctanoic acid is one of the widely used surfactant and phase behavior data with carbon dioxide are useful in industrial process design and operation for supercritical process. The cloud points of this surfactant in carbon dioxide were measured and the phase behavior of water in CO₂ micro-emulsion was measured by using a visual and variable volume equilibrium analyzer. A transparent phase was observed above the upper phase transition pressure and a cloudy phase emulsions appeared between the upper and the lower phase transition pressures. Cloud phase transition pressures for carbon dioxide + pentadecafluorooctanoic acid binary system were increased with increasing temperatures. Also, cloud phase transition pressures for ternary mixtures of carbon dioxide + pentadecafluorooctanoic acid + water system were measured. Measured data were correlated with modified Peng-Robinson equation of state. The association term of the SAFT model was adapted for considering hydrogen bonding of water.