Paper ID: 13673
student

SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

Author: Dr. Rui Zhang
College of Aerospace and Materials Engineering, National University of Defense Technology, China, nudtzhang@163.com

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

EFFECTS OF DISCHARGE CHARACTERISTICS ON PROPELLANT ABLATION IN PULSED PLASMA THRUSTER

Abstract

To gain insight into the process of Polytetrafluoroethylene (PTFE) ablation in Pulsed Plasma Thruster (PPT), a one-dimensional ablation model was developed and implemented numerically using a non-uniform grid and implicit finite-volume method. The effects of PTFE surface optical characteristic, in-depth radiation, and material properties variations with temperature were considered. Heat flux profile was obtained from experimental measurements. Compared with previous models, this model provides more accurate description of the PTFE ablation process during PPT operation. Finally, the numerical ablation model was used to evaluate effects of discharge characteristics on propellant ablation in a PPT built at NUDT (National University of Defense Technology). Calculated from heat flux measurements propellant losses and measured in experiments are in a good agreement, the results of simulations were consistent with experimental trend. It was shown that the ablation physical process was evaluated qualitatively by the model. In addition, on the basis of this model, a more sophisticated three-dimensional ablation model may be used in the future for the 3-D MHD model developed previously at NUDT to provide time-dependent boundary conditions.