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STUDY ON THE OPTIMAL CANDY AS FUEL FOR HYBRID ROCKETS AND LAUNCHING EXPERIMENT OF CANDY HYBRID ROCKET FOR SPACE EDUCATION

Abstract

The hybrid rocket propulsion system has a good safety benefit for human as non-explosive propulsion, because the system is using inert solid fuel such as a plastic. Currently, solid rocket and liquid rocket system have been used as large thrust power generation system. However, these systems include dangerous of explosive abilities. Therefore, the hybrid rocket was focused the safety system as non-explosive propulsion. The benefits of hybrid rocket can select widely solid materials of high calories as a solid fuel. Therefore, this study focused a candy for hybrid rocket fuel. The candy has superior high calories and very familiar to us. Not only the candy is able to eat and change to our energy, but also that high calories very useful as rocket fuel. Especially, that fact is very important things in a state of emergency for example emergency escape from the Mars. Because only the resources of a limited amount can be transported to the space, therefore, it is desirable that one of the material is responsible for more than one role. Further, hybrid rockets have several benefits: throttlability, environmentally friendly nature, simplicity, and low costs. Some of these benefits suggest that hybrid rockets would be excellent educational tools for students. Therefore, the small hybrid rocket of the candy was prepared for the rocket launch program of the space-education. The requirement for the rocket is to lift 500g of the payload beyond 200m height. Average thrust level is 300N. Average oxidizer mass flux range is 300kg/m2s, average pressure range 2.5MPa and burning time 3 seconds. In this propulsion system, Japanese soft candy was chosen as hybrid rocket fuel because of its high calorie and excellent mechanical property. Two times of the hybrid rocket combustion test was succeeded. Results of combustion tests measured at 340.1 N as average thrust and 973.4 Ns as total impulse. The result was satisfactory to requirement of a candy rocket specification except for burning time. The student designed the small rocket based on these results and did a launch experiment in Japan. Candy hybrid rocket was launched using candy fuel in the Kada Cosmo Park successfully. The motor carried the Candy rocket to 220m altitude and worked completely under the high acceleration environment. These detail results of combustion tests and launch experiment of Candy hybrid rocket are reported in this paper.