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

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CHALLENGES AND SOLUTIONS FOR HIGH-TEMPERATURE APPLICATIONS IN SPACE: MATERIALS AND STRUCTURES FOR SPACECRAFT AND SATELLITES"

Abstract

In the space industry, advanced materials and structures for high-temperature applications are especially crucial. Extreme pressure, heat, and other environmental conditions, as well as elevated radiation levels, must be withstood by spacecraft, satellites, and other space-based equipment. Space temperature extremes can have a variety of effects on satellites. Space's severe temperatures can result in thermal stress, which can harm or deteriorate a satellite's systems and components. There are number of ways in which satellites or spaceships get affected by high temperature like thermal expansion, heat dissipation, solar radiation and thermal cycling. Satellites are built with improved materials and cooling systems that can resist the thermal stress of space to lessen the impacts of high temperatures. To guard against sun irradiation and heat loss, they also use thermal coatings and insulation. In order to ensure optimal performance and longevity, satellites are also made to operate within a certain temperature range. In this research, we examine these problems and utilize the use of cutting-edge materials and architectures to identify solutions. The structural and thermal modelling are all carried out in the Ansys programme that we are using for our work and simulations. For instance, we are experimenting with copper and aluminium alloys at the surfaces that are most frequently exposed to high temperatures. These surfaces are then connected to carbon composition materials that include heat dissipators or radiators. In conclusion, due to the absence of atmosphere to act as insulation in space, things might experience significant temperature swings due to the lack of a permanent heat sink, which makes the temperature problem distinct from that on Earth. By enhancing thermal management and lowering heat generation, advanced materials in satellites can aid in overcoming these difficulties.