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Experimental Study of Vitiation Effects on hydrogen/kerosene fueled Supersonic Combustor

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Abstract

Direct-connect tests were performed to determine the effects of vitiation on combustion in a supersonic combustor. Major combustion vitiation species (H_2O and CO_2) were added to the airstream. The tests were conducted in a direct-connect combustor with a Mach 2.02 inlet，hydrogen and kerosene were chosen as the test fuel. In the cases fueled with hydrogen, with an equivalence ratio of about 0.25, transition from cavity shear-layer combustion mode to combined shear-layer/recirculation combustion mode was observed in three test conditions, clean air stream, air stream with 4.5% H_2O and 4.5% H_2O + 4.5% CO_2, but not occurred in the case with 4.5% CO_2. In addition, in cases fueled with kerosene, the equivalence ratios were about 0.53 and 0.73 and tests with two matching types in vitiated air were conducted: A. matching total temperature and total pressure; B. matching static temperature and static pressure. Results show that the pressure profile decreased with the increasing H_2O and CO_2 contents, but the difference of pressure between the two matching types was not significant because of the small difference of two matching types.

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