

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

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EVALUATION OF THE EFFECT OF LEO ENVIRONMENT ON IMPACT CHARACTERISTICS OF
NANO-FILLER REINFORCED CFRP COMPOSITE**Abstract**

Recently the composite material is widely used as the structural material of space vehicles because of their high specific strength and stiffness, and low thermal expansion coefficient. In spite of these merits, there is one problem. That is the erosion and mass loss of polymer matrix which can carry the degradation of composite material properties due to harsh environment such as atomic oxygen, UV light, thermal cycle, high vacuum. Another harsh environment is micro-meteoroid and debris which move with hypervelocity (1-12km/s). Therefore, characteristics of polymer matrix composite under LEO space environment have to be understood before design space craft with composite material. In this paper, nano-filler reinforced composite is suggested as one of the solution to improve resistance against LEO space environment. Accelerated aging experiment was performed for CFRP composite and nano-filler reinforced CFRP composite. After performed aging experiment in the ground simulation machine, high velocity impact test was performed for each material. The used ground simulation facility can simulate high vacuum, atomic oxygen, UV light and thermal cycling simultaneously. The capacities of facility are as follows. The vacuum level is about 2.5×10^{-6} torr, A/O flux is 9.15×10^{14} atoms/cm²/s, thermal cycling is -70C-100C, and wave length of UV light is 200nm. The aging experiment was performed for 20 hours which is equivalent with STS-4 space shuttle condition. The used high-velocity impact test machine is 1 stage gas gun which can accelerate aluminum particle with 300m/s.