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SORET COEFFICIENT MEASUREMENTS IN CRUDE OILS DURING THE CHINESE SJ-10 MISSION

Abstract

The Soret Coefficients in Crude Oils (SCCO) equipment is an experiment payload that aims at measuring thermo-diffusion effects in multicomponent fluid mixtures, as these measurements are of great interest to the petroleum industry and the related academic institutions. SCCO is currently poised to fly on the SJ-10 Chinese retrievable capsule (launch scheduled winter 2015-2016).

The conditions of the fluid samples in the SCCO experiment are closely adapted to those of realistic oil reservoirs and academically interesting model fluids. Typically, the fluid cell contains from 0.3 to 1 ml of hydro carbides at pressure between 50 and 350 bar.

The SCCO experiment unit was already flown previously on three space missions of the Russian spacecraft FOTON. Those were the result of a Canadian-European cooperation. The Canadian partners provided the software and electronics. while the European partners provided the cell boxes (C-Boxes).

Each C-Box contains 6 thermally controlled fluid cells: the hot side temperature is adjustable in between 40C and 65C, while the cold side can be set at any temperature in between 15C and 30C. The thermal gradient makes some of the liquid components moving towards the hot side and the others towards the cold side, resulting in a kind of "de-mixing" of the original multi-component blend. Just before the conclusion of the orbital flight phase, the hot and cold side of the liquid are separated from each other by means of a middle valve that prevents mixing during re-entry. Finally, a special mechanism inside the cell allows one to take a micro sample, at hot and cold side respectively, to be analysed in a gas chromatograph after the mission.

As the retrieval of the flown specimens is essential to the scientific result of the experiment and because of the objective difficulties to fly SCCO on one of ESA's microgravity platforms, it is currently planned to fly one box with 6 samples on board the Chinese spacecraft SJ-10, whose re-entry module will safely return the processed hydro carbide samples to Earth. This is part of a joint scientific program between the European and the Chinese space agencies. The final composition of liquids will be selected by European and Chinese scientists, in consultation with oil industries such as TOTAL and PETROLCHINA.

This paper describes the functionality of the SCCO instrument, its interfaces towards the SJ10 spacecraft and the operations related to its specific space flight on SJ-10.