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Abstract

ON BEHALF OF THE INTERNATIONAL TOPICAL TEAM DCMIX

In a liquid mixture composed of several components, a temperature gradient leads not only to transport of heat, but also to mass transport and thus also to differences in concentration between various components. This so-called thermodiffusion (also Soret effect or thermal diffusion) may play an important role in many natural and technological processes. Thermodiffusion is present in most reservoirs because the fluids in place are subject, over geological times, to a vertical geothermal gradient of about 0.03 K/m.

With the aim to establish reliable and guaranteed convection-free reference data on thermodiffusion, ESA (European Space Agency) has developed an instrument SODI (selectable optical diagnostics instrument) which is placed on the ISS. While examining a binary solution, the IVIDIL, the first experiment inside the SODI, made a significant step toward ternary mixtures confirming that (a) the daily onboard environment of the ISS does not perturb diffusion-controlled experiments and (b) the results obtained onboard the ISS are reliable. Currently, the interest of science has moved towards ternary mixtures that can be seen as prototypes for truly multicomponent mixtures.

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 international DCMIX project is focused on the investigation of mass transport in ternary mixtures and comprises four experiments on the ISS with participating research groups from Belgium, Canada, France, Germany, Italy, Japan, Russia, and Spain.

Three campaigns of experiments in convection-free environment are already finished. They have examined: (DCMIX1) a mixture of hydrocarbons composed of THN-IBB-C12 (DCMIX2) a partially miscible mixture composed of toluene, methanol, and cyclohexane; (DCMIX3) an aqueous mixture composed of water, ethanol, and triethylene glycol. The following DCMIX4 experiment has already been planned for the end of 2018.

One of the questions under discussion is the value of microgravity experiment. The DCMIX Project has significantly increased knowledge about ternary mixtures. Microgravity experiments have played a key role in these studies. DCMIX has permitted a consolidation of strong international science teams for the study of multicomponent mixtures. The tests onboard the ISS were an essential motivation. The results from all DCMIX experiments will be discussed shortly.