MICROGRAVITY SCIENCES AND PROCESSES (A2)
Facilities and Operations of Microgravity Experiments (5)

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DECLIC, SOON TWO YEARS OF SUCCESSFUL OPERATIONS

Abstract

DECLIC is a multi-user facility to investigate the behaviour of critical fluids and the directional solidification of transparent alloys.

As part of a joint NASA/CNES research program, the facility was launched with 17-A Shuttle flight and has been operated onboard the ISS since October 2009.

The instrument monitoring is mainly carried out from the CADMOS (CNES, France). Two out of the three developed inserts have been tested so far.

The DSI (Directional Solidification Insert) is dedicated to the study of the solidification of succinonitrile based alloys, analogue of metallic ones. Its first cycle of operations with a succinonitrile - 0.24 wt% camphor sample, which is close to the end, has already shown unprecedented and unique 3D observations. The results will be used as benchmark data concerning the solidification interface pattern characteristics. The DSI insert will be brought back with the ULF-6 Shuttle flight for refurbishment (the cartridge will be replaced by another one containing a different camphor concentration) and launched again by the end of 2012.

The HTI (High Temperature Insert) is dedicated to the study of pure water as a critical fluid. It has produced fundamental results concerning the critical point of water after having faced a troublesome thermal gradient that was finally solved through software modifications (1). Even if it has to be confirmed by post-flight tests, a first water critical temperature value has been approached for the first time in microgravity and interesting light turbidity measurements have been performed. The insert will fly back with the ULF-5 Shuttle flight and will be refurbished in order to be launched again by mid-2012. The pure water filled cell will be replaced by a salted water filled cell in order to study salt precipitation phenomenon in supercritical water.

The ALI insert hosts SF6 (sulphur hexafluoride) as a near-ambient temperature critical fluid. The commissioning is scheduled in March 2011 and experimental sequences will follow. The ALI experiment will measure thermodynamic quantities (thermal diffusivity, heat capacity and turbidity) and boiling crisis effects near the liquid-gas critical point of SF6.

When the IAC 2011 takes place, the instrument should have performed two years of operations. Complementary results with the DSI and HTI inserts should be available, as well as preliminary results with the ALI insert. Moreover, the HTI refurbishment process should have started.

REFERENCES (1) G Pont et Al. “Declic, First Results on Orbit” IAC-10-A2.5.1(2010)