SPACE DEBRIS SYMPOSIUM (A6)
Hypervelocity Impacts and Protection (3)

Author: Dr. Koji Tanaka
Japan Aerospace Exploration Agency (JAXA), Japan, ktanaka@isas.jaxa.jp

Mr. hiroki miyoi
Kogakuin University, Japan, h-miyoi@ac.jaxa.jp
Prof. IchiroIchiro Shiota
Salesian Polytechnic, Japan, shiota@salesio-sp.ac.jp
Ms. Masumi Higashide
Tokai University, Japan, *(email is not specified)*
Prof. Susumu Sasaki
Japan Aerospace Exploration Agency (JAXA), ISAS, Japan, sasaki.s@apost.plala.or.jp

OBLIQUE HYPERVELOCITY IMPACT EXPERIMENT FOR SPACECRAFT DEBRIS SHIELD

Abstract

Space dusts, such as natural meteoroids or man made orbiting debris, are recognized as a serious and growing threat to man's utilization and exploration of space. Debris larger than 10 cm in diameter is detected by ground based radars and optical observations. But it is impossible to detect debris smaller than 10 cm by ground-based observations using existing technologies. Typical debris impacts are thought to occur at a velocity of around 10 km/s. Shiota proposed a new concept on the debris protection system applying a principle of the stone skipping for the large space craft or the solar power satellite. We have carried out the experiments for the research on the oblique hyper velocity impact experiment using several materials in order to confirm an effect of the stone skipping on the surface of the target. Especially, we have interests in the CFRP materials that have unique directional characters. Results of the CFRP plate and metal plates were compared. Two stage light gas gun was used. Nylon sphere with a diameter of around 7 mm and a weight of around 0.004 g was used as a projectile. Ejectors were monitored by the high speed video camera and captured using a shielding plate. The impact experiment chamber that consists of an impact section with a viewing port and several feed-through flanges is installed at the back of the light gas gun. The chamber was evacuated to several ten Pa using the vacuum pump system. Velocities of the projectile for our experiments were from 2 km/s to 5 km/s. CFRP or Aluminum target was set on the target holder that could make an adjustment of the impact angle. We confirmed recoiled conditions of the projectile, and observed destruction phenomena of the CFRP and Aluminum plate for the several incident angles. We evaluate a threshold parameter that leads to a destruction hole on the target.