Paper ID: 64046
interactive

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Fluid and Materials Sciences (2)

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MICROGRAVITY FLUID PHYSICS RESEARCH PLANNING FOR SPACE AND GROUND APPLICATIONS

Abstract

The research on microgravity fluid physics in Chinese Space Station (CSS) can be divided into three research topics: microgravity fluid dynamics and its application, multiphase flow and phase change heat transfer and its application, and complex fluid and special fluid. In addition to the study of mechanism and the discovery of new phenomena and laws of fluid movement and heat (mass) transport under microgravity, it has important space and ground applications in space fluid management, chemical smelting, biology and medicine, material manufacturing and processing and other fields. In space applications, research on scientific issues related to the design of aerospace engineering fluid systems such as cryogenic propellant storage and transportation systems, life support systems, including interfacial flow and heat transfer, propellant phase change heat, and autogenous pressurization delamination, liquid-solid coupling sloshing, capillary transport interface stability, etc., promote the development and manufacturing of new safe and efficient space thermal equipment. Carry out research on space fluid films. Functional films have a wide range of applications in space, such as thermal control coatings, mirror surfaces for astronomical observation, and so on. Fluid film formation is a common thin film forming method. Studying the film formation mechanism under microgravity will not only help expand "space manufacturing", but also guide our ground engineering activities. In terms of ground applications, research on biological fluids (such as blood, sweat, etc.) is carried out. Biological fluids are a type of highly complex fluid system. They are the basic substances that constitute life and carry a large amount of biological, physical, and chemical information related to human health. Research on it is helpful for space disease diagnosis and health monitoring. Carry out space microgravity experimental research on colloidal phase separation, research on colloidal particle separation and collection, and have reference value for the research on the phase separation process of polymers, metal smelting, biological macromolecules and other different systems;In order to ensure product quality (such as skin care products), extend the shelf life of products, and provide theoretical and scientific experimental basis, carry out research on non-Newtonian fluids such as emulsions. This paper will take the application as the goal, discuss the possible microgravity fluid physics research in the CSS, and provide reference for the planning and development of future research projects in the field of fluid physics.