Paper ID: 40279
oral

SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Technology (3) (10)

Author: Dr. Zhaopu Yao
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China, yzp02@mails.tsinghua.edu.cn

Prof.Dr. Yan Shen
Beijing Insitude of Control Engineering, China, shenyan7806@163.com
Dr. Jun Chen
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China, sportcj@163.com

THE EXPERIMENTAL INVESTIGATION AND ON-ORBIT FLYING VALIDATION OF AN ADN-BASED LIQUID THRUSTER

Abstract

Ammonium dinitramide (ADN) is a high energy-density and chlorine-free inorganic salt with low toxicity. This "green" propellant can be used as an oxidizer in the ADN-based liquid propellant with higher performance than the traditional hydrazine. This paper introduced the experimental investigation and validation of an 1N ADN-based liquid thruster in Beijing Institute of Control Engineering (BICE). First, the experiments were mainly focused on the combustion mechanisms in the combustion chamber of a 1N model thruster. Using the Tunable Diode Laser Absorption Spectroscopy (TDLAS) method, flow parameters such as the gas temperature and the characteristic species concentrations of CO and N2O in the combustion chamber were measured instantaneously with the atmospheric back pressure. The effects of the propellant inlet pressure on the combustion process were evaluated. Second, the hot fire test results of an ADN-based 1N liquid thruster were presented. The performance data with different operation conditions were obtained and discussed. And finally, the on-orbit flying validation of the 1N ADN-based liquid thruster was presented. These results provided a better understanding of the mechanisms of the chemical reaction with ADN-based liquid propellant and gave details of the performance of the ADN-based liquid thruster. The contents in this paper are beneficial to the development of green aerospace propulsion techniques.