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MICROGRAVITY EXPERIMENTAL OF BUBBLES THERMOCAPILLARY MIGRATION AND INTERACTION INTERACTION

Abstract

Some results on bubble thermocapillary migration and interaction in microgravity are presented in the paper. The microgravity experiment was performed on board the Chinese 22nd recoverable satellite in 2005. A bubble will move to hot side when placed in fluid with a temperature gradient in microgravity condition. If there are multi-bubbles in the fluid, it is possible that we observer to chase, hit, surpass or coalescence of the bubbles or drops etc. Such a phenomenon is already known as an interaction problem in Marangoni or thermocapillary migration. Bubble and drop dynamics problem is very significant because this investigation is very important for basic research as well as for applications in reduced gravity environment, such as space material science, chemical engineering and so on. In the space experiment, a cubic test cell was designed. Silicone oil was used as matrix phase. Two independence sets of injected liquid facility are installed in the experimental box. The recorded temperature data, video image of bubble migration in the experiment and the test facility were recovered along with the recoverable cabin of satellite. The bobble migration velocities are obtained by measuring the bobble's tracks according to recorded image. The chase and interaction of bubbles are observed. The track and velocity change during the approach were obtained in different ratios of bubble radius. Specially, the obvious velocity attenuation of small bubble owing to the interaction of bubbles ware displayed clearly. Even the moving forwards of smaller one may stop in a short time when two bubbles migrate side by side. The effect range of Interaction during chase and surpass can be analyzed according to the velocity curves of bubble migration. Bubble coalescences are also observed through the bubbles staying at the upper side of the test cell in the experiment. Reduced gravity is the only way to observe the coalescences of large spherical bubbles without deformation of shape. It is the first time to obtain the detail results of coalescences of large size bubbles in reduced gravity. In the several times of coalescences, the radius of bubbles ranges from 1.02 mm to 9.26 mm. And the coalescence time and size of bubbles are fitted with a formula derived from the theory that the coalescence phenomenon is driven by chemical potential difference between bubbles or drops.