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Effects of Particle Additives on Acoustically Coupled Fuel Droplet Combustion[1] HYUNG SUB SIM, MIGUEL PLASCENCIA QUIROZ, ANDRES VARGAS, JOHN BENNEWITZ, OWEN SMITH, ANN KARAGOZIAN, UCLA — Addition of nanoscale particulates to liquid hydrocarbon fuels is suggested to have numerous benefits for combustion systems, although aggregation of metal nanoparticles can produce deleterious effects. The present experiments explore the effect of nano Aluminum (nAl) additives on the combustion of single liquid fuel droplets, with and without exposure of the droplets to standing acoustic waves. Building on prior studies[2], the present experiments quantify variations in the burning rate constant K for ethanol droplets with increasing concentrations of nAl in a quiescent environment. Burning fuel droplets that are continuously fed via a capillary as well as suspended (non-fed) droplets are examined. Nano Al is observed to create ejections of both particles and vapor toward the end of the burning period for non-fed droplets; this phenomenon is delayed when the droplet is replenished via continuous fuel delivery. Yet for the majority of conditions explored, increasing concentrations of nAl tend to reduce K. When ethanol droplets with nAl are exposed to standing waves, acoustic perturbations appear to delay particulate agglomeration, sustaining combustion for a longer period of time and increasing K.

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[2]Sevilla, et al., Comb. Flame **161**, pp. 1604-1619, 2014

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