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

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MODELING OF DAMAGE FORMATION ON A FRONT WALL OF SHIELDED COMPOSITE OVERWRAPPED PRESSURE VESSEL SUBJECTED TO SPACE DEBRIS IMPACT

Abstract

Detailed numerical models implementing two filament winding patterns with different degrees of interweaving were developed and used to simulate 2.5 km/s and 5.0 km/s impacts of 5 mm-diameter spherical aluminum-alloy projectile on a shielded front wall of a composite overwrapped pressure vessel (COPV). Obtained results indicate that winding pattern may have a pronounced effect on vessel damage in case of space debris impact, influencing propagation of the stress waves in composite material. Pattern with higher degree of interweaving was found to eliminate excessive propagation of damage. As a result, it was recommended to maximize the degree of interweaving when designing a vessel for the use in spacecraft onboard systems, where there exists a probability of space debris impact.