

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Smart Materials and Adaptive Structures (5)

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DESIGN AND PREPARATION OF A NEW TYPE OF ADVANCED THERMOCHROMIC SMART
RADIATOR DEVICES

Abstract

This paper describes the research work on the materials and design methods for advanced smart radiator devices (SRDs) for spacecrafts. The functional material is thermochromic vanadium dioxide. The multilayer film design of SRD is similar to the design of broadband filter coatings in a mid-infrared region. The multilayer coatings have complex structures. Coating materials must be highly transparent in a required spectrum region and also mechanically robust enough to endure the influence from the rigorous environments of outer space. The number of layers must be much small, suitable for the deposition on large-area flexible substrates. All the coatings are designed initially based on optical calculation and practical experience, and then optimized by TFCALC software. Several designs are described and compared with each other. Two kinds of thermochromic multilayer SRDs are designed and optimized. The results show that the optimal design is very encouraging with $\Delta\varepsilon/\varepsilon$ large than 1000% with special materials. The SRD based on Ge is very good and robust enough with $\Delta\varepsilon/\varepsilon$ larger than 400%, which is also much better than that of traditional thermochromic SRDs.