SPACE PROPULSION SYMPOSIUM (C4)
Propulsion System (2) (2)

Author: Mr. Akihiro Iwasaki
The Graduate Universty for Advanced Studies (SOKENDAI), Japan, iwasaki.akihiro@ac.jaxa.jp

Mr. Shun Yoshihama
Chuo University, Japan, s_yoshihama@bio.mech.chuo-u.ac.jp
Ms. Kana Otake
Kansai University, Japan, k941959@kansai-u.ac.jp
Mr. Naomasa Hosomi
Kansai University, Japan, k155916@kansai-u.ac.jp
Ms. Natsuyo Uegaki
Kansai University, Japan, k205204@kansai-u.ac.jp
Dr. Kotaro Matsumoto
Japan Aerospace Exploration Agency (JAXA), ISAS, Japan, matsumoto.kohtaroh2@jaxa.jp
Dr. Yasuyuki Yamada
Chuo University, Japan, y.yamada156159@gmail.com
Dr. Soichiro Yamaguchi
Kansai University, Japan, yamso16@kansai-u.ac.jp
Prof. Taro Nakamura
Chuo University, Japan, nakamura@mech.chuo-u.ac.jp
Dr. Hiroto Habu
Japan Aerospace Exploration Agency (JAXA), Japan, hiroto@isas.jaxa.jp

PERFORMANCE EVALUATION OF COMPOSITE PROPELLANT SLURRY MIXING BY PERISTALTIC CONTINUOUS MIXER

Abstract

The target of this study is to realize the continuous solid propellant producing technique for a cost reduction of solid rocket motor systems. In the process of the solid propellant manufacture, the mixing process controls the quality of the loaded solid propellant; the batch process is impossible to be replaced at present. We have considered the peristaltic pumping action mixer as one of the candidates for the continuous mixer. This mixer system is based on the artificial muscle actuator (soft actuator), and it is elongated and contracted by the pressurized gas. The system has some segments that has double rubber pipes (inner /outer), and the units can work independently. The outer rubber tube controls the shape change direction; the inner one works as a mixing chamber. The outer tube is swollen by the pressurized gas and the segments constrict axially; the inner tube inflates and the free volume can be changed. We expected that this mixer system has possible to replace the batch process by the continuous one. The peristaltic motion enables not only the mixing but also conveying even high viscosity slurry. The mixing mechanism by the soft actuator compress has no impact for the safety of the solid propellant handling. In this research, the mixing completeness of the composite solid propellant slurry by the peristaltic pumping mixer was estimated. The dispersion of the particle materials in the binder and the existing voids was observed by the X ray CT microscope. The solid propellant samples were made by our mixing system. The test materials were as follows: Hydroxyl terminated polybutadiene (HTPB) polymer as for the binder, aluminum powder as for the metallic fuel, dioctyladipate as for the plasticizer, ammonium perchlorate

particles as for the oxidizer. The propellant composition was HTPB/AP/Al = 14/68/18 in massThe result showed that the mixer we proposed could mix the propellant slurry. The X ray CT scanning images showed that the solid materials well dispersed through the analysis of the luminance histograms.