Impact of Alternative Fuels Physical Properties on Combustor Performance

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Abstract

This article describes a modeling procedure for calculating real fuel mixture thermophysical properties. First a GC-MS analysis gives the detailed composition of the fuel mixture. This enables to derive a multicomponent surrogate mixture, which encompasses all major fuel families and species. A property computation scheme is then described, which is based on pure species property semi-theoretical models and adequate mixing rules. Quantitative results are provided for the liquid mass density, viscosity and surface tension of crude-based kerosene and Diesel fuels and their alternatives. These properties are finally used to compute the Sauter mean diameter of two types of atomizers one pressure swirl atomizer and one pre-filming airblast atomizer in order to compare the alternative fuels composition effect on combustor performance with respect to their respective crude-based fuel. The larger departures in physical properties between Diesel fuel and Canola methyl ester when compared to kerosene-type fuels yield larger differences in Sauter mean diameters. Concerning the atomizers, pressure swirl type atomizers display a stronger dependency upon fuel physical properties when compared to airblast atomizers.

Key words: alternative fuels, thermophysical properties, atomization

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