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RESULTS OF DCMIX2 SPACE EXPERIMENT: TEMPERATURE DEPENDENCE OF TRANSPORT COEFFICIENTS IN A BINARY MIXTURE OF TOLUENE-CYCLOHEXANE

Abstract

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A series of experiments under the common acronym DCMIX (Diffusion Coefficients in MIXtures) is conducted on the International Space Station (ISS) with the support of the European Space Agency. The second in the series, the experiment DCMIX2 studying the transport properties of mixtures composed of toluene, methanol, cyclohexane, was carried out in the period of Dec. 2013–Jan. 2014 (see the details of the experiment preparation in [1]. In addition to five ternary mixtures filling the primary cells, a reference binary mixture with composition 0.40/0.60 mass fractions of toluene–cyclohexane was thoroughly investigated on the ISS. Eleven successful runs performed with this mixture at different mean temperatures allowed accurate estimations of temperature dependency for all the transport coefficients of interest, i.e., diffusion, Soret and thermodiffusion coefficients. The obtained coefficients were carefully examined by comparing with accessible literature data. Since the available literature data exist for similar but different concentrations, the comparison was indirect[2]. To complete the comparison, diffusion coefficients were measured in the ground laboratory after the completion of the ISS experiment. The results of the microgravity experiment demonstrated excellent agreement with the ground measurements. The unexpected result obtained in the course of the ISS experiment is that the thermodiffusion coefficient does not depend on temperature [3].

[1] Shevtsova, V., Santos, C., Sechenyh, V., et al., Microgravity Sci. Tec., 25, pp. 275-283, 2014.
[2] Wittko, G. and Koehler, W., Europhys. Lett., 78, 46007, 2007.
[3] Mialdun, A. and Shevtsova, V., J. Chem. Phys., 143, 224902, 2015.