Effect of PNA Composition on Solubility of Gases, Liquids and Solids in Petroleum Fractions

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Knowledge of the solubility of gases, liquids and solids in petroleum fluids is important in petroleum production, processing and transportation. One model that can be used for solubility calculations is the regular-solution theory and the Scatchard-Hildebrand relation for the solubility parameter. According to this method, no adjustable parameter is required, and for defined hydrocarbon mixtures relatively accurate solubility parameters can be calculated. However, for petroleum fractions, the common practice is to calculate solubility parameters from fractional bulk properties. In this way, the mixture is considered as a single pseudocomponent. In this paper, we study the effect of paraffin (P), naphthene (N) and aromatic (A) contents of petroleum fractions on the solubilities of gases, liquids and solids in the fraction. The solubility parameter and molar volume of several petroleum fractions have been calculated through the pseudocomponent approach. Resulting activity coefficients have been used to calculate solubilities of light gases (H_2S, CO_2, N_2 and C_1), water (as liquid) and naphthalene (as solid) in different petroleum fractions with varying degrees of PNA composition. The results have been compared with the common method of considering the fraction as a single component as well as with the methods suggested in the API-Technical Data Book. Preliminary calculations show that in cases that variation of PNA composition is significant; the effect of PNA composition cannot be neglected on solubility predictions.