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FEASIBILITY STUDY FOR APPLICATION OF OPTICAL TWO WAVELENGTH TECHNIQUES TO
MEASUREMENT OF THE SORET COEFFICIENTS IN TERNARY MIXTURES**Abstract**

The liquids appearing in nature and industrial applications are essentially multi-component. The prediction of mass transfer processes in multicomponent systems greatly relies on the knowledge of diffusion and thermodiffusion coefficients, which appear in the equations describing these phenomena. The appearance of cross-molecular diffusion complicates measurement of the coefficients in ternary and higher mixtures in comparison to that in binary mixtures. At present, there exist two methods, optical beam deflection (OBD) technique and optical digital interferometry (ODI), which are suitable for measurements of diffusion and thermodiffusion (Soret) coefficients in ternary mixtures using sources of light with two different wavelengths.

Until now the values of Soret coefficient were measured only in three hydrocarbon liquid ternary mixtures. Taking into account that the Soret coefficients for the same mixture obtained by different techniques differ not only in values but even in signs, the need in trustworthy results is obvious. One of the ways for solving this problem is to conduct an experiment in the absence of gravity on the ISS, with a purpose to provide incontestable benchmark results for ground experiments. Such an experiment is already in ESA planning (DCMIX) and it should be carefully prepared keeping in mind that the facility available currently on the ISS is the SODI instrument. That instrument includes an optical interferometer, and its real time results (images) can be sent to researchers via telemetry. Similar optical technique has been used on the ground for binary mixtures in [1].

We discuss the application of two-wavelength optical methods for the determination of Soret coefficient. We report on the development of a simple mathematical approach to verify applicability of chosen wave lengths for laser diodes to measure transport coefficients for a certain class of ternary mixtures. The approach has been applied to a number of aqueous ternary mixtures. The regions of feasibility/infeasibility of the methods have been revealed for these mixtures.

References

1. A. Mialdun, V. Shevtsova, J. Chem. Physics, 134, 044524 (2011)