

Accelerator Systems for Long-Life Ion Thruster Operation at Specific Impulses Greater than 4000 s

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Future deep space missions using ion propulsion will require ion thrusters that have both greater specific impulse and greater total impulse capabilities. The key thruster component affecting these capabilities is the ion accelerator system that extracts and accelerates the ions produced in the thruster's discharge chamber. The service life of the ion accelerator system is limited by erosion from ions produced in charge-exchange collisions between and downstream of the electrodes that form the accelerator system. Charge-exchange (CEX) ions formed between these electrodes acquire energies proportional to the total voltage. A fraction of these ions strike the walls of the apertures of the outer electrode (called the accelerator grid) causing erosion by ion sputtering. As the specific impulse is increased, the energy of the CEX ions striking the accelerator grid apertures increases, which increases the erosion rate of the grid reducing its life. A combination of computer simulations and beam extraction experiments are used to develop accelerator systems that have long life at the specific impulses required for future missions.