Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Oil-coated bubble formation at coaxial orifices BINGQIANG JI, JIE FENG, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Dispersions of gas bubbles in liquids are widely present in natural phenomena and various industrial processes, therefore surface phenomena effect on bubble formation in liquids remains as one of the most significant research questions in fundamental multi-phase flows. Here, we document the formation of an oil-coated bubble at coaxial orifices in quiescent liquids. The air bubble is generated inside an oil domain, and then exits into the water with an oil coating under buoyancy. The existence of the oil significantly modified the bubble size, compared with the case of bubble formation in water. We developed a force balance model to predict the oil-coated bubble size, considering the orifice geometry as well as the compound air/oil/water interface. We found that the model agrees well with the experimental results, and we further discussed the dependences of the bubble size on the Bond number, size ratio of the orifices, as well as the interfacial tension ratio of oil/water and oil/air interfaces. Our study contributes to a further understanding on the dynamics of bubbles with a compound interface.

Bingqiang Ji
University of Illinois at Urbana-Champaign

Date submitted: 01 Aug 2020 Electronic form version 1.4