

Design, Modeling, Fabrication, and Testing of a Scaled down Hybrid Rocket Engine

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Abstract : A hybrid rocket is a rocket engine which uses propellants in two different states of matter- one is in solid and the other either gas or liquid. A hybrid rocket exhibit advantages over both liquid rockets and solid rockets especially in terms of simplicity, stop-start-restart capabilities, safety and cost. This paper deals the design and development of a hybrid rocket having paraffin wax as solid fuel and liquid oxygen as oxidizer. Due to variation of pressure in combustion chamber there is significantly change in mass flow rate, burning rate and uneven regression along the length of the grain. This project describes the working model of a hybrid propellant rocket motor. We have designed a hybrid rocket thrust chamber based on the predetermined combustion chamber pressure and the properties of hybrid propellant. This project is all ready in working condition with normal oxygen injector. Now we have planned to modify the injector design to improve the combustion property. We will use spray type injector for injecting the oxidizer. This idea will increase the performance followed by the regression rate of the solid fuel. By employing mass conservation law, oxygen mass flux, oxidizer/fuel ratio and regression rate the thrust coefficient can be obtained for our current design. CATIA V5 R20 is our design software for the complete setup. This project is fully based on experimental evaluation and the collection of combustion and flow parameters. The thrust chamber is made of stainless steel and the duration of test is around 15-20 seconds (Maximum). These experiments indicates that paraffin based fuel provides the opportunity to satisfy a broad range of mission requirements for the next generation of the hybrid rocket system.

Keywords : burning rate, liquid oxygen, mass flow rate, paraffin wax and sugar

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