

SPACE PROPULSION SYMPOSIUM (C4)
Advanced and Combined Propulsion Systems (8)

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NUMERICAL INVESTIGATION ON LASER ABLATION CHARACTERISTICS OF PTFE IN
ADVANCED PROPULSION SYSTEMS**Abstract**

The Polytetrafluoroethylene (PTFE of Teflon) based propellants may be used in Pulsed Plasma Thruster, laser ablation thruster and other advanced propulsion systems. Because of the complex behaviors and phenomena of PTFE in ablation process, the study on thrusters' operation process becomes complicated. Thermal and mechanical events are investigated, including phase transition, thermo-chemical property variations and plasma formation during laser ablation of PTFE. Considering more details including internal absorption of radiation, transmission and reflectivity of material, a one-dimensional ablation model is developed and implemented numerically using a non-uniform grid and implicit finite-volume method to gain greater insight into the physical process of laser ablation. The model is validated against analytical solutions and is in accordance with previous experimental results. Besides, the density, temperature, number density and other parameters are also calculated for chemical equilibrium species of the PTFE plasma. It's indicated that the laser ablation process are influenced intensively by changing the contributing factors, such as laser power density, wavelength, laser output repetition rate and the material physicochemical parameters. The numerical simulation in the paper provides insight into physical mechanism of laser ablation and suggests potential ways of improving thruster efficiency.