# ABSTRACT

Diffusion Coefficients for Several Dilute Solutes in
n–Eicosane, n–Octacosane, and Fischer–Tropsch Wax
at 373 – 533 K. (December, 1988)
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A Taylor dispersion apparatus was constructed which is capable of measuring diffusion coefficients in liquid solvents with melting points up to 400 K. Infinite dilution mutual diffusion coefficients of hydrogen, carbon monoxide, carbon dioxide, and several n-alkane solutes were measured in the solvents n-eicosane, n-octacosane, and Fischer-Tropsch reactor wax at 200 psia at temperatures to 533 K. Using the same apparatus, the solvent density was also measured at each experimental condition.

All diffusion coefficient data were analyzed using a computer model based on the analytical solution to the Taylor dispersion problem. The model was developed as a part of this study and is superior to the approximate mathematical models used in previous Taylor dispersion research. An improved technique for collecting gaseous solute data using the Taylor dispersion apparatus was also developed.

Finally, the results of this study were used to develop a single correlation based on the Rough Hard Sphere theory which predicts diffusion coefficients in alkane solvents ranging from n-heptane ($CH_3(CH_2)_5CH_3$) through n-octacosane

($CH_3(CH_2)_{26}CH_3$). The correlation was then used to verify the hypothesis that diffusion coefficients in Fischer-Tropsch wax can be estimated by assuming that the wax behaves as a pure alkane with chain length equal to the mean chain length of the mixture. The results of the study indicate that actual diffusion coefficients in Fischer–Tropsch reactor wax are significantly larger in magnitude than estimates typically used in Fischer–Tropsch reactor models.