

The Hall thruster technology: from the classical design to the wall-less concept.

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The Hall thruster (HT) is a gridless positive ion accelerator used for spacecraft propulsion. The original idea of ion acceleration in a quasi-neutral magnetized plasma discharge was introduced in the mid-1960s. The first HT was successfully operated in space in 1972 aboard the former USSR Meteor satellite. Since that time numerous works have been performed, the technology has greatly evolved with an increase in thrust level and efficiency and an extension of the operating envelope. Over the last decades, HTs have equipped tens of commercial and military satellites for attitude control, trajectory correction and, nowadays, for orbit topping and orbit transfer maneuvers. This contribution mostly focuses on the technological aspect of HTs with only a brief overview of the underlying physics. After a description of the classical HT annular architecture, which rests on an ExB discharge confined into a dielectric cavity, we will present the current state of the technology in terms of sizes, power and thrust, including constraints and limits. Then we will discuss the magnetic shielding configuration, which, by strongly reducing plasma/surface interaction, leads to an extension of the thruster lifespan with, in addition, the possibility to operate at larger voltages. Finally, the last part of the contribution will deal with Hall thruster variants and new architectures that offer interesting characteristics for low power and high power applications. In particular we will describe nested-channel HTs, cylindrical HTs, double-stage HTs and the wall-less HT.

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