MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond - Part 1 (6)

Author: Mr. Quentin Galand
Université Libre de Bruxelles, Belgium, qgaland@ulb.ac.be

Prof. Stefan Van Vaerenbergh
Université Libre de Bruxelles, Belgium, svanvaer@ulb.ac.be
Mr. Amirhossein Ahadi
Ryerson University, Canada, aahadi@ryerson.ca
Prof. Ziad Saghir
Ryerson University, Canada, zsaghir@ryerson.ca

FINAL RESULTS OF THE DSC/DCMIX 1 EXPERIMENT: BENCHMARK MEASUREMENTS OF THERMODIFFUSION AND DIFFUSION COEFFICIENTS IN MULTICOMPONENT LIQUID SYSTEMS

Abstract

A fundamental step in a comprehensive modelling of the diffusive processes in liquids relies the possibility of obtaining reliable and accurate experimental data of the diffusion and thermodiffusion coefficients of multicomponent liquid systems. In the DSC/DCMIX1 experiment [1], a 'Transient Interferometric Technique' was implemented aboard the International Space Station to obtain an accurate experimental determination those coefficients for several organic liquid systems, composed of 1,2,3,4-Tetrahydronaphtalene, Isobutylbenzene and Dodecane. Those particular species were selected as a simplified multicomponent system modelling the fluids contained in natural crude oils reservoirs. The three equimassic systems of those components were studied in the Fontainebleau benchmark [2]. During the DSC/DCMIX1 experiment, a series of five ternary systems were studied syste. For each system, several experimental runs were performed, in order to quantify the reproducibility of the technique and to investigate the temperature dependence of the thermodiffusion and diffusion coefficients. The data collected during this experiment were analysed independently by several research teams around the world. The results obtained through this procedure were compared with several experimental results performed under gravity conditions to establish a benchmark for the thermodiffusion and diffusion coefficients in a three-components liquid systems. In the present paper we report the temperature and chemical concentration profiles observed during several experimental runs. We detail the analytical techniques developed by our team. We report the thermodiffusion coefficients obtained from the stationary concentration profiles. We explain the modelling of the diffusive processes and the obtained values for the molecular diffusion coefficients. We finally compare the results obtained through several data processing techniques.

[1] Van Vaerenbergh S., "The DSC program: from multicomponent transport (SCCO, SoDiUM) to asphaltenes (GANIMEDE)", Microgravity Science and Technology, XVIII (3/4), pp. 150-154, 2006. [2] Platten J. K., Bou Ali M. M., Costesèque P., Dutrieux J. F., Köhler W., Leppla C., Wiegand S., Wittko G., Benchmark values for the Soret, thermal diffusion and diffusion coefficients of three organic liquid mixtures, Philosophical Magazine, 83 (17-18), 2003. [3] Galand Q., Van Vaerenbergh S., Saghir M. Z., Dejmek M., "Preliminary Results of the DSC on SODI Experiment: Experimental Determination of Soret Coefficients in Ternary Liquid Systems", presented during 10th International Meeting on Thermodiffusion, Brussels, Belgium, 04-08/06/2012. [4] Galand Q., Van Vaerenbergh S., Saghir M. Z., Dejmek M., "Preliminary Results of the DSC on SODI Experiment: Experimental Determination of Soret Coefficients in Ternary Liquid Systems", presented during 63rd International Astronautical Congress 2012, Naples,

Italy, 01-05/10/2012.