

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Interactive Presentations - IAF MATERIALS AND STRUCTURES SYMPOSIUM (IPB)

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APPLICATION OF METAMATERIALS IN OPTICAL SOLAR REFLECTORS FOR SPACECRAFTS

Abstract

Optical Solar Reflectors(OSRs) have been incorporated in various space missions. OSRs play a crucial role in the thermal control of a satellite by being glued to the external skin of the radiator panels. They are fabricated to reflect solar radiation and to dissipate internal heat. The OSR market is currently dominated by quartz OSRs and to a much lesser extent by silver/ teflon foils. However, current OSR technologies have certain shortcomings. They are either heavy, fragile and inflexible or they age rapidly. Meta-OSRs of the next generation promise to tackle these issues whilst still reducing overall spacecraft/satellite weight. Metamaterial Optical Solar Reflectors (meta-OSRs) are first-surface coatings on the outside of a spacecraft that are designed to effectively reflect much of the optical solar spectrum while radiating infrared heat away from it. By dynamically modifying the bulk thermal conductivity and managing the instantaneous heat flux through them, metamaterials can actively manage the temperature of an interface. Only a few are significant for prospective use in space-based passive optical devices. This study examines the best materials for the construction of OSRs. To understand the discrepancies between the results, a comparison study was conducted between the various surface coatings and meta-OSRs. In addition, simulations were run in Thermal Desktop based on the parameters of several materials to determine the quantity of infrared heat rejected by each, and graphs were generated for each.