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An Improved Flamelet-Based Model for Non-Premixed Supersonic Combustion ZHIPENG LOU, FOLUSO LADEINDE, Stony Brook University, Stony Brook, NY 11794-2300, WENHAI LI, TTC Technologies, Inc., Centereach, NY 11720 — The flamelet approach to turbulent reacting flows, though originally developed for essentially incompressible flows, has been used by many authors to simulate supersonic combustion, often without much justification other than that pressure scales in certain ways. In a compressible flow, pressure and temperature vary strongly, meaning that the use of a fixed value of pressure for generating flamelet libraries may be prone to errors in the flamelet modeling of supersonic combustion. We study the influence of static pressure on the flamelet solutions intended for use in modeling supersonic combustion. With various values of static pressure, we found significant differences in the values of the quenching stoichiometric scalar dissipation rate, reaction rate of species and progress variable, heat release rate and the temperature profile. As a result, at high static pressures, the flame is less likely to extinguish and the S-curve shows a steeper angle. We have experimented with the addition of pressure as an independent variable in the flamelet table, toward modeling pressure-sensitive properties and the variable quenching conditions. The effects of this kind of scheme on supersonic combustion will be discussed.

Foluso Ladeinde
Stony Brook University, Stony Brook, NY 11794-2300

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