

INFLUENCE OF TARGET SPUTTERING ON THRUSTER PARAMETERS.

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Abstract

It was shown, that at sputtering of metal target thruster integral parameters are decreased and the anode begins intensively to heat up. At MIREA vacuum conditions parameters degradation is caused by appearance of non-conducting film on the anode. The non-dusted anode was designed and tested. Using of modified anode eliminates the decrease of parameters under MIREA vacuum conditions.

The experimental investigations of influence of target sputtering on thruster parameters were carried out on the device, which diagram is shown on fig.1. Thruster (2) was installed into vacuum chamber (1). Target (3)

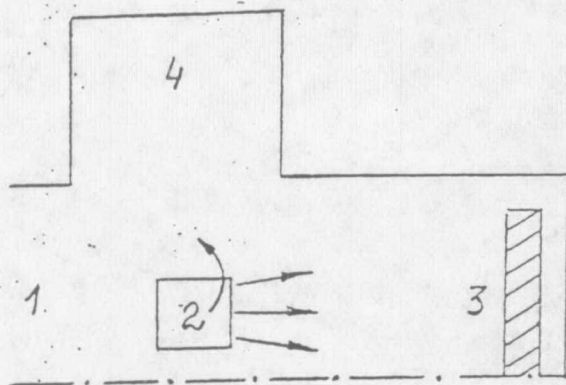


Fig.1. Block-scheme of experiment.

1 - vacuum chamber; 2 - thruster;
3 - target; 4 - diffusive pump.

was placed at the end of the chamber. The thruster may turn at 90° with aid of electric drive, and the jet from the thruster may hit either target (as it is shown on fig.1), or aside, the place, where the diffusive pump was placed. The integral parameters of the thruster were measured before and after sputtering. The target was iron sheet, placed at about 1m from the thruster outlet. Table 1 represents the integral parameters before and after 2-hours sputtering. One may see that the thruster parameters are decreased sufficiently after sputtering. Before sputtering we had increase of efficiency, when the discharge voltage was increased; on the contrary, after sputtering the efficiency was decreased. We discovered visually, that, after approximately 10-15 minutes after the beginning of sputtering, the face of the anode began to heat up, and the discharge current was increased.

m_A , mg/s	3	3	3	3
U_d , V	300	350	300	350
F , g	6.2	6.9	5.9	6.3
η , %	67	70	62	58
	a		b	

Table 1:

a) before sputtering;
b) after sputtering.

The step-by-step cleaning of inner surfaces of the thruster showed, that, under vacuum conditions of MIREA stand, the decrease of integral parameters is determined, mainly, by dusting of the anode. Only the cleaning of anode work surface permitted us to return to initial values of parameters. We discovered also, that fly-in of particles from target takes

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place along the plasma jet. So, the work surface of the anode is covered with nonconducting film, whereas the parts of insulators, which are orthogonal to the thruster axis become conducting.

The nondusting corrugated anode was designed and tested in order to eliminate this defect. The results are represented in table 2, the sputtering had place during 2 hours.

m_A , mg/s	2.9	2.9	2.9	2.9	One can see from table 2, that, even after 2-hours sputtering of iron, the thruster parameters have not changed practically. We did not observe the heating-up of the anode, the discharge current approximately remained constant during sputtering. Thus, we may see, that the sputtering of metal is one of the reasons of, the thruster parameters decrease. Using of modified anode eliminates this defect under MIREA vacuum conditions.
U_d , V	300	350	300	350	
F, g	6.3	6.95	6.3	6.9	
η , %	73	73.8	73.5	74	
	a		b		

Table 2. Corrugated anode:
 a) before sputtering;
 b) after sputtering.