Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Oscillatory Flame Response in Acoustically Driven Fuel Droplet Combustion[1] BRETT LOPEZ, CRISTHIAN SEVILLA, TAKESHI SHOJI, ARI EKMEKJI, OWEN SMITH, ANN KARAGOZIAN, University of California, Los Angeles — This experimental study focuses on droplet combustion characteristics for various liquid fuels during exposure to external acoustical perturbations generated within an acoustic waveguide. The study examines combustion during excitation conditions in which the droplet is situated in the vicinity of a pressure node (PN). In response to such acoustic excitation, the flame surrounding the droplet is deflected, on average, with an orientation depending on the droplet's relative position with respect to the PN. Flame orientation is always found to be consistent with the sign of a theoretical bulk acoustic acceleration, analogous to a gravitational acceleration.[2] Yet experimentally measured acoustic accelerations based on mean flame deflection differ quantitatively from that predicted by the theory. Phase-locked OH* chemiluminescence imaging reveals temporal oscillations in flame standoff distance from the droplet as well as chemiluminescent intensity which are especially pronounced when the droplet is situated close to the PN. Quantification of combustion-acoustic coupling via the Rayleigh index reveals a more detailed understanding of dynamical phenomena.

[1]Supported by the Air Force Research Lab/ERC Inc. and the UC CARE and MSD Scholars programs.
[2]Tanabe, et al., PCI, 2000

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Date submitted: 30 Jul 2013 Electronic form version 1.4