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FEASIBILITY STUDY OF SYMMETRICAL CAPACITOR THRUSTERS FOR SPACE PROPULSION

Abstract

Asymmetrical Capacitor Thrusters have been proposed and widely tested in different environmental conditions over ninety years. It has been proven to generate thrust in atmospheric and reduced pressures due to the corona discharge and momentum transfer between ions and air molecules. Also, numerous experiments on the well-known aircraft— "lifter", which consists of copper strings and aluminum foils as the propulsion system, demonstrated that it can lift off when high voltage is applied to the thruster in atmospheric pressure. However, there is no experiments that show this type of thruster works in vacuum. In this paper, experiments have been conducted by measuring the thrust force generated by the copper string and aluminum foil structure in the vacuum chamber. The thrust force reduced to zero when the pressure was decreased from one atmospheric pressure to 10^{-4} Pa when high voltage was applied, which shows a good agreement with other experimental results. However, the thrust force abruptly appeared again and started to increase when the pressure reached 10^{-6} Pa and lower pressure when high voltage was remained during the test. Although the force generated in high vacuum environment was several orders of magnitude lower than that in atmosphere, which is not enough to lift off the "lifter", the results were not null. Neither electric arc nor ablation spot were observed after hundreds of operations. The experimental results were showed accompanied with analysis of possible reasons that may cause this effect. The results may suggest a new mechanism of generating thrust force in high vacuum environment, which can be used for space propulsion.