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Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

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MEASUREMENT OF SORET COEFFICIENTS FOR A TERNARY HYDROCARBON MIXTURE IN LOW GRAVITY ENVIRONMENT

Abstract

While Soret coefficients of binary mixtures have been measured on board the International Space Station (ISS) successfully, for the first time, we report the Soret coefficient of a ternary mixture in a low gravity environment condition. The sample was contained in a cell 10 mm x 10 mm x 5 mm (w,l,h) and was monitored by means of a Mach-Zehnder interferometer at two wavelengths. The results of this experiment, which correspond to the following four mixtures; mixture 1 0.10 tetrahydronaphthalene , 0.10 isobutylbenzene, 0.80 dodecane , mixture 2, 0.40 tetrahydronaphthalene, 0.20 isobutylbenzene, 0.40 dodecane, mixture 3 0.10 tetrahydronaphthalene, 0.80 isobutylbenzene, 0.10 dodecane and mixture 4 0.45 tetrahydronaphthalene, 0.10 isobutylbenzene, 0.45 dodecane are presented in this study. While perfect thermal isolation near the lateral walls was set experimentally, the separation of the components in the mixture behaved in the same manner as pure diffusion at the central region of the cavity. The experiment is repeated to verify the accuracy of the setup with a mean temperature of 298 K. The unique obtained results demonstrate the repeatability of thermodiffusion experiments in a microgravity environment. For mixture 1 almost equal separation of the tetrahydronaphthalene and isobutylbenzene along opposite directions were recorded. Dodecane experienced a weak separation in the same direction as isobutylbenzene. Finally, image processing results and trends of transient separation of components were used to analyze the phenomenon of heat transfer in the system and to measure the Soret coefficients for this ternary mixture.