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Influence of Cathode Material on Vacuum Arc Thruster Perfomance

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The use of micro/nanosatellite (weight < 100 kg) is a long history since the first satellite Spoutnik-1 launched in 1957 can be classified in this category (83 kg with a power of few watts). Nowadays there is clear renew of the use of micro/nanosatellite for new missions, in the CubeSats class (6-12 U, one U being a square of 10 cm side): (1) scientific, with constellations of satellites to explore and collect data about the Earth and to test new instruments. Education programs have also been proposed worldwide to attract students to fabricate, test and launch small satellites; (2) military, for real time surveillance, space control and protection of systems; (3) commercial applications, the goal is to deploy satellites to collect informations for agriculture support in developing countries to limit the risk of climatic conditions and water excess/lack, to explore the ground to find hidden natural resources, for real time imagery (e.g. coast evolution closed to the sea), to adapt communications network. The technologies of micro/nanosatellite are very attractive (low cost, rapid demonstration, limited risks, etc.) [1-2]. The demand of is estimated to reach few hundreds of satellites from 2023 and beyond [3].

To reduce the cost, most of times micro/nanosatellites are launched with geostationary orbit satellites in a non-chosen orbit. A propulsion system is needed to pass from the separation orbit to final low Earth orbit, to counter-act the drag forces during the mission, and to de-orbit the satellite at the end of mission. Such propulsion system must be cheaper, reliable, simple, scalable and modular (according to the CubeSat size). Various micro-propulsion (electrical) systems with different propellant can achieve acceptable performance to fulfill the mission requirements [4], [5]. In this presentation, we describe the fundamentals of one candidate the vacuum arc thruster (VAT). We analyze with a simple hydrodynamic model the origin of the thrust. Finally, measurements of the thrust for a typical configuration proposed by Comat Aerospace, France, will be shown.

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