MICROGRAVITY SCIENCES AND PROCESSES (A2)
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EVAPORATION EFFECTS ON THERMOCAPILLARY CONVECTION IN VAPOR-LIQUID SYSTEM

Abstract

The thermocapillary convection is of great importance in microgravity environment and small-scale thermal process. In this talk, our recent work on the theoretical and experimental investigations of evaporation process coupled with thermocapillary convection will be presented. The numerical simulation on the combined effects of thermocapillary convection and the evaporation in a pure liquid layer with a top free surface in contact with its own vapor was performed, especially in microgravity condition. Three different regimes of the coupling mechanisms were found in this modeling system. The coupling of evaporation effect and thermocapillary convection in a thin evaporating liquid layer was also studied experimentally on the ground. We measured successfully the average evaporating rates and temperature profiles along the evaporating interface, and the temperature jumps at the interface were found in experiments. For this study, a space experiment of evaporation liquid drop on plate is designed to be conducted on board the Chinese recoverable satellite. Two main conditions will be set. One is that liquid drop on plate has uniform temperature, with given initial ambient temperatures, expecting that thermal conductivity would play a dominative role to evaporate the liquid in this case. For the other condition, the liquid drop will be heated or cooled, imposing temperature gradient on the drop surface to introduce and enhance thermocapillay convection. Drop shape and its changing during evaporation will be captured and recorded by a high resolution CCD camera in real time. A quasi-steady evaporation experiment can be performed, in which the volume of drop liquid will keep constant during the experimental run. Through this evaporation experiment in microgravity, it is expected to have a better understanding of the evaporation mechanism.