



航空学报 » 2005, Vol. 26 » Issue (1) :13-17 DOI:

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大气吸气模式激光推进的实验研究

唐志平¹, 龚平¹, 胡晓军¹, 蔡健¹, 谭荣清², 吕岩²

1. 中国科学技术大学 力学与机械工程系, 中科院材料力学行为和设计重点实验室, 安徽 合肥 230026; 2. 中国科学院电子学研究所 高功率激光技术部, 北京 100080

Experimental Investigation on Air-Breathing Mode of Laser Propulsion

TANG Zhi-ping¹, GONG Ping¹, HU Xiao-jun¹, CAI Jian¹, TAN Rong-qing², LU Yan²

1. Key Lab for Mechanical Behavior and Design of Materials, CAS, Department of Modern Mechanics, University of Science and Technology of China, Hefei, China 230026; 2. Department of High Power Lasers, Electronics Research Institute, CAS, Beijing, China 100080

摘要

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摘要 激光推进是一种新概念推进技术,在未来航天事业中将有重要的应用前景。利用高重复频率高功率TEA-CO₂脉冲激光器进行了抛物形飞行器的水平和垂直激光推进实验,实现了大气模式的激光垂直推进,飞行高度超过了1m。实验测定了多种工作状况下光脉冲能量转变为飞行器动量的推进效能,测得的光能-冲量耦合系数C_m达到27.7dyne·s/J,与国外文献报道相当。

关键词: 航空 航天推进系统 激光推进 TEA-CO₂激光器 大气吸气模式 冲量耦合系数

Abstract: The recent progress in the authors experimental investigation on air-breathing mode of laser propulsion are reported. With a high power TEA-CO₂ pulsed laser, both horizontal and vertical propulsion experiments are conducted.

The energy of each pulse is about 18.58J. The frequency can be adjusted from 20 to 180Hz. Several parabolic reflectors of aluminum alloy with different focuses *f* are used in the experiments. A high speed CCD camera is applied to record the movement variables of the reflectors. For single pulse experiments, the measured momentum coupling coefficients C_m are 27.7dyne·s/J for *f*=10mm and 22.82dyne·s/J for *f*=15mm. For multi-pulse experiments (frequency 50Hz, work time 0.5s), the horizontal propulsion distance is greater than 1.5m, and the vertical propulsion height exceeds 1m.

Keywords: aeroastro-propulsion system laser propulsion TEA-CO₂ pulsed laser air-breathing mode momentum coupling coefficient

Received 2003-10-24; published 2005-02-25

引用本文:

唐志平;龚平;胡晓军;蔡健;谭荣清;吕岩. 大气吸气模式激光推进的实验研究[J]. 航空学报, 2005, 26(1): 13-17.

TANG Zhi-ping;GONG Ping;HU Xiao-jun;CAI Jian;TAN Rong-qing;LU Yan. Experimental Investigation on Air-Breathing Mode of Laser Propulsion[J]. Acta Aeronautica et Astronautica Sinica, 2005, 26(1): 13-17.

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