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PETROLEUM RESERVOIRS, POLYMER FRACTIONATION AND THE ORIGIN OF LIFE: THERMODIFFUSION EXPERIMENTS ABOARD THE ISS

Abstract

The well-known Fickian diffusion in liquid mixtures describes a mass flux of one component due to a concentration gradient. In non-isothermal systems, e.g. inside a Soret cell which is cooled from below and heated from above, a second mass transport mechanism occurs: thermodiffusion or thermophoresis. This so-called Ludwig-Soret effect leads to, e.g., an inhomogeneous composition of the crude oil within the earth's crust or is used for the analytical fractionation of polymers. Furthermore, the enrichment of organic molecules inside the porous rock of black smokers in the deep sea is assumed to have played an important role in the evolution of life.

The demixing of fluid samples during the experiments in ground-based laboratories may cause unwanted convective instabilities due to the gravitational force. To overcome this disturbing effect, the European Space Agency (ESA) as well as the Roscosmos State Corporation for Space Activities (ROSCOSMOS) started the DCMIX program in 2012 aboard the ISS inside the Microgravity Science Glovebox (MSG) with the aim to obtain a convection-free reference data set for the validation of ground experiments on the Soret effect in ternaries as model systems for truly multicomponent mixtures. To the present day four different campaigns with different characteristics of the samples were performed under microgravity conditions inside the Mach-Zehnder interferometer SODI.

In the interactive presentation we will give a short introduction in thermophoresis and show an overview on the DCMIX program in general, and the DCMIX-3 campaign in detail. Furthermore we will explain the interferometer aboard the ISS as well as our ground-based experiments.