

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Experiments from Sub-orbital to Orbital Platforms (3)

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ESTIMATION OF THE THERMODIFFUSION COEFFICIENTS FOR
DODECANE/N-BUTANE/METHANE MIXTURES AND COMPARISON WITH EXPERIMENTAL
DATA FROM FOTON M3 MISSION

Abstract

Flow due to thermodiffusion may change direction in fluid mixtures with the variation of composition and temperature. This occurrence remains an unraveled phenomenon in the measurement of thermodiffusion coefficients for hydrocarbon mixtures at high pressure. Using a theoretical approach of the irreversible thermodynamics theory, this paper evaluates the thermal diffusion factor for ternary mixtures of dodecane/n-butane and methane. Six different combination of those three components were flown on board FOTON M3 mission and experimental results were compared with the theoretical approach. The mixtures, which were flown, are; Mixture 1: Dodecane(C12)(0.7), n-Butane(C4)(0.1), Methane(C1)(0.2), Mixture 2: Dodecane(C12)(0.6), n-Butane(C4)(0.2), Methane(C1)(0.2), Mixture 3: Dodecane(C12)(0.5), n-Butane(C4)(0.3), Methane(C1)(0.2), Mixture 4: Dodecane(C12)(0.4), n-Butane(C4)(0.4), Methane(C1)(0.2), Mixture 5: Dodecane(C12)(0.3), n-Butane(C4)(0.5), Methane(C1)(0.2) Mixture 6: Dodecane(C12)(0.2), n-Butane(C4)(0.6), Methane(C1)(0.2). The analysis and the experiments were performed at a pressure of 350 bars with a temperature variation from 323 to 333 degrees Kelvin. A detailed thermal analysis of the experiment was performed using ANSYS relying on measured experimental temperature far to determine the accurate temperature applied at the hot and cold side of the sample. In addition, measured g-jitter data from FOTON M3 mission were used to study the fluctuation effect of the concentration on the theoretical estimation of thermal diffusion factor. Results revealed some agreement in certain mixtures and disagreement on other mixtures. Results also showed the importance of measuring those coefficients in a convection free environment as the one available on board FOTON M3.