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Author: Mr. Amirhossein Ahadi
Ryerson University, Canada

Mr. Q. Galand
Belgium
Prof. Stefan Van Vaerenbergh
Belgium
Prof. Ziad Saghir
Ryerson University, Canada

SORET AND MOLECULAR DIFFUSION COEFFICIENTS MEASUREMENTS OF A BENCHMARK TERNARY MIXTURE ONBOARD ISS

Abstract

While Soret coefficients of binary mixtures have been measured onboard ISS during pervious project, received interferometry data from ISS were used to measure the diffusion coefficients of the ternary mixture. The mixture of tetrahydronaphtalene, isobutylbenzene, and dodecane at five different compositions is hosted in a cell array.

Because of the critical condition of the apparatus on board the ISS, the images of this experiment were analyzed using an advance image processing method to extract the real trend of the concentration and temperature. Consequently, a combination of fast Fourier transform and windowed Fourier transform techniques were being used in this study for the first time in the thermodiffusion optical interferometry problem to extract the smooth trend and filter the noises in the system. During the first part of the experiment, thermodiffusion phase, a 10 K thermal gradient was applied to the cell as result of that a separation occurred in the system. By reaching to diffusion time and having steady separation condition, the temperature gradient was removed and consequently the molecular diffusion can be observed in the system. Preliminary results during the thermal time provokes that a perfect thermal isolation near lateral walls was not obtained, while the separation of the components at the center region of the cavity and at the end of the thermodiffusion phase behaved like pure diffusion. Thus, this region was cropped and used to measure the maximum separation and then estimation of the Soret coefficient. Finally, based on image processing results and transient trend of the separation of the components in the first and second phase of the experiment, Soret coefficients and diffusion coefficients of the ternary mixture can be estimated. This measurement can be served as the standard for ground experiments or numerical modeling of hydrocarbon mixtures.