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ST-40 HALL THRUSTER TESTING WITH LAB6 HOLLOW CATHODE

Abstract

The results of experimental investigation of the ST-40 Hall thruster operating with the preheated hexaboride cathode are presented. The readiness of the preheated hollow cathode to the thruster ignition was assessed by reducing the cathode keeper voltage from the start value of 100 V to 15 ... 17 V, when an internal discharge in the hollow cathode occurred. Various cyclograms of the thruster start are considered with the definition of the purpose of the cyclogram, which ensures reliable thruster ignition. Three cyclograms of the thruster ignition are investigated: with the thruster electromagnet coils switched on; with the coils off; without switching off the voltage at the hollow cathode keeper, which made it possible to restart the thruster without preheating the hollow cathode. The obtained cyclograms make it possible to ensure a reliable start of the ST-40 thruster when operating with a preheated hexaboride hollow cathode. In the frame of laboratory testing, the PPU-300 power processing unit was used. It ensured the stabilization of the discharge power in the thruster accelerating channel and stabilization of the currents supplied to the central and external coils of the magnet system. The main operating characteristics and parameters of the ST-40 thruster were obtained for three fixed values of the discharge power: 260, 280, 300 W and a change in the mass flow rate of the working substance (Xenon) through the anode unit of the thruster 0.7 ... 1.3 mg/sec. Experimental investigation of the ST-40 thruster in a wide range of parameters made it possible to determine the optimal thruster parameters that provide the maximum values of thrust and specific impulse for the given values of the discharge power in the accelerating channel of the thruster and the minimum discharge current. The process of the St-40 thruster parameters optimizing was carried out by changing the currents flowing through the internal and external coils of the thruster. In the course of experimental investigation, it was found that the inner coil and the serially connected outer coils can be connected in parallel and powered by a single power supply. Experimental studies have confirmed the correctness of the adopted technical solutions in the development of the ST-40 Hall thruster and the preheated hexaboride hollow cathode. Key words: HALL-EFFECT THRUSTER, LaB6 HOLLOW CATHODE, HALL THRUSTER START SEQUENCE DIAGRAMS, LABORATORY TESTING, HALL THRUSTER OPTIMAL PARAMETERS.