

The solubility of high molecular weight *n*-alkanes in supercritical carbon dioxide at pressures up to 50 MPa

Abstract

Solubilities of *n*-tetracosane, *n*-pentacosane, *n*-hexacosane, *n*-heptacosane and *n*-nonacosane in supercritical carbon dioxide were measured in the pressure range 10–50 MPa and 313 K. The solubility data were found to be internally self-consistent according to the theory of dilute solutions. Krichevskii parameters were calculated from the data and exhibited regular trends with the carbon number of the *n*-alkane. The Krichevskii parameter vs carbon number behavior was also consistent with that found in our earlier work for mixtures of low and high molecular weight *n*-alkanes in carbon dioxide.

© 2003 Elsevier B.V. All rights reserved.

Keywords: Data; Solid–fluid equilibria; Dilute solutions; Supercritical fluids; Solubility; *n*-Alkanes

1. Introduction

The solubility of heavy *n*-alkanes in supercritical carbon dioxide is of interest in the design of hydrocarbon processing systems. In spite of this interest, however, literature data on these systems are scarce and often contradictory [1–8]. The latter may be partly due to the variety of methods that have been employed to measure solid solubility. These methods include synthetic methods that employ variable-volume view cells [1], spectroscopic methods [2], chromatographic techniques [3], and dynamic or flow methods [4–8]. It is important to check the consistency of data from these methods, as differences between data sets are

often greater than the claimed accuracy of the data. Theories that allow checks of consistency, and interpolation/extrapolation of limited data, are therefore of considerable practical importance.

In the present work, the solubility of heavy *n*-alkanes in supercritical CO₂ was measured using a static or synthetic method in a variable-volume view cell. The experimental data were compared with data reported in the literature, and were correlated using an extension of the theory of dilute solutions proposed by Méndez-Santiago and Teja [9]. This theory predicts a linear relationship for the solubility of solids in supercritical fluids over a wide range of temperatures and pressures according to the relationship:

$$T \ln E = A + B\rho, \quad (1)$$

where *T* is the temperature, *A* and *B* are temperature independent parameters that are related to