

SPACE DEBRIS SYMPOSIUM (A6)
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BEHAVIOR OF EJECTORS AT OBLIQUE COLLISION FOR DEVELOPING A DEBRIS SHIELD

Abstract

A space solar power satellite (SPS) is expected as one of future sustainable energy sources. Space debris is a great problem for utilizing an SPS. As the debris flies at a very high speed, collision of the debris with an SPS will cause a fatal damage. Then a protection shield is essential. Various ideas have been proposed to protect the SPS from debris. A Whipple shield, which consists of two parallel layers, is the most famous one. Collision of the debris at normal direction to the panel is assumed in the Whipple shield. Then a thick panel is necessary to protect the SPS from the debris. We propose a novel shield which a debris collides with at an oblique angle. The debris only changes the flying direction after collision, so that the panel needs not to absorb whole energy of the debris. Then thin panels will be sufficient. In our former paper, a projectile was collided with two parallel panels. As the result, the projectile formed a hole on the first CFRP panel but no hole was observed on the second panel at any collision angle to the first layer. The ejectors scattered mainly to the normal direction of the first panel. From these results, we obtained a prospect to construct a thin and light weight CFRP protector by oblique collision. In this paper, two panels were set at 60 degrees. Then a projectile and ejectors collided with the second panel at a smaller angle than 60 degree, even the projectile collided with the first panel at any angle. We estimated the collision energy on the second panel. In the case of two parallel panels, the energy was three times larger than the case of 60 degree. Simulation was carried out to clarify the collision process by using AUTODYN. The SPS may be damaged not only by debris but also by various cosmic-rays such as ultraviolet, proton and so on. Therefore deterioration of the shield in the space is a great problem for long term usage. Deterioration process of CFRP was also discussed.