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SPACE PROPULSION SYMPOSIUM (C4)
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DESIGN AND EXPERIMENTAL CHARACTERIZATION OF A HYDROGEN PEROXIDE-ETHANOL BASED COMBUSTOR FOR SPACE PROPULSION

Abstract

A combustion chamber has been successfully designed and experimentally characterized for reactions between hydrogen peroxide and ethanol, which would cater to the demand of energy sources for use in alien environment (e.g. space) endowed with atmospheres bereft of oxygen. Although a plausible source, DC power supplies generate long lasting power output at the cost of energy density. Gasoline powered energy sources are plagued by their low conversion efficiencies, and prohibitively high requirements for oxidizers in alien environments. Monopropellants, such as hydrazine and hydrogen peroxide, are compounds that decompose exothermically either though catalytic modes or through thermal modes to generate gases that may be expanded pneumatically to extract the generated energy. Hence, they may be utilized in such environments as possible replacement for DC motors

This work will present the design objectives of such a combustion chamber and also an experimental study of catalytic combustion of mixtures of hydrogen peroxide and ethanol on a manganese di-oxide (MnO2) catalyst bed. During the experiments, the mixture was sprayed on the heated MnO2 bed, where hydrogen peroxide decomposed to provide oxygen, which was used as an oxidizer for ethanol generating steam and carbon-dioxide at high pressures. Various combustion characteristics, such as rates of pressure rise, maximum pressures achieved, ignition delays etc. were determined from the recorded chamber pressure. Several design changes were introduced in the combustion chamber to improve the system-characteristics determined by above parameters. The equivalence ratios were also varied for sustained combustion. Ultimately the best performance of the chamber was achieved. The gases generated by the chamber may be used in robotic actuation or in space propulsion applications by expanding it into piston cylinder assembly or passing through a converging diverging nozzle.