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Ao Su, Sifang Li

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Chemical Engineering Thermodynamics

Measurement and correlation of solid-liquid phase equilibria for binary and ternary systems consisting of N-vinylpyrrolidone, 2-pyrrolidone and water

Ao Su(苏傲), **Sifang** Li(黎四芳)*

Department of Chemical and Biochemical Engineering, College of Chemistry and Chemical Engineering, Xiamen University, Xiamen 361005, China

*Corresponding author. E-mail: sfli@xmu.edu.cn

Abstract The solid-liquid equilibria (SLE) for binary and ternary systems consisting of N-Vinylpyrrolidone (NVP), 2-Pyrrolidone (2-P) and water are measured. The phase diagrams of NVP (1) + 2-P (2), NVP (1) + water (2), NVP (1) + 2-P (2) + 1 wt. % water (3) and NVP (1) + 2-P (2) + 2 wt. % water (3) are identified as simple eutectic type with the eutectic points at 263.75 K (x_{1E} = 0.5427), 251.65 K (x_{1E} = 0.3722), 260.25 K (x_{1E} = 0.5031) and 256.55 K (x_{1E} = 0.4684), respectively. The phase diagram of 2-P (1) + water (2) has two eutectic points (x_{1E} = 0.1236, T_E = 259.15 K and x_{1E} = 0.7831, T_E = 286.15 K) and one congruent melting point (x_{1C} = 0.4997, T_C = 303.55 K) because of the generation of a congruently melting addition compound: 2-P▪H_2O. The ideal solubility and the UNIFAC models were applied to predict the SLE, while the Wilson and NRTL models were employed in correlating the experimental data. The best correlation of the SLE data has been obtained by the Wilson model for the binary system of NVP + 2-P. The UNIFAC model gives more satisfactory predictions than the ideal solubility model.

Keywords phase equilibria, thermodynamics, model, N-vinylpyrrolidone, 2-pyrrolidone, water

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