Microcalorimetric and Condutivity Studies of the Effects of Solutes on the Percolation Behavior of Reverse Micelle Systems

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Abstract

This study employed high sensitivity microcalorimetry to investigate the percolation behavior of W/O microemulsions of AOT with and without solutes of salts, amino acids, and proteins. The dilution heat and the enthalpy behavior of the reverse micelle solutions in the percolation process were measured by isothermal titration microcalorimetry (ITC). The enthalpy behavior reported in this investigation supports qualitatively the association model of percolation. The second virial coefficient of the interactions between reverse micelle droplets can be derived from the information of the dilution heat of the reverse micellar system with the concentration of the reverse micelles and incorporating a hard-sphere interaction potential assumption. The derived second virial coefficients of different reverse micelle solutions are discussed along with the conductivity percolation temperature, and the difference between the interaction potentials are in good agreement with the shift of the percolation temperature of various micellar systems. Viscosity measurements were also taken from of the micellar solutions in the process of percolation in this study. A discussion on the relationship between the solute effects and the percolation in terms of the charge and the surface activity of the solutes is also included.