MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Fluid and Materials Sciences (2)

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PULSE DETONATION THRUSTERS FOR SPACE APPLICATIONS

Abstract

The advantages of constant volume combustion cycle as compared to constant pressure combustion in terms of thermodynamic efficiency has focused the researches of advanced propulsion on detonation engines. One of the schemes for producing enhanced thrust at both static and dynamic conditions is pulse detonations. Thermodynamic efficiency of Chapmen-Jouget detonation as compared to other combustion modes is due to the minimal entropy of the exhaust jet. Based on this efforts have been made during the past several decades to show that proper utilization of the operation cycle does result in improved performance. However, there are several issues in developing this technology, which represent scientific and technological challenges. The success in resolving these problems will determine the implementation of pulse detonation propulsion. The control of detonation onset is of major importance in pulse detonating devices. The advantages of detonation over constant pressure combustion bring to the necessity of promoting the deflagration to detonation transition (DDT) and shortening the pre-detonation length. Most of combustible mixtures being heterogeneous the problem of liquid droplet interaction with surrounding gas flow with account of heat and mass transfer and atomization becomes of key interest. The paper gives the results of comparative analysis of effectiveness of pulse detonation engine, and classical rocket engine using the same fuel. The present investigation was supported by Russian Foundation for Basic Research Grant 10-03-00789.