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Author: Prof. Li DUAN
National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences., China, duanli@imech.ac.cn

Dr. Peng ZHU
Institute of Mechanics, Chinese Academy of Sciences, China, pengzhu405@yahoo.com.cn
Prof. Qi KANG
National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences., China, kq@imech.ac.cn

SURFACE OSCILLATION OF THE BUOYANT-THERMOCAPILLARY CONVECTION IN A RECTANGULAR CAVITY

Abstract

The thermocapillary convection is primary flow in microgravity environment, it is important to influence heat and mass transfer. The fluid interface is essential factor for forming the thermocapillary convection. Surface oscillation reflects the convection characters. In the transition process, the coupling of the interface and the convection expresses complicated physics mechanism. Study on the fluid interface behavior supplies new method for studying the nonlinear characters, the convection stability, and the fork process. This research work could improve the techniques of the fluid engineering, the heat energy machine, the material machining, and the chemical engineering.

The non-uniformity of surface tension brings the unstable convection and the unstable free surface. We could understand instability of the buoyant thermocapillary convection by studying the behavior of the fluid free surface. The purpose of the present research work is to study the behavior of the fluid free surface in the transition process of the buoyant thermocapillary convection, and analyses the oscillation mechanism and the fork process.

In this paper, the buoyant thermocapillary convection in an open rectangular cavity is discussed. The convection transition mechanism is very complex, the thickness of liquid layer and the temperature difference play key roles. The result shows that there are two primary surface oscillations, related to the transition of the convection states. The critical parameters for the transition of buoyancy-thermocapillary convection flow states are obtained through analysis and experimental observations of the surface oscillation.