Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Thermal effects in the collapse of a cavitation bubble[1] MINKI KIM, ERIC JOHNSEN, University of Michigan — Cavitation bubbles play an important role in determining the efficacy and sustainability of a given system in naval hydrodynamics and biomedical applications. The energy concentration and shock emission during collapse are significant damaging mechanisms. Thus, we need to better understand energy concentration efficacy during the collapse. In the present study, energy budgets and energy transfer pathways in the spherical collapse of a gas bubble are investigated with specific consideration of thermal effects. A Rayleigh–Plesset-type equation is solved with taking into account compressibility and heat diffusion. Energy in the liquid-bubble system is partitioned into four components: liquid potential, kinetic and internal energy and bubble internal energy. As a bubble collapses, the initial liquid potential energy is transferred to the liquid kinetic energy and bubble internal energy. In addition, the bubble loses its thermal energy to liquid through heat diffusion, which leads to the increase in the liquid internal energy. At the final stage of collapse, thermal effects play a role in energy concentration due to coupling between heat diffusion and compressibility.

[1]This work was supported in part by ONR grant N00014-18-1-2699 under Dr. Ki-Han Kim and by DOE grant DE-NE0008747 and used the Extreme Science and Engineering Discovery Environment (XSEDE), which is supported by National Science Foundation grant number ACI-1548562. MK gratefully acknowledges support provided by the Kwanjeong Fellowship.

Minki Kim
University of Michigan

Date submitted: 29 Jul 2020 Electronic form version 1.4