Paper ID: 26377
oral

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond - Part 1 (6)

Author: Mrs. Carole Lecoutre
CNRS-ICMCB, France, lecoutre@icmcb-bordeaux.cnrs.fr

Dr. Romain Guillaument
CNRS - ICMCB, France, guillaument@icmcb-bordeaux.cnrs.fr
Dr. Yves Garrabos
CNRS, France, garrabos@icmcb-bordeaux.cnrs.fr
Dr. Daniel Beysens
Commissariat à l'énergie atomique et aux énergies alternatives (CEA), France, daniel.beysens@espci.fr
Dr. Inseob Hahn
National Aeronautics and Space Administration (NASA), United States, inseob.hahn@jpl.nasa.gov

A HIGH RESOLUTION THERMAL TOMOGRAPHY OF SF6 FLUID NEAR ITS CRITICALITY IN WEIGHTLESSNESS

Abstract

Early stage of thermal equilibration near the liquid-gas critical point of fluid sample in a constant volume cell is rapid due to the adiabatic process, called "piston effect." Nevertheless, the later stage of the equilibration is governed by the slow diffusive process. Therefore the complete equilibration process depends on the thermal performance of the regulation system, and then of the sample cell material, its geometry, thermophysical properties of the sample fluid, and the thermal history of the sample. Experiments to study the critical phenomena extremely close to the critical point have been hampered by the resulting residual temperature gradient and its associated local density inhomogeneity. Even for a high quality level thermal regulation, this residual temperature inhomogeneity inside the fluid can be extremely small near the critical point and not measurable directly using a conventional thermometry. Here we show indirect measurements of two dimensional temperature and density profile of near critical SF6 fluid in an entire cylindrical cell by a wide field-of-view turbidity measurements and a theoretical equation-of-state model. This turbidity measurement was performed in weightless conditions using the DECLIC (Dispositif pour l'Etude de la Croissance et des LIquides Critiques) facility and the ALI insert on board International Space Station (ISS). We will present the new thermal tomography technique for a near critical fluid and its applications to study critical phenomena.