Measuring formation of a vapor bubble around a heated nanoparticle and size of nanoparticles by holography

Linglong Wang*, Yingchun Wu, and Xuecheng Wu

State Key Laboratory of Clean Energy Utilization, Zhejiang University, 38 Zheda Rd., 310007 Hangzhou, China

**Presenting author (wanglinglong@zju.edu.cn)*

Nanoscale particles and micron-sized bubbles are widely found in many industrial processes. The properties exhibited by nanomaterials in the fields of chemical, medical, material and environment sciences are closely related to particle size [1]. When the laser is focused on liquids dispersed with nanoparticles, the formation of laser-induced bubbles are related to the size of particle [2–5]. In this talk we will present the recovery of the size of nanoparticle by measuring the growth process of the laser-induced bubble when the nanoparticles are dispersed in liquids and irradiated by a strong pulsed laser. First, vapor bubbles are formed due to photothermal conversion between laser pulses and liquids containing absorptive nanoparticles, and the growth process of induced bubbles (including expansion and contraction) is recorded by high-speed holography. Then a bubble growth model is established based on heat transfer and bubble dynamics for predicting the size change of bubble generated by the laser irradiation of the nanoparticle. Finally, the size of nanoparticle is deduced and obtained from the experimentally measured bubble size and the numerical simulation results. The research result provides a method for measuring the size of nanoparticles and vapor bubble variation during liquid flow.

References

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