

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

Author: Dr. Xiaokang Li

National University of Defense Technology, China, lxk0330@163.com

Mr. Xingyue Duan

National University of Defense Technology, China, duanxingyue@163.com

Prof. Mousen Cheng

National University of Defense Technology, China, chengmousen@vip.sina.com

EXPERIMENTAL STUDY ON THE IMPULSE MECHANISM GENERATED BY LASER ABLATING  
POLYMER IN THE ATMOSPHERE AND VACUUM

**Abstract**

Focusing on the transient process of impulse generation caused by laser ablating polymer in laser ablation propulsion (LAP), the different features of impulse mechanism in the atmosphere and vacuum are investigated and compared. Using a TEA CO<sub>2</sub> laser as energy source and a polyoxymethylene platelet as target, the thrust histories are acquired by a piezoelectric film sensor for different laser fluences. The flow fields are also recorded by the shadowgraph method with an ultra-high speed camera. The results show that under low laser fluence the thrust history in vacuum is similar to the one in the atmosphere. In contrast, under higher laser fluence, the impulse is remarkably larger than that in the atmosphere, because the ablative-product jet in vacuum is not quite affected by the plasma shielding and holds a directed brush-pattern even after the laser pulse, while in the atmosphere the flow loses lots of energy in the radial expansion. As an improvement, the impulse in the atmosphere can be significantly increased by imposing a cylinder constraint.