

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Advanced Materials and Structures for High Temperature Applications (4)

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DESIGN AND THERMAL PERFORMANCE TEST OF A NOVEL THERMAL
PROTECTION/INSULATION ANTENNA WINDOW FOR LONG TIME REENTRY SPACE
VEHICLES

Abstract

To keep up with the new demands of thermal protection/insulation of antenna window for long time reentry space vehicles, two different types of integrated thermal protection/insulation designs for antenna windows, which are double-layer materials and multi-layer materials designs, is proposed in the study. Then ground test program including two working state: higher and lower temperature conditions, is designed, and the two samples of antenna window were heated by an arc tunnel to investigate their ablation and thermal insulation performances in the two state for long time. Based on analyses of the test phenomenon and results, two important conclusions have been concluded: first the two types of antenna window are capable of resisting the surface high temperature of 1400 degrees for long time; they have well ablation performance and no thermal deformation during the test. After 1000s, the maximal mass ablation rate and linear ablation rate for double-material samples are 0.00093g/s and 0mm/s, which are 0.00716g/s and 0.00034mm/s for multi-material samples, respectively. Second the highest temperature rise of inner surface of the samples is about 42 degrees after the heating of 1000s, indicating that the two antenna window all has excellent thermal insulation property in long heating condition and could maintain the temperature of internal antennas within acceptable temperature margins. This study breaks through the traditional design opinion that the antenna window is single-layer materials structure, exploring a new approach for the integrated thermal protection/insulation design technology of antenna window, and has a guiding significance for the engineering development and application of the antenna window in long time reentry space vehicles.