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Effects of Nanoparticulate Additives on Acoustically Coupled Fuel Droplet Combustion[1] ANDRES VARGAS, MIGUEL PLASCENCIA, HYUNG SUB SIM, OWEN SMITH, ANN KARAGOZIAN, UCLA — The present study investigates interactions between applied acoustic perturbations and burning ethanol droplets containing nano particulate additives. Reactive nanoscale aluminum (nAl) as well as inert silica (nSiO2), each with an 80 nm average diameter. Continuously-fed fuel droplet combustion experiments were conducted in the vicinity of a pressure node created in a closed acoustic waveguide, with a range of applied forcing frequencies, pressure or velocity perturbation amplitudes, and particle loading concentrations. Simultaneous phase-locked OH* chemiluminescence and high-speed visible imaging enabled quantification of the influences of nanoparticle concentration on burning rate constant K and combustion-acoustic coupling. Results indicated that nAl particles in ethanol yielded measurable increases in K with increasing applied perturbation amplitudes, as compared to pure ethanol in the presence of acoustic excitation. Droplets with nAl exposed to moderate acoustic excitation exhibited sustained combustion for much longer periods of time than for unforced conditions. Post analysis of particulate matter collected from residue via electron microscopy aids in interpreting these trends and findings.

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