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REVIEW AND DEVELOPMENT PLANNING OF MICROGRAVITY FLUID PHYSICS IN CHINA

Abstract

The development of China's space industry has provided an unprecedented opportunity for the study of microgravity fluid physics. The manned space project is one of the main approaches for the study of microgravity fluid physics. Microgravity fluid physics experiments were arranged in ShenZhou (SZ) series spacecraft, TianGong (TG) space laboratory and TianZhou (TZ) cargo spacecraft. Among them, Droplet Thermal Capillary Migration Experiment in SZ-4, Complex Colloidal Crystal Growth Experiment in TG-1, Large Prantl Liquid Bridge Thermal Capillary Convection Studies in TG-2, Key Technologies of Two-phase System Experimental Platform Studies in TZ-1 were carried out.

Return satellite is another important approach for the study of microgravity fluid physics. The studies of Migration and Interaction of Bubble Marangoni and Filamentous Heating Surface Pool Boiling Heat Transfer have been carried out in the 22nd return satellite. Four fluid physics experiments were carried out in ShiJian-8(SJ-8). Among them,(1)study of the kinematic behavior of the particulate matter under slight vibration driven in microgravity for the first time, and (2) application of space Mach-Zehnder interferometer and measurement of Eucommia protein diffusion coefficient for the first time were the main achievements. Fluid physics experiments using SJ-10 include:(1) Evaporation and Fluid Interface Effect Experiment. (2) Particle Motion Behavior-Particle Fluid Gas-Liquid Separation Experiment. (3) Study on the Thermodynamic Characteristics of Bubbles during Microgravity Boiling. (4) Hot Capillary Convection Surface Wave Experiment.(5)Colloidal Orderly Arrangement and New Material Research. (6) Study on Thermal Diffusivity of Petroleum Components and Measurement of Soret Coefficient. A large number of research results were achieved.

In the future, China will make use of the development of the space station to gradually establish an experimental platform of international advanced level. Chinese Space Station has planned experiment cabinets dedicated to fluid physics research. Fluid Physics Experiment Cabinet supports for fluid dynamics and complex fluid science experiments. Two-phase System Experiment Cabinet supports for basic research for applications such as space phase transition heat transfer, two-phase flow heat transfer and fluid management. Relevant projects are being solicited. It is expected that systematic achievements will be made in the basic research on new fluid systems such as soft matter, dispersion system, multiphase flow and phase transition heat transfer and so on.

The research results obtained by China in completed microgravity fluid physics experiments will be discussed in detail. The future development plan of microgravity fluid physics in China will be analyzed.