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EXPERIMENTAL RESEARCH AND COMPARATIVE ANALYSIS OF PERSPECTIVE MPPT PROPELLANTS EVAPORATION BY UV-VUV RADIATION*

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A serious increase in the number of CubeSat satellites launches is noticed over the last five years [1]. This type of spacecrafts are simple to manufacture and cheap to launch. This advantages provide solutions to various problems. Many publications on micro propulsion systems proves that this topic became highly relevant. Electric propulsion (EP) is suitable for CubeSat. Ablative pulsed plasma thruster (APPT) is highlighted because for its low manufacturing price and simple design [2].

APPT are performed with polymer propellant. The pulsed discharge vaporizes part of the polymer. Radiation energy (UV and visible range) from the plasma formation heats and vaporizes the propellant. Ionized and accelerated by Lorentz force vapor of propellant creates thrust.

Investigation of the broadband high-brightness radiation interaction on the polymers is necessary to optimize the characteristics and the processes in operation of the microAPPT. There is no complete and acknowledged model of the ablation process despite the fact that polymers light erosion research has been going on for more than fifty years [3]. In this regard, the experimental study of polymers evaporation under the action of broadband radiation becomes even more topical.

We performed experiments of light erosion (including the vacuum UV range) of different polymers, that can be used as propellants of APPT. This work presents determination of plasma parameters of microAPPT's promising propellants: PTFE, polyamide-6, acrylic glass, etc.

The source of radiation was an erosive type discharge of the magnetoplasma compressor (MPC), which is similar to the APPT discharge [4]. Usage of different gases with MPC discharge makes it possible to control the spectral composition of the radiation. So does the distance from the sample to the emitter for the radiation energy coming to the sample. The discharge radiation heats, evaporates and ionizes the sample vapor. It expands and realizes the "plasma piston" model, compressing the layer of background gas above the sample surface.

Diagnostics of evaporation processes was performed by schlieren photography and the method of double-exposure laser holographic interferometry [5]. Interferograms and schlieren photographs processing made it possible to determine the studied materials dynamics of evaporation and ionization. It is a necessary step for choosing the optimal propellant for microAPPT.

The obtained results are discussed.

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