DESIGN, ANALYSIS AND QUALIFICATION OF HYDROGEN-OXYGEN BASED GASEOUS IGNITER

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Abstract

Scramjet engine technology is successfully demonstrated with two scramjet engines, mounted diametrically opposite on a vehicle. The scramjet engine mainly consists of engine frame structure, combustor flow duct and other sub-systems. The major subsystems are air intake cowl opening mechanism, avionics system and pilot flame ignition system. All sub-systems are housed inside the space available in the engine bay. An external source of energy is essential to ignite a non-hypergolic propellant mixture present in a combustion chamber. This has been the case with the scramjet engine where gaseous hydrogen as fuel is to burn in the presence of the high velocity stream of air entering to the combustion chamber. A hydrogen – oxygen based gaseous torch igniter is employed in the scramjet engine to ignite the mixture and to act as a pilot flame to stabilize the flame in the high velocity ambience prevailing in the combustor. Each engine carries two igniters mounted on the fuel injection struts feeding from the same source. Flight interface configuration and performance of the system is simulated during ground test and igniter is successfully qualified for flight. New concept of gaseous igniter function was well proven through flight test. Details of design, analysis and performance qualification are presented.

Keywords: Flame, Ignition, Pilot Strength, Premixed Combustion, Mixing Zone, Reaction Zone, Quenching Distance and Mixing Length