

Thermal Control Characteristics of Dielectric Multilayer Films for Space Use

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Thermal control devices for space applications based on dielectric multilayer films have been developed in our laboratory. In the proposed device, the solar absorption (α_s) and infrared emissivity (ϵ_H) can be easily controlled by the multilayer interference in specific optical wavelength region. The radiowave transmission is also accomplished in the proposed device, therefore, our device can be applied for the antenna of spacecrafts. In the previous study, we have developed the COSF (Controlled Optical Surface Films) using dielectric multilayers for the thermal control device with low α_s and high ϵ_H , which can be utilized for the thermal insulation in the space-exploration mission. We have developed a novel thermal insulation device based on a COSF-IR for the infrared astronomical satellite and deep space exploration mission. In these missions, the spacecraft is exposed to cryogenic environment, therefore the thermal insulation device with low emissivity at low temperature is required. The temperature dependence of the proposed device was measured and estimated using FT-IR and calorimetry methods. Infrared reflectance spectrum and total hemispherical emittance were revealed by these measurement results. Furthermore, a novel thermal control device using dielectric multilayer films for a Mars exploration mission is investigated. The validity of proposed dielectric multilayer films to control the heat dissipation and absorption in the Mars atmosphere is discussed in the presentation.