SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Systems II (2)

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DEVELOPMENT AND EXPERIMENTAL STUDY ON KICK MOTOR IGNITER OF KSLV-I

Abstract

A pyrogen-type igniter has been developed to satisfy the required condition of Kick Motor system for Korea Space Launch Vehicle-I (KSLV-I). The igniter consists of head, case, retainer, insulation, propellant, liner, booster charge, pellet holder, and so on. The igniter head is attached to the front boss of the Kick Motor case with bolts, and is sealed with o-rings to prevent to gas leakage during the whole motor operation. The igniter head is also mated with two Safety Arming Device (SAD) and the pressure sensor device. The case contains the igniter propellant, and prevents the environmental contamination during the storage and transportation process. A pellet holder is filled up with the powder and pellet-type booster charge made of BKNO3, and is mounted into the igniter head. The igniter propellant is the HTPB (Hydroxyl Terminated Poly-butadiene Polymer) type propellant with high burning speed. The liner is used to attach the propellant to the igniter case. The insulation is applied to the igniter head and case to protect the igniter from the high operating pressure and temperature of combustion products. The specification of the igniter was determined on the basis of the empirical relation and analysis. The mass flowrate and the weight of igniter charge were determined to ignite the motor propellant stably within the design condition. In the design process, the arc-image test was carried out to find the sufficient heat flux as varying the initial pressure from 10 to 700 kPa. The analysis indicated that the initial pressure condition would delay ignition time within a range from 100 to 500 ms. The developed igniter passed structural and environmental qualification tests successfully before manufacturing the flight models. The combustion test with an inert chamber was also performed to understand the ignition characteristics with the variation of the initial pressure of free chamber volume. In order to increase the reliability of the developed igniter, we carried out more than 10 real-scale Kick Motor ground tests. From the results of the ground test, we confirmed that the igniter could provide the acceptable energy to ignite the propellant of Kick Motor, and found that the ignition delay time was within the design range at the atmospheric pressure condition.