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Flamelet model for supersonic combustion[1] VINCENT TERRAPON, HEINZ PITSCH, RENE PECNIK, Stanford University — The vast majority of computational work in supersonic turbulent combustion has so far relied on simplified/reduced mechanisms and the explicit transport of the involved species. Such approaches require then closure of the chemical source term in the species transport equation. An alternative approach is based on the flamelet concept which assumes that the chemical time scales are shorter than the turbulent time scales so that the flame can be approximated as one-dimensional. However, the implementation of the flamelet model is based on a low Mach number assumption, explaining the still very limited number of studies of high speed flows using this approach. Since supersonic speed and compressibility effects play an important role at supersonic speeds, the flamelet implementation has been reformulated where temperature is not any longer given by a chemistry table but computed from the total energy and the tabulated species mass fractions, thus, better accounting for compressibility effects. The model is applied to the combustor of the HyShot II vehicle and results are compared to experiment measurements and simulation data.

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