Perspectives for Nitrous Oxide-based Green Bi-Propellants for Small Satellites Beyond LEO

Propulsion systems utilising Nitrous Oxide and propylene as propellants is serious alternative to conventional chemical propulsion systems such as Hydrazine based systems. While demonstrated in Low Earth Orbit (LEO), with a continually increasing heritage over 30 thrusters in orbit on eight small-class satellites[1], this propellant combination is suitable and provides opportunities for missions beyond LEO.

Hydrazine is traditionally used as a propellant for chemical propulsion systems. However, health and safety concerns have led to the development of greener alternatives, such as LMP-103S monopropellant. More recently, Nitrous Oxide based bipropellant solutions have gained flight heritage, with over 30 thrusters in orbit on eight satellites. The self-pressurizing properties of the propellants and the fact that no catalyst is need for initiating the combustion reduces the complexity the system architecture to a hydrazine system. Other properties, such as the wide operational temperature range of – 5 °C to + 30 °C and non-operational temperature range of – 30 °C to + 40 °C and cold-start capability using a spark plug make it an interesting choice for deep space missions on small to medium spacecrafts.

The presentation describes the opportunities, key challenges and current developments to increase the suitability for missions beyond LEO, including lunar, interplanetary up to deep space and presents the roadmap for further product improvements to be made for deep space missions.

The anticipated presentation outline:

1. Introduction
2. Nitrous Oxide-based state-of-the-art propulsion systems
3. In-space propulsion solutions and its opportunities for beyond LEO missions
4. Perspective development road map with key challenges for a deep space mission
5. Conclusion

[1] https://spacenews.com/dawn-grants-2022/