Flow insurance, Equations of state of hydrocarbon fluids

A joint project with Imperial College

On April 6th 2016 at 01:38 local time, a Long March (Chang Zheng) 2D rocket lifted off from China’s Jiuquan Satellite Launch Centre carrying the SJ-10 (Shi Jian 10) research spacecraft. The satellite’s scientific payload included a variety of experiments including SCCO (Soret Coefficients in Crude Oil). SJ-10 landed in the Inner Mongolia region north of Beijing on April 18th at 15:04, a bit more than 12.5 days after its launch.
The SCCO experiment, which consists of cells under high pressure enclosed in a C-box, is the result of a partnership between the European Space Agency and China's National Space Science Center. UPPA is the scientific lead. It involves Imperial College London (ICL) among the academic partners as well as Université de Paris-Sud, Mondragon Unibertsitatea, Universidad Complutense and the Chinese Academy of Sciences. Two industrials from France (TOTAL) and China (Petrochina RIPED) also support the project.
The microgravity experiment was designed to provide reliable data on Soret coefficients in multicomponent mixtures under reservoir conditions. This intriguing phenomenon, also called thermodiffusion or thermophoresis, discovered more than a century ago, but is still poorly understood. It is observed in gaseous, liquid and even solid mixtures when subjected to a temperature gradient. In a convection free environment, the presence of a temperature gradient leads to a composition gradient in a mixture, as species preferentially migrate towards either cold or hot sections because of thermodiffusion. This intriguing phenomenon is present in most petroleum reservoirs because the fluids in place are subject to a vertical geothermal gradient. It thus affects the initial state of fluid distribution in a reservoir before production and explains the interest of the oil and gas industry for quantifying this phenomenon.

Within the framework of this project, the collaboration between UPPA (LFCR, UMR TOTAL-CNRS-UPPA 5150) and ICL (Dpt of Earth Science and Engineering) is mainly focused on the modelling of the Soret coefficient by combing molecular simulations, extended kinetic theories and modern liquid state theories.