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Flame speeds and curvature of premixed, spherically expanding flames advecting in a turbulent channel flow[1] DAN FRIES, BRADLEY OCHS, DEVESH RANJAN, SURESH MENON, Georgia Institute of Technology — A new facility has been developed at the Georgia Institute of Technology to study sub- and supersonic combustion, which is based on classical flame bomb studies but incorporates a mean flow, allowing for a wider variety of turbulent conditions and the inclusion of effects like compressibility, while supporting shear-free spherical flames. Homogeneous, isotropic turbulence is generated via an active vane grid. Methane-air flame kernels advecting with the mean flow are generated using Laser Induced Breakdown ignition. The facility is accessing the thin reaction zone regime with $u'_{RMS}/S^0_L = 6.9 - 22$, $L_{11}/\delta_F = 44 - 68$ and $Re_\lambda = 190 - 550$. The flame kernels are probed with OH-Planar Laser Induced Fluorescence (PLIF). To validate the facility, results at $\overline{U} = 30$ m/s are compared to existing data using a scaling derived from a spectral closure of the G-equation. This indicates the reacting flow remains Galilean invariant under the given conditions. The differences between global and local turbulent consumption speeds derived from OH-PLIF results are discussed with a focus on modeling efforts. The curvature of flame wrinkles is evaluated to examine the impact of different turbulent scales on flame development.

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