Paper ID: 44164
oral
student

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

Author: Mr. Kenji Kobayashi
University of Tsukuba, Japan

Dr. Akiko Kaneko
University of Tsukuba, Japan
Dr. Koji Hasegawa
Kogakuin University, Japan
Prof. Yutaka Abe
University of Tsukuba, Japan

# EFFECT OF EVAPORATION ON FLOW STRUCTURE OF ACOUSTICALLY LEVITATED DROPLET

**Abstract**

In recent years, containerless processing using levitation method is of great importance in various fields. The realization of non-contact suspension of samples is expected to avoid problems caused by container wall such as heterogeneous nucleation, contamination of impurities, and adsorption to container wall. The acoustic levitation method is one of the methods to achieve a containerless processing. This method enables any and larger sample to levitate and manipulate relatively easily. On the other hand, it has been pointed out that the nonlinear phenomenon such as acoustic streaming is caused by the strong sound field. In particular, the complicated flow generated inside and outside a droplet has a close relationship with the phase change behavior such as evaporation which is essential in the process of containerless processing. Therefore, it is necessary to elucidate the interaction between the internal and external flow structures and the phase change behavior of the acoustically levitated droplets for a containerless processing using the acoustic levitation method. In this study, six samples with different saturated vapor pressures was used to evaluate the effect of droplet evaporation on the flow structure. We visualized and quantified the flow structure by applying PIV and PTV to the obtained flow structure. Density change around a levitated droplet was also measured by using Mach-Zehnder interferometer. From the result of external flow measurement, it was found that the external flow structure around the levitated droplet changed with the increase of the saturated vapor pressure. In addition, the flow velocity and the thickness of the vortex structure in the vicinity of the droplet decreased as the saturated vapor pressure increased. From the results of the contactless density measurement, it was found that the phase difference around the droplet became larger as the saturated vapor pressure increased. It is considered that this phase difference represents the density change around the droplet due to the evaporation of the droplet. In order to investigate the interaction between the flow structure and the phase change behavior, we carried out experiments using rigid spheres coated with pentane to visualize the transition of flow structure and density distribution around the rigid sphere. Experiments with coated rigid spheres demonstrated the transition process of the external flow structure of the droplet. Note that the external flow structure of the acoustically levitated droplet was changed due to the density change caused by droplet evaporation.