

Thermo-kinetics characterization of kerosene/RP-1 combustion

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A one-formula surrogate fuel, C₁₂H₂₄, and its quasiglobal kinetics have been developed to support the conceptual design of the injectors and thrust chambers of tri-propellant engines. This surrogate fuel represents a fuel blend that properly depicts the physical and chemical properties of kerosene/RP-1. The accompanying thermodynamics for the substitute fuel is generated and anchored with the heat of formation of kerosene/RP-1. The surrogate fuel model and its thermodynamics are verified by comparing a series of one-dimensional rocket thrust chamber thermo-equilibrium calculations under a kerosene-fueled Russian engine (RD-170) operating conditions. The models are then tested in conjunction with a CFD formulation for predicting the thermo-flowfield of two single-element shear triaxial injectors: a gaseous oxygen-kerosene-hydrogen injector and a liquid oxygen-liquid kerosene-gaseous hydrogen injector. The mixture ratio of those injectors is that of a proposed tri-propellant engine RD-704. A reasonable flame structure is predicted for those injectors. (Author)

