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TEMPERATURE AND DENSITY RELAXATION NEAR THE LIQUID-GAS CRITICAL POINT: A MODELING FOR DECLIC/ALI EXPERIMENTS IN MICROGRAVITY

Abstract

To study thermodynamic properties of a fluid extremely close to the liquid-gas critical point, it is crucial to understand the temperature and density equilibration of the sample. In the most cases, this equilibration process depends on the sample cell material, its geometry, thermophysical properties of the sample fluid, and thermal history of the sample. We present a study of the temperature and density relaxation of a composite system with a SF6 sample fluid at its near critical point and a circular disk shaped sample cell. A previously developed analytical solution of the piston effect in two dimension for a cylindrically symmetric three dimensional cell, including finite conductivity of the sapphire cell window, is analyzed together with a recent crossover equation-of-state model. To assess the validity of this approach, a numerical simulation based on the pancake cell design is also performed. The results will be used to understand the recent DECLIC-ALI microgravity experiment and to optimize the future monitoring of the new ALI-R sample cell. The ALI-R is a flight experiment to measure turbidity of SF6 at its liquid-gas critical point utilizing the DECLIC facility on board ISS, and currently planned to be launched in 2015.