Study of Hypergolic Hybrid Rocket Using Hydrogen Peroxide as Oxidizer

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Hybrid rocket with hypergolic feature is capable of producing reliable rapid ignition and generating thrust without additional ignition device. Hypergolic mechanisms utilized in hybrid rockets also have enormous research potential to develop into throttling and multi-ignition propulsion system and fulfilling the functionality of hybrid rocket propulsion. In this research, the outstanding features of hypergolic ignition are achieved by using high concentration hydrogen peroxide as oxidizer and catalyst was added in fuel grain, a mixture of plastic binder and manganese catalyst for the decomposition of hydrogen peroxide. It is found that as hydrogen peroxide droplets contact with catalytic propellant surface, the exothermic heterogeneous reaction is initiated on the interface and heats up fuel grain surface inducing hypergolic motor ignition. By modifying the oxidizer operating condition and fuel grain configuration, we have successfully ignited the motor within a short period of time (on the order of 100 ms) in hot fire experiments, The results show that the motor starting characteristics can be classified into three characteristic ignition process based on pressure rises shown in Fig.1. From the transparent motor experimental observation, we found that the motor starting characteristics is strongly related with the interaction of hydrogen peroxide droplets and catalytic propellant surface, as liquid oxidizer may induce flooding and splattering phenomenon on propellant surface, leading to hard-start or smooth-start of rocket motor.

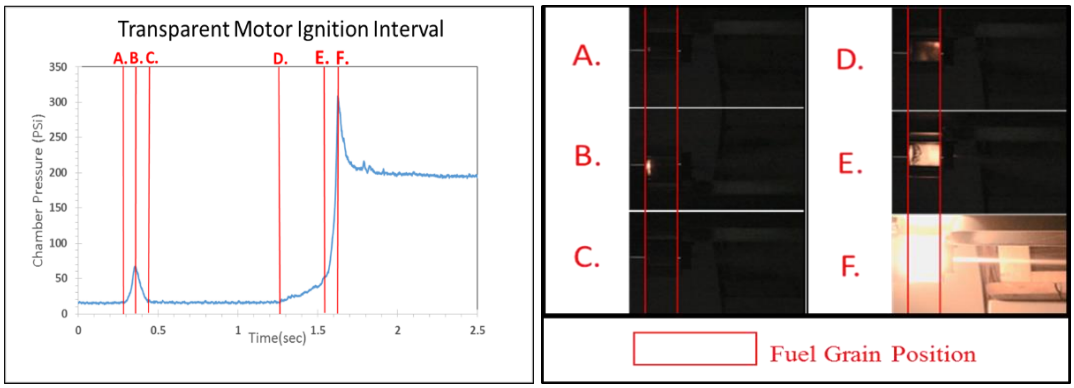

Figure 1. Hypergolic hybrid motor Ignition Interval Chamber Pressure

References

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