Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Nucleation of Plasmonic Bubbles in Binary Liquids MARVIN DETERT, Physics of Fluids Group, University of Twente, The Netherlands, BINGLIN ZENG, YULIANG WANG, Robotics Institute, School of Mechanical Engineering and Automation, Beihang University, P.R. China, HAROLD J. W. ZANDVLIET, Physics of Interfaces and Nanomaterials, MESA+ Institute for Nanotechnology, University of Twente, The Netherlands, DETLEF LOHSE, Physics of Fluids Group, Max Planck Center Twente for Complex Fluid Dynamics, University of Twente, The Netherlands — When a noble metal, plasmonic nanoparticle is immersed in a liquid and irradiated with a laser of resonant frequency, it can heat rapidly and a vapor bubble can be nucleated. Bubbles generated this way are called plasmonic bubbles and have garnered a lot of attention due to their variety of applications. We want to disentangle the effect of various control parameters, such as the boiling temperature, the heat conductivity, the latent heat of vaporization etc., by measurements via ultra-highspeed imaging. A perfect candidate for these measurements are binary liquids, because their parameters can be tuned by their composition. We show both experimentally and theoretically that the time of bubble nucleation is determined by the total amount of dissolved gas. In contrast, the maximum volume of the bubble is governed by the energy needed for vaporization. Consequently, the bubble's nucleation time and its maximal size can be tuned by varying the corresponding liquid parameters. We envisage that our findings will not only have important consequences for current applications, but might also result in new applications.

Marvin Detert
Physics of Fluids Group, University of Twente, The Netherlands

Date submitted: 01 Aug 2019 Electronic form version 1.4