SPACE PROPULSION SYMPOSIUM (C4)
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LOW COST HYDRAZINE DECOMPOSITION CATALYST (KCMC-7) DEVELOPED WITH TEMPLATING METHOD FOR GENERATION OF MACROPORE FOR FACILE MASS AND HEAT TRANSFER

Abstract

Early 1960, Shell 405 catalyst developed in Shell Chemical Co. is the state of art technology for the hydrazine monopropellant thruster application in aerospace fields during more than last half century. There have been extensive efforts to develop the low cost catalyst due to high cost of iridium compromising 32 wt% in the catalyst. However, the catalyst employing carbon nanofiber, metal carbide, sol-gel alumina etc. as a support does not meet the requirement of flight model for satellite attitude and altitude control during the prolonged mission life because the mechanical stability of the catalyst is inferior to that of Shell 405 because of the harsh reaction conditions, high temperature and high pressure. Initially, the Shell 405 catalyst was produced using special alumina obtained from Reynolds Metal Co., now Alcoa Inc. Recently, the technology transfer program to Aerojet at Redmond and the demonstration program were conducted to procure the catalyst product due to the shutdown of product line in Shell Chemical Company. However, the detail characteristics of such a special alumina are not well-known. In this work, the macropore was introduced into alumina itself using macroporous template such as wood flour, microcrystalline cellulose etc. when extrudating into alumina pellet or granule starting from amorphous alumina. Such a macroporosity can facilitate the heat and mass transfer during hydrazine decomposition reaction. The obtained macroporousity in alumina resulted in the high permeability measured from mercury intrusion experiment comparable to that of Shell 405 without sacrificing the mechanical strength. Further the macroporosity was tunable and also the corresponding packing density can be lowered, thereby producing low cost catalyst support. The catalytic performance of the KCMC-7 (Korea Aerospace Research Institute-Chonnam National University Model Catalyst-7) with tunable macroporousity met the requirement as flight model. Here, the design and preparation of alumina of tunable macroporosity will be presented with the catalytic performance of hydrazine decomposition reaction from the beginning of life to the end of test.