

MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Space Environmental Effects and Spacecraft Protection (6)

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PROTECTION OF SPACECRAFT FROM SPACE ENVIRONMENTAL EFFECTS

**Abstract**

This paper deals with the impact of micrometeoroid and space debris on spacecrafts and the methods used for protection against them. Manned or unmanned spacecrafts crossing a certain altitude are vulnerable to damage by micrometeoroids and space debris. They are defragmented parts of asteroids and meteors (space rocks ) or man made debris (solidified exhaust from earlier missions, etc.). Collision of space debris with the spacecraft structure can cause damage , considerable enough to cause problems in its control systems. Also, these collisions cause slow degradation of material properties. Various protective techniques are required for damage prevention and making the space mission a success. One of the most common techniques used for shielding against space debris and micrometeoroids is the usage of protective blankets made up of a material which can absorb the impulse produced due to collision without causing damage to the structure and also withstand the harsh environment of the outer space i.e the material is so selected that it does not get degraded in the space environment. Presence of atomic oxygen, charged particles, UV radiations are some of the causes of material degradation in space. The factors to be considered in the selection are : strength of the material, melting temperature, surface properties like absorptance and emittance, mass density, cost. These blankets are either multi or single layered depending upon the requirement. Some of the protective covers used are beta cloth, Kevlar, Tedlar, ceramic blankets and aluminum shields. Materials like Teflon can also be used but when used they should be bonded to a more durable support material such as Kapton. After detailed a comparison between the potential materials and their properties, specific areas of application of each material depending on the requirement is highlighted. Thus , a shield is fabricated considering its reliability in space environment , its ability to withstand space temperature , weight constraints of the spacecraft and cost effectiveness.