Paper ID: 35289
oral
student

SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations (IP)

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EXPERIMENTAL STUDY ON COMBUSTION CHARACTERISTICS OF A SINGLE BI-SWIRL INJECTOR FOR VARIABLE THRUST LOX/KEROSENE ROCKET ENGINE

Abstract

The objective of this study is to investigate the combustion characteristics of a single bi-swirl injector for lox/kerosene rocket engine experimentally. During the whole period of this research, each chamber was tested under fuel-rich mixing ratio of 2.6 and equivalent mixing ratio of 3.4. A heat sink chamber were experimented for 1s at first with liquid oxygen mass flow rate 100g/s, 200g/s and 300g/s respectively, in order to verify the ignition scheme and the rationality of the structure of bi-swirl injector and inner surface of chamber. Meanwhile, the time it would consume to fill the pipe of liquid oxygen and kerosene was measured, together with the time sequence of ignition. Three heat sink chamber were connected in parallel to explore their synchronism of ignition. On the basis of the above experiences of hot fire tests, three chamber with water-cooling channels were used to validate the feasibility of this thermal protection scheme under more than 30s long-time combustion. In addition, the mass flow rate of liquid oxygen of each chamber varied continuously from 100g/s to 300g/s together with each other under the same mixing ratio of 2.6 or 3.4 to realize variable thrust control and verify the accuracy of adjusting of mass flow rate. Several effective methods had been concluded to restrain the instability of combustion based on this study and it will contribute to full scale lox/kerosene rocket engines.