

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialized Technologies, including Nanotechnology (8)

Author: Dr. Karl Fleury-Frenette
CSL (Centre Spatial de Liège), Belgium, kfleury@ulg.ac.be

NANOPARTICLES IN SOLAR SAIL MATERIALS

Abstract

Solar sailing is a spacecraft propulsion mean exploiting the radiation pressure of sunlight. This concept is undergoing a regain of interest from the space agencies around the world partly driven by the development of manufacturing technologies. Typically, tens of thousands of square meters of sail materials are required to propel a spacecraft. In its most common proposed embodiment, the sail material is constituted of a thin (μm) polymer foil coated with a reflective layer on the front side and an emissive layer on the back side. The photons momentum is transferred to the sail upon reflection and its thermal balance is governed by radiative processes (absorption over the solar spectrum and reemission of thermal infrared radiation). The impact of nanoparticles inclusion in the thin foil and coatings on the sail performance will be evaluated for operation between 0.2 and 2 AU (namely between mercury orbit and the asteroid belt). The aspects of thermal regulation and resistance of the polymer to UV radiation will be addressed within the framework of calculations based on effective medium approximations.