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THE EFFECT OF FUEL LENGTH ON THE REGRESSION RATE IN SWIRLING-OXIDIZER-FLOW-TYPE HYBRID ROCKET USING A LIQUEFYING FUEL

Abstract

A hybrid rocket system possesses several excellent benefits such as high safety, low cost, and green propellant characteristics. However, the conventional hybrid rocket system has a low thrust level because of its low fuel regression rate. Low-melting-point thermoplastic (LT) fuels as a liquefying fuel provide a higher fuel regression rate than conventional fuels such as hydroxyl-terminated polybutadiene (HTPB), and are expected to obtain huge thrust. Additionally, the LT fuel equip excellent mechanical property, which is elongation of more than 300 In this study, static firing tests were carried out by changing fuel length and Sg. As a result, the averaged regression rate was decreased when more than the 200 mm as fuel length in the conditions of the oxidizer mass flux is 70 to 80 kg/m2s, Sg is 9.7 and 19.4. Swirling oxidizer effect is suppressed to the rear region of the fuel, and local regression rate at the rear region is decreased. The local regression rate was also investigated in this study. When Sg = 0, the local regression rate gradually decreased with increasing of the fuel length. The oxidizer swirling flow test observed the constant value of the local regression rate of rear fuel compared with the case of Sg=0. It is contributed to minimizing the fuel residue. This study considered the effect of fuel length on the regression rate and local regression rate, and propose a prediction formula of regression rate that considers fuel length.