GROUND TESTING OF SCRAMJET ENGINE IN 1METER SHOCK TUNNEL AND COMPARISON WITH FLIGHT DATA

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Abstract

Experiments were carried out on a scaled down model of scramjet engine with gaseous hydrogen as fuel in 1meter combustion driven shock tunnel at VSSC. The tests were carried out at an enthalpy of 2.6 MJ/kg, at a free stream Mach number of 6.8 with stagnation pressures varying from 11-19MPa, dynamic pressure varying from 72-130 kPa and fuel to air equivalence ratio varying between 0.34-1.16. Experiments were carried out with air and nitrogen as a test gas with H_2 injection to bring out the difference between reactive and non-reactive cases. For the current model scale, it was found that when combustion chamber inlet pressure (Pc) is greater than 0.1 MPa, a sharp increase in pressure downstream of fuel injection struts is observed, whereas when Pc is < 0.1 MPa, marked rise in pressure just downstream of the strut is not observed. The pressure rise at the location immediately downstream of fuel injection struts due to supersonic combustion is approximately three to four times as compared to without combustion case. Scramjet flight test data are compared with Shock tunnel pressure measurements for with and without combustion cases and reasonable match of peak combustion pressures and over all trends is observed.

Keywords: Scramjet, Shock Tunnel, Supersonic Combustion, Equivalence Ratio, Flight Test