Transport Phenomena in liquids: Experimental Thermodiffusion view

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Abstract

Thermodiffusion is known as the transport of matter, in a solid, liquid or gas phase, generated by a variation of temperature. The thermodiffusion phenomenon was studied for the first time by C. Ludwig [1856] and later by C. Soret [1879].

In recent years, thermodiffusion has gained a great interest both academically and industrially due to its importance in many scientific and engineering applications. Binary mixtures are relatively well understood and several theoretical models exist for the prediction of the thermodiffusion coefficient. However, multicomponent mixtures are no so deeply understood, therefore experimental results are needed in order to validate the proposed theoretical models for these multicomponent mixtures (nonequilibrium thermodynamics and molecular dynamics).

Recently, some experimental techniques such as thermogravitational columns, modern optical methods and microgravity experiments have been improved. Accurate experimental techniques and comprehensive theoretical models are essential to develop the relationship of transport phenomena to fluid analysis.

In the Laboratory of Fluid mechanics of Mondragon University, we use the Thermogravitational technique for the determination of thermodiffusion coefficients and the Sliding Symmetric Tubes technique for the determination of molecular diffusion coefficients. Nowadays, Soret coefficients are determined by the combination of the measurements of thermodiffusion and molecular diffusion coefficients.

These experimental studies have helped, among others, to analyse the thermohidrodynamic stability by the thermogravitational effect and the validity limits of FJO theory, or to determine different quantitative correlations to predict thermodiffusion and molecular diffusion coefficients in binary and ternary mixtures. In addition, they have been useful to develop new experimental processes.

References

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