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ASSESSMENT OF THE MPPT PROPELLANTS EVAPORATION CAPACITY CAUSED BY UV RADIATION.

Abstract

The tendency to reduce of modern devices structural and functional elements size has become increasingly evident in recent years. Spacecrafts are no exception. More and more private and state organizations are resorting to use the CubeSat technology. These are simple and cheap to manufacture spacecraft that are suitable for testing new equipment. One of such devices development problems is the creation of propulsion systems for them. This is confirmed by a significant increase in the publications number over the past 5 years. Cheap microsatellite technology requires the same simple and cheap thruster, and the ablative pulse plasma microthruster (mPPT) satisfies these requirements well due to its simple design.

The idea of such thrusters is the thrust creation due to acceleration of ionized dielectric vapors by inherent discharge Lorenz forces. This is achieved by a pulse discharge over the propellant surface. Dielectric propellant heating and evaporation occur due to light erosion caused by absorption of radiation energy (UV and visible spectrum) from the plasma.

The mPPT processes research and optimization is divided into two main ways - the electrical circuit optimization and the broadband high-brightness radiation impact on dielectric study. Review of polymers light erosion studies, which is started in the 70s and continuing to this day, reveals a lack of consensus on these processes' nature.

This paper presents the experimental research results of mPPT's perspective propellants light erosion (including the vacuum UV range): Teflon, polyamide-6, acrylic glass, polyvinyl chloride, polyoxymethylene, polyethilene, etc.

The magnetoplasma compressor (MPC) discharge was used as a source of radiation. Such a discharge has not only high spectral-brightness characteristics of radiation in the UV spectrum, but also simulate the mPPT discharge. The radiation energy and spectral range can be modified by using the different gas media and changing the distance between the discharge and the experimental sample.

The polymer vaporization dynamics over the sample's surface investigation was performed in this work by the shadow method (Schlieren-photography) and the method of double-exposure laser holographic interferometry. This study is a necessary step for the optimal propellant selection for mPPTs. The obtained results are discussed.

The presented results have been obtained at largescale research facilities "BeamM" of Bauman Moscow State Technical University.