Abstract: $\nu X$ properties of the binary systems $\text{CO}_2-\text{CH}_4$ and $\text{CO}_2-\text{N}_2$ are described with improved accuracy and for the full ranges of composition and molar volume. $PTX$ conditions of phase transitions including liquid, gas and solid are modelled by the Soave-Redlich-Kwong equation of state, and molar volumes by the Lee-Kesler correlation. The Soave-Redlich-Kwong equation of state has been improved for critical fluids. $\nu X$ diagrams are presented, which describe phase transitions involving liquid, gas and $\text{CO}_2$ solid phases for $\text{CO}_2-\text{CH}_4$ and $\text{CO}_2-\text{N}_2$ fluid inclusions. Also discussed are the conditions of the metastable liquid-liquid-gas phase assemblage.

Key-words: fluid inclusions, $\text{CO}_2-\text{CH}_4-\text{N}_2$ system, phase equilibria, $\nu X$ properties, equations of state.

Introduction

The determination of fluid compositions ($X$) and molar volumes ($\nu$) is an essential step for any quantitative study of paleo-fluids, presently found as relics in fluid inclusions. Temperature measurements of phase transitions observed by microthermometry and combined with Raman spectrometry allow fairly accurate determinations of the $\nu X$ properties of the non-aqueous volatile parts of fluid inclusions. As popularized by Bur­russ (1981), $\nu X$ diagrams are most appropriate for quantitative interpretations of phase transitions in fluid inclusions. In many cases, non-aqueous volatile portions of fluid inclusions can be described in the $\text{CO}_2-\text{CH}_4-\text{N}_2$ system. Unfortunately, experimental data are not numerous enough for an accurate interpretation of phase equilibria, and molar volumes of $\text{CO}_2-\text{CH}_4-\text{N}_2$ fluids are poorly known. Thus, the accuracy of $\nu X$ determinations mainly relies on the applied equations of state (EOS) and the derived phase diagrams. The large amounts of microther­mometric and Raman data, produced during the last decade, have demonstrated that available phase diagrams for the $\text{CO}_2-\text{CH}_4$ system (Her­skowitz & Kisch, 1984; Heyen et al., 1982) and for the $\text{CO}_2-\text{N}_2$ system (Darimont & Heyen, 1988) have limited ranges of application and are