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EFFECT OF MIXING DEVICES ON COMBUSTION EFFICIENCY IN PARAFFIN/N2O BASED HYBRID ROCKET MOTORS

Abstract

Hybrid propulsion system has many advantages over solid motors and liquid engines. Operation feasibility at low temperatures, long oxidizer storage capability with non-hazardous manufacturing make the hybrids more practical for deep space missions. In addition, these advantageous make hybrids quite convenient for low cost launch vehicle applications. Paraffin is the most common fuel type provide high regression rate and more stable (efficient) ignition compared other traditional polymeric fuels. Therefore, paraffin based hybrid rocket motor development is the key for a launch system. A novel approach of high combustion efficiency in paraffin based motors is the design of mixing devices. Thus, this study aims to provide mixing device design for Paraffin/Nitrous Oxide based rocket motors. Hybrid rocket motor provides up to 12 seconds of burn time with 200 grams/seconds flow rate value. Preliminary experiments with Paraffin/Nitrous oxide motor provide 28% increase in regression rate compared to motor design without a mixing device. Material of the mixing device is based on phenolic resin. Following approaches will be studied in this research; (i) various of shape designs, (ii) mixing device location in the motor (such as aft or fore of the motor), and (iii) metallic powder addition to the fuel grain also studied to emphasize the additive effect on combustion efficiency.