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Lagrangian Analysis of Premixed Turbulent Flames CLARISSA BRINER, PETER HAMLINGTON, Univ of Colorado - Boulder, ALEXEI POLUDNENKO, Naval Research Laboratory — Turbulent premixed combustion is a complicated problem that requires understanding of turbulence and chemistry, as well as their interactions. By contrast to the Eulerian approach, Lagrangian analyses track the evolution of chemical species and flow properties for an advecting fluid parcel. This approach permits detailed analysis of chemical reaction rates and validation of chemical reaction models. Lagrangian trajectories also allow changes in chemical species and flow properties to be examined locally and instantaneously through premixed flamelets. In this study, a Lagrangian analysis has been performed on data from direct numerical simulations of premixed H_2-air flames for two different turbulence intensities, using a 8-species chemical reaction mechanism. The relative contributions of dynamical budget terms are calculated for both chemical species, including reaction and diffusion terms, as well as vorticity, which depends on baroclinic torque, dilatation, and viscous effects. Scales of motion throughout the flame are also characterized using multi-point correlations. The results reveal complicated dynamics, including non-monotonic behavior of temperature and fuel mass fractions along trajectories, as well as changing scales of motion through the flameout.

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