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Abstract: **Atomization and Performance Analysis of Metallized Gel Propellants for Liquid Rocket Application**

Liquid propulsion is a chemical rocket system used mainly for the different stages of the space vehicles, satellite manoeuvring and defence application. It has higher specific impulse compared to the solid and liquid rocket engine. This benefit has favoured most for the launch vehicle as well as defence application. The drawback of the liquid rocket is its low density impulse as compared to the solid rocket. Other problem associated with this system is sloshing, chances of leakage, difficulties of adding metal additives in the liquid fuel or oxidizer which prevents improvement on the performance of liquid rocket engine. In order to overcome these issues the liquid fuel or oxidizer could be converted into gel form and further could be used in the liquid rocket engine. It improves density impulse, performance, and also reduces sloshing. This type of system is also named as gel propulsion system. It would make the missile more compact and streamlined, and would provide the scope for the higher payload/warhead carrying capacity.

To achieve improved performance, fine atomization is needed that requires efficient injector to get optimized fine sprays. The information related to rheological properties of gel propellants is important to control flow behaviour. Metals such as boron, magnesium, and aluminium have been utilised as metal additives to improve the performance. Ethanol would be utilized as the green gel fuel; it would also further be compared with the most practical UH-25 fuel. These gel fuels would be analysed for its rheological properties, atomization characterization under varying pressure and varying injectors mainly impinging type as well as air-blast atomizer, and stability of the gel under varying temperature conditions. Apart from this, a liquid rocket testing would also be conducted to analyse the performance with gaseous oxygen and Nitrogen tetroxide as the oxidizer.