Paper ID: 13422
oral
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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialised Technologies, Including Nanotechnology (8)

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PLASMA SPUTTERED OXIDE FILMS ON CARBON COMPOSITES FOR REUSABLE TPS FOR RE-ENTRY SYSTEMS

Abstract

Space structures nowadays are becoming more and more in the need of use reusable structures. The most critical part of a space structure is the thermal protection system (TPS) which must protect the vehicle from the extreme environment of the launch and re-entry phase. Caused by the extreme environment (such as plasma, high temperatures etc.) the common effects on a TPS are coating cracks and loss, erosion, embrittlement, chips, gouges, slumping, charring etc. The other big criticality is the captive device system which has to assure a good fastening to the underlying structure to be protected. In this case sneak flows must be avoided. A first step to solve all this problem is the choice of the material: carbon Silicon carbide composites (SiC) are nowadays the most suitable as they has a good thermal resistance, a good thermal stability which preserves the mechanical properties at high temperatures and they can resist to the oxidation phenomena more than the carbon carbon materials. But this is not enough, there is however the need to make a good coating on the captive device surface. The proposed approach is to study and optimize plasma deposited valve-metal (Ta, Nb, Zr, Ti) oxides coatings on the captive device. In particular, Nb2O5 and ZrO2 nanostructured thin films were deposited in a RF (13.56MHz) magnetron sputtering reactor, staring from Nb and Zr targets (purity 99,99The plasma sputtered coating have been implemented on a captive device, patented by DIAEE (University of Rome Sapienza) and Italian Space Agency, which has been developed for hypersonic and re-entry vehicles applications. This captive devices is composed not only by the CSiC components but also by a metallic mechanical element which is an insert put into the CSiC structure. This element needs to be coated because of the possible sneak flows which can oxidize it.