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GAS-LIQUID INTERFACE DISTRIBUTION OF CRYOGENIC PROPELLANT TANKS AT DIFFERENT MICROGRAVITIES

Abstract

The distribution of the gas-liquid interface inside the cryogenic propellant tank is critical for long-term on-orbit storage and engine on-orbit start-stop. At present, through simulation analysis and ground drop tower experiments, it is found that the gas-liquid interface in the microgravity environment will have a completely different distribution than that in the normal gravity environment. This is because the effect of gravity is significantly weakened at this time, and the Marangoni effect driven by surface tension dominates. To understand the unexpected result, the Kinetic Theory of Gases (KTG) is used to establish the evaporation-condensation model in the cryogenic propellant tank, and the distribution of the gas-liquid interface and the heat and mass transfer between the gas-liquid-solid under different gravity are simulated and analyzed. Different fluids and different sizes of tanks under microgravity are also simulated at the same Bond number.