

Abstract Submitted
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Combustion of droplets in turbulence¹ PHILIPP WEISS, STHAVISHTHA BHOPALAM RAJAKUMAR, DANIEL W. MEYER, PATRICK JENNY, Institute of Fluid Dynamics, ETH Zurich, Sonneggstrasse 3, 8092 Zurich, Switzerland — The combustion of droplets in turbulence involves complex, interacting phenomena. First, the droplets cluster in regions of low vorticity and modulate the velocity fluctuations of the gas. Second, the droplets release vapor and energy, which then mix with the gas. Third, the vapor reacts with the oxidizer creating diffusion flames, which surround individual droplets or droplet clusters, and premixed flames, which propagate through mixtures of vapor and oxidizer.²

These phenomena are investigated with direct numerical simulations. The gas phase is modeled with the low Mach number approximation, and the droplets are modeled as point droplets.³ The combustion of vapor and oxidizer is modeled with a one-step reaction mechanism. Droplet clusters are analyzed with Voronoi tessellations, and diffusion and premixed flames are identified with Takeno's flame index.⁴ Simulations with different droplet diameters, droplet number densities and turbulence intensities are performed.

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²Jenny, Roekaerts, and Beishuizen, *Progress in Energy and Combustion Science* **38**, 846-887 (2012).

³Weiss, Giddey, Meyer, and Jenny, *Physics of Fluids* **32**, 073305 (2020).

⁴Yamashita, Shimada, and Takeno, *26th Symposium on Combustion*, 27-34 (1996).

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