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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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NANOCOMPOSITE MATERIALS AND STRUCTURES: NEW PERSPECTIVES FOR HUMAN LIFE IN SPACE

Abstract

The human exploration of non-Earth planets is the Pillars of Hercules of the contemporary era. Indeed, the space agencies around the world have ambitious plans of allowing permanent human bases on Mars and Moon within our lifetime. However, these ambitions face with the limitations of the current technologies. The need to reduce the weight of the spacecraft at launch, to improve the flexibility while maintaining the mechanical strength, and to realize new sustainable structural and non-structural elements of life support for long explorations are just some of the challenges to overcome. Nanocomposite materials and structures seem to be the key to go beyond many technological challenges. Nanocomposites are materials consisting of at least one component in the nanoscale, which gives multi-functional characteristics to the structures where they are embedded. Carbon nanoparticles, such as nanotubes and graphene nanoplatelets, combine mechanical exceptional properties with excellent electrical and thermal properties. These materials can be used for realizing multifunctional structures to achieve lightweight and high performance spacecraft, radiative shields, and create new sensors to monitor the human life in space, as well as highly reliable energy storage systems. In this presentation, we will analyze how nanocomposite materials and structures can be used to promote human space exploration, as extravehicular activities and colonization of non-Earth planets. In particular, we will focus on the design of novel miniaturized nanocomposite sensors that could monitor the interaction of the astronaut with the space environment, and lightweight structural elements for human life protection.