PA 02

Phase Behavior of CO_2/Toluene/PMMA ternary system

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Abstract (less than 300 words)

Supercritical fluids, especially the combination of supercritical carbon dioxide ($scCO_2$) and polymers, has been attracting much attention as an inexpensive, safe, and environmentally friendly processing process. Furthermore, attempts have been made to add organic solvents as third components to improve the solvent properties of the CO_2. In that regard, reports have been published indicating that performance can be changed ~~more~~ broadly with the addition of the organic solvents. It is thought that the change in physical properties, especially the change in the phase behavior, is a major factor for the enhancement of the solvent properties. However, phase equilibrium data for carbon dioxide (CO_2)/organic solvent/polymer ternary systems are rare. In this work, the phase diagram of a CO_2/Toluene (Tol)/Polymethyl methacrylate (PMMA) ternary system was measured using a synthetic method. In this system, the vapor-liquid equilibrium and vapor-liquid-liquid equilibrium (bubble point, BP) and the liquid-liquid equilibrium (cloud point, CP) were confirmed as the phase separation points. The BP was measured by the method combined with a laser rangefinder, and the CP was measured by the method combined with a laser turbidimetry. The phase boundaries were measured at temperatures of 313.2 K and 353.2 K, and CO_2 weight fractions ranging from 0.10 to 0.48.

The homogeneous phase area decreased with the increase of the concentration of PMMA or the temperature. These changes were expected to be related to the mutual solubility between the components. Therefore, the changes in the homogeneous phase area were evaluated using the solubility parameters. In addition, the phase diagram of the triangular prism was constructed from the obtained phase diagram, and the overall picture of the phase behavior of the ternary system was confirmed.

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