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EXPERIMENTAL STUDY ON THE OSCILLATION MECHANISMS OF THE BUOYANT THERMOCAPILLARY CONVECTION

Abstract

The non-uniformity of surface tension brings unstable convection and unstable free surface. We could understand the instability of thermocapillary convection by studying the behavior of fluid free surface and the temperature in the liquid layer. The purpose of the present research work is to study the behavior of fluid free surface and the temperature oscillation in the transition process of thermocapillary convection, and analyses the oscillation mechanism and the bifurcation process of the buoyant thermocapillary convection. In this paper, the thermocapillary convection in an open rectangular cavity is discussed. A displacement sensor is used to measure the surface oscillation, and a thermocouple is used to measure the temperature in the liquid layer. In the evolution of the convection, the free surface oscillation in micro-nanometer order has been measured quantificationally, and the temperature oscillation also has been measured. They are controlled by the thickness of liquid layer and the temperature difference. The result proves that the oscillations are related to the transition of the convection states, and the double frequency signal demonstrates that the convection transits to chaos.