Paper ID: 45643
student

IAF SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Technology (2) (5)

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CATALYST SUPPORT DEVELOPMENT FOR HIGH PERFORMANCE GREEN MONOPROPELLANT THRUSTER

Abstract

Recently, researches for high performance green monopropellants have much progress for substitution of very hazard hydrazine propellant. Especially, LMP-103S (ECAPS AB) and AF-M315E (US Air Force) monopropellants composed by ionic oxidizaer blended with hydrocarbon fuel have superior performance and environmental than hydrazine, so they become promising candidates for this purpose. Furthermore, nowadays they are success and planning for space flight test each in 2010 and 2018. However, this is the defect that the adiabatic decomposition temperature is very high over 1600 °C. This defect makes γ-alumina generally used to catalyst support suffer from sintering and phase transformation to α-phase, reducing surface area and agglomerating to one body. This decrease results in deactivation of catalyst and the increase of pressure difference. Previous researches are conducted to delay sintering phenomenon of alumina by various synthetic methods and doping other elements like La, Ba, Si, especially La and Ba makes hexaaluminate structure (LHA, BHA). On the other hand, some researchers use another support material like LCH-240 (Hafnium oxide). However, these improved alumina have also drastic shrinkage in surface area over 1400 °C, and hafnium oxide is precious material, so it is very expensive. Because of that. in this research, various oxide materials are considered as new catalyst supports. Among many materials, MgO, ZrO_2 each has very high melting temperature 2852 °C, 2715 °C, and have reasonable oxidation characteristics compare with Al_2O_3. These candidates are tested by BET surface area measurements for getting over 10 m^2/g after 1400 °C treatment. Moreover, preparing small thruster system with LMP-103S or ethanol blended hydrogen peroxide monopropellants (each has T_{ad}=1640 °C, 1370 °C), catalysts performance and sintered suface are also observed after thruster environment comparing with previous sintering resistant alumina (BHA, Si doped alumina). Thus, those high temperature resistant catalyst supports are suggested as superior element in HPGP monopropellant thruster.