Paper ID: 66525
student

IAF SPACE PROPULSION SYMPOSIUM (C4)
Solid and Hybrid Propulsion (2) (4)

Author: Mr. Pranjal Mhatre
University of Mumbai, India

Mr. Saumya Shekhar
SRM Institute of Science and Technology, India
Mr. BHUSHAN THOMABRE
SRM Institute of Science and Technology, India
Ms. Preethi S
India

ENERGETIC HYDROCARBON BASED ROCKET PROPELLANTS FOR UPPER STAGE PROPULSION

Abstract

Liquid fuel research aims to develop safe and efficient fuels with higher performance. In most of the upper stage of rocket engines, the performance and specific impulse will be high enough for liquid propellants. The higher is the specific impulse, the lesser duration it takes to reach orbit. Cruise speed design is done for initial and direct rocket mass. The major liquid fuel used in the upper stages is cryogenic liquid oxygen as an oxidizer and liquid hydrogen as fuel. They have a high specific impulse and exhaust velocity which enhances the performance. The major problem is due to high tank pressure resistance, the fuel tanks become bulky which requires strong insulation for storage. Therefore, productivity and functionality are declining due to excessive dependence on cryogenics. This also leads to the high amount of investment in storing, transporting, and launching the rocket which increases the budget of space missions. As a part of the work, systematic modeling was performed using NASA CEA software. Comparative analysis of different Hydrocarbons as fuel was done and the hydrocarbon which shows the highest performance was selected as a base fuel composition and Hydrogen Peroxide (H2O2) was selected as a base Oxidizer. Selected energetic materials were added to enhance the performance. It requires attractive efforts to find a propellant combination that can improve the driving characteristics, energy materials, and emission of harmful exhaust gases. The proposed work also includes an investigation of the exact proportional use of rocket fuel oxidizers as drivers, Energy fuels, oxidants, and selected catalysts were tested to see their effectiveness and related thermochemistry of liquid fuels. The performance was analyzed in terms of change in specific impulse, characteristic velocity, and thermodynamic potential. It is because the underlying energy in the material affects the fluid driver performance. There are many cases of proportional use of energetic substances. The main motive was to improve performance and safety by reducing the total cost of production and storage.