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Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

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THERMOCAPILLARY CONVECTION EXPERIMENT FACILITY OF AN OPEN CYLINDRICAL ANNULI FOR SJ-10 SATELLITE

Abstract

During the past decades, thermocapillary convection has drawn much attention for its internal scientific rules and practical research value. Lots of works have been done including a lot of theoretic analysis, numerical calculations as well as ground experiments. Subjected to a radial temperature difference, the liquid layer's fluid motion in an open cylindrical annuli will occur as a convection driven by temperature-induced interfacial-tension variations. A space experiment about thermocapillary convection in an open cylindrical annuli will be conduced on SJ-10 satellite, which is a Chinese recoverable satellite launched in 2015. The outer radius of the annuli test cell R is 20mm, the inner radius r is 4mm, the depth H is 12mm; the liquid layer is heated by inner rod (copper), cooled by 6 semiconductor coolers connected to the outer wall. The test fluid will be 2cSt silicone oil or 5cSt silicone oil. A set of facility has been established, which includes a cylindrical annuli liquid test system including liquid storage and filling liquid system, two sets of temperature controlling system and a set of temperature measurement system, a thermal infrared imager, a high-precision displacement sensor to surface oscillation system, and experiment controlling system. By the facility some experiments have been done on ground in order to comparing the experiment results of μg and $1g$. From the ground experiment, the temperature oscillation, surface oscillation, and the flow pattern transfer have been observed.