MICROGRAVITY SCIENCES AND PROCESSES (A2)
Microgravity Sciences onboard the International Space Station and Beyond (6)

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THERMODIFFUSION OF BINARY AND TERNARY FLUID MIXTURE IN THE REDUCED GRAVITY ENVIRONMENT OF THE INTERNATIONAL SPACE STATION

Abstract

The International Space Station provides a reduced gravity environment to study thermodiffusion. However, the presence of micro-accelerations can induce convection in the fluids that can impede the pure diffusion process. Hence, in order to estimate the accuracy of such diffusion experiments in space, it is important to have a good measure of the impact of such micro-accelerations on the thermodiffusion in the fluid mixtures. Accordingly, in this computational study, the impact of the vibrations on ISS on the thermodiffusion process in a binary and ternary liquid mixture that are at pressure of 1atm, have been investigated. In this, computational fluid dynamics tools have been used to simulate the complete set of Navier-Stokes equation coupled with a thermodiffusion model to understand fluid motion in a 2-dimensional domain. For the simulations, a thermal gradient of 10 K has been employed along the lateral boundaries of the rectangular domain. Further, the vibrations recorded on the ISS have been imposed as the source terms in the momentum equation. Comparisons with the simulation results from an ideal diffusion process indicate that the ISS vibrations can be detrimental to the accuracy of the separation behavior in the mixture. Finally, the significance of a thermodiffusion model is highlighted based on comparisons with simulations with a constant thermodiffusion and molecular diffusion coefficients.