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Author: Mr. Sangwoo Jung
Korea Advanced Institute of Science and Technology (KAIST), Korea, Republic of, jsw747@kaist.ac.kr

Mr. Kyu-Seop Kim
Korea Advanced Institute of Science and Technology (KAIST), Korea, Republic of, kswind@kaist.ac.kr
Prof. Sejin Kwon
Korea Advanced Institute of Science and Technology (KAIST), Korea, Republic of, trumpet@kaist.ac.kr

# MINIMUM CATALYST BED LENGTH FOR HIGH TEST HYDROGEN PEROXIDE THRUSTERS

**Abstract**

High Test Hydrogen Peroxide is one of the green propellant candidates for replacing high toxic propellants such as hydrazine and its derivatives. Due to its easy handling, many small scale hydrogen peroxide thruster systems are being developed. Since the hydrogen peroxide thruster uses catalytic decomposition in the catalyst bed, the volume design of the catalyst bed is crucial. If the size of the catalyst bed is too small, the thrust performance will not be achieved. If the size of the catalyst bed is too large, the high-pressure drop will occur. An adequate design parameter is needed to design the optimum catalyst bed size. Currently used catalyst bed design parameters are mass flux and catalyst capacity. Mass flux is the mass flow rate per unit cross-section area, and catalyst capacity is the fully-decomposable mass flow rate per unit volume. But mass flux doesn't have information about the bed length. And catalyst capacity is an empirical constant that varies depending on the various conditions. It is necessary to study the way to design the optimum size of the catalyst bed.

Referring to the study of Schmitz et al., the equation of minimum catalyst bed length for hydrazine thrusters can be achieved by experiments. The equation consists of mass flux, chamber pressure and specific surface area of catalysts. In this study, the relationship between minimum bed length and mass flux is studied when injection pressure and catalyst particle size are the same. To get the relationship between mass flux and minimum catalyst bed length for complete decomposition, optimum catalyst capacity which was given by preceding modeling study is used. Optimum catalyst capacity is the mass flux divided by the minimum catalyst bed length for complete decomposition. As a result of the conversion, it is confirmed that the minimum length and the mass flux are linear when injection pressure and catalyst particle size are the same. The slope is positive, and the y-intercept is negative. These constants are determined by the injection pressure and catalyst particle size. The parametric study will be conducted using the modeling to determine the relationships between the constants (slope and y-intercept) and conditions (injection pressure and catalyst particle size). With the parametric study result, the optimum volume of the catalyst bed can be designed easily with the linear relationship.