Paper ID: 17060
oral
student

SPACE PROPULSION SYMPOSIUM (C4)
Poster Session (P)

Author: Mr. Hua Zhang
College of Aerospace Science and Engineering, National University of Defense Technology, China, zhann10000@163.com

Mr. Daixian Zhang
College of Aerospace Science and Engineering, National University of Defense Technology, China, zhangdaixian@163.com
Dr. Rui Zhang
College of Aerospace and Materials Engineering, National University of Defense Technology, China, nudtzhang@163.com
Dr. Jianjun Wu
National University of Defense Technology, China, jjwu@nudt.edu.cn
Dr. Zhen He
College of Aerospace and Materials Engineering, National University of Defense Technology, China, hezhen_2012@sina.com

STUDY ON THE OPERATION PROCESS OF PULSED PLASMA THRUSTERS BY A MODIFIED ELECTROMECHANICAL MODEL

Abstract

Pulsed plasma thrusters (PPTs) have been used widely in space flight mission due to their high specific impulses, low power requirements, and simple propellant management. Even with the more precise numerical simulation codes available, electromechanical models can still be used for a fast parameter variation and a quick first order design optimization of PPTs due to their simplicities. Unfortunately, the ablation process in these models is often subjected to considerable simplification. In fact, the ablation mass is always assumed to be constant or relies on empirical formulations. To gain greater insight into the ablation process, a modified electromechanical model is presented in this paper. A one-dimensional ablation model is developed that addresses the more detailed thermal and thermodynamic behavior of Teflon during simulated operation of a PPT. The operation process of a PPT is simulated by this analytic model and results of the numerical simulations are discussed. Effects of variations of electric parameters, configuration parameters and the late time ablation on PPTs' performance are studied by numerical simulation using this modified electromechanical model.