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Oscillatory Flame Response in Acoustically Driven Fuel Droplet Combustion[1] CRISTHIAN SEVILLA, AYABOE EDOH, JEFFREY WEGENER, AARON SUNG, KELVIN CHEN, BRETT LOPEZ, OWEN SMITH, ANN KARAGOZIAN, University of California, Los Angeles — This experimental study focuses on combustion of liquid fuel droplets during exposure to external acoustic disturbances generated as standing waves within a closed acoustic waveguide. Both visible imaging as well as phase-locked OH* chemiluminescence imaging are used to quantify flame motion and response during such excitation. Acoustic perturbations create both a mean flame deflection as well as flame front oscillations in time that can be dependent on the droplet's location relative to the pressure node (PN) or pressure antinode (PAN) in the waveguide. A range of acoustic forcing frequencies and droplet locations can be used to investigate flame movement. Phase-locked OH* chemiluminescence imaging reveals not only a deflected flame which oscillates in position relative to the droplet, but also different degrees of oscillation depending on excitation frequency and droplet position within the waveguide; there are also oscillations in localized flame front chemiluminescent intensity. Results for differences in flame dynamics are explored in the context of the well-known Rayleigh criterion, with implications for other non-premixed reactive systems.

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