Paper ID: 45471
oral

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Science Results from Ground Based Research (4)

Author: Ms. Wang-Fang Du
Institute of Mechanics, Chinese Academy of Sciences, China, duwangfang@imech.ac.cn

Prof.Dr. Jianfu Zhao
National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences., China, jfzhao@imech.ac.cn

CRITERIA FOR DOMINATED FORCE REGIME MAP IN MULTIPHASE THERMAL FLUID SYSTEM

Abstract

The gravity effect is one of the key problems of microgravity multiphase thermal fluid dynamics, which has attracted wide attentions. In the present paper, focusing upon the gravity-independence, the up-to-date progress of the research on dominated force regime map in multiphase thermal fluid system is reviewed comprehensively based on analyzing main forces such as surface tension and inertia force, which can act as an opposite side of gravity in multiphase thermal fluid system. Three dimensionless numbers, i.e. Bond number, Weber number and Froude number, are then able to act as the criteria for differentiating different regimes. Only two of the above three dimensionless numbers are independent. The other one can then be represented as a combination of these two independent dimensionless numbers. There are, however, many definitions for the latter two dimensionless numbers because of lots of variables existed in multiphase thermal fluid systems. For example, Zhao et al. (2000) proposed the gas superficial Weber number which is based on the parameters of the gas phase ought to be the most appropriate one, while Baba et al. (2011) used the mixture Weber number based on the parameters of the gas-liquid two-phase mixture. Detail analyses are made on the difference between the two criteria for dominated force regime map in multiphase thermal fluid system based on some new experimental data. And then a dominant force regime map and the corresponding criteria for the boundaries between adjacent regimes are presented. The results are helpful for the research and development of multiphase thermal fluid technology in space applications, as well as for those in ground applications, such as micro-channel multiphase thermal fluid system.