

High-Power Krypton Hall Thruster Technology Being Developed for Nuclear-Powered Applications

The NASA Glenn Research Center has been performing research and development of moderate specific impulse, xenon-fueled, high-power Hall thrusters for potential solar electric propulsion applications. These applications include Mars missions, reusable tugs for low-Earth-orbit to geosynchronous-Earth-orbit transportation, and missions that require transportation to libration points. This research and development effort resulted in the design and fabrication of the NASA-457M Hall thruster that has been tested at input powers up to 95 kW. During project year 2003, NASA established Project Prometheus to develop technology in the areas of nuclear power and propulsion, which are enabling for deep-space science missions. One of the Project-Prometheus-sponsored Nuclear Propulsion Research tasks is to investigate alternate propellants for high-power Hall thruster electric propulsion.

The motivation for alternate propellants includes the disadvantageous cost and availability of xenon propellant for extremely large scale, xenon-fueled propulsion systems and the potential system performance benefits of using alternate propellants. The alternate propellant krypton was investigated because of its low cost relative to xenon. Krypton propellant also has potential performance benefits for deep-space missions because the theoretical specific impulse for a given voltage is 20 percent higher than for xenon because of krypton's lower molecular weight. During project year 2003, the performance of the high-power NASA-457M Hall thruster was measured using krypton as the propellant at power levels ranging from 6.4 to 72.5 kW. The thrust produced ranged from 0.3 to 2.5 N at a discharge specific impulse up to 4500 sec.



NASA-457M Hall thruster operating at 65 kW on krypton propellant.
Electric propulsion device with a 457-mm outside-diameter annular discharge chamber.

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