Paper ID: 73541
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IAF SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM (IP)

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# ELECTRODELESS PLASMA THRUSTER CONCEPTS FOR HIGH-POWER PROPULSION SYSTEMS

**Abstract**

For the last decades, there have been a tremendous proliferation of low-power and low-thrust electric propulsion systems among which Hall Effect, Ion thrusters, and electrosprays have got the most attention. With the development of the new space missions and the increasing interest in outer space missions – including scientific and commercial in some near future, - the need for high-thrust propulsion systems that are capable of propel spacecraft for a long time and long distances from the Earth has become critical. Currently, the chemical propulsion is the only choice when the high thrust level is important. However, the low specific impulse makes chemical propulsion impossible to propel spacecraft for a long distance due to inefficient propellant utilization. Not yet saying that chemical propulsion's specific impulse is too low for the fast completion of outer space missions beyond Solar system. The modern electric propulsion in its turn can potentially suggest the speeds of exhausted flows up to 100000 km/s, and the space missions can potentially go far away from the Earth fastly. However, the price for this high speed is the too low power-to-thrust efficiency – not allowing to achieve high thrust with an imaginable power system, - and resulting the long time for acceleration of the spacecraft. Moreover, there are multiple critical physical and engineering problems with modern electric propulsion systems. In case of Hall Effect and Ion thrusters, the problem is the current limitations of cathode-neutralizers – even if the 500 A was achieved recently, it is still far away from the actual needs for outer space flights thrust level not yet saying about lifetime. Also, modern electric propulsion systems are based on the architecture of the external power sources that will have significant power transfer losses at high power levels required for high thrust level of electric propulsion systems. Moreover, the modern electric propulsion systems do not follow the principles of generation and acceleration of plasma flows that can be seen in space and potentially borrowed for artificial applications - for example, the acceleration of plasma by means of rotating magnetic field. This paper discusses several promising electrodeless plasma thruster concepts for high-power and high-thrust propulsion systems. The discussed concepts are proposed and considered capable of overcoming modern limitations of high-power propulsion systems enabling new outer space missions that are otherwise not achievable by conventional thrusters' architectures.