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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
New Materials and Structural Concepts (4)

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INNOVATIVE THERMAL PROTECTION SYSTEM FOR RE-ENTRY APPLICATION

Abstract

The Italian Space Agency (ASI) is envisioning a prominent role to technologies and projects involving atmospheric re-entry capabilities. This is because the shuttle age is over and there is the need to invest and develop new re-usable structures which can withstand with the necessity to be lightweight, as cheap as it is possible and safe. The safety concept is important to lead the project for next commercial use of hypersonic vehicles. The project ASA (Advanced Structural Assembly) is devoted to developing an innovative structural component for space vehicle performing a re-entry flight from space through the Earth's atmosphere. The investigation is, however, expanded to the all mission phases. The choice of the re-entry test conditions for the design and develop is due to the fact that this are the most severe of the overall mission. The project requirements take into consideration the harsh condition of a re-entry mission. It is thought that this developed thermal protection system (TPS) has to be installed on the I-XV vehicle. The ASA innovative layout is designed to withstand structural and thermal loads, optimising weights and thicknesses with respect to the state of the art. The key factor of this new advanced composite structure is its reusability. A specific set of characterization and functional test has been defined to assess the technologies readiness level and qualify the component for a re-entry nominal mission. In this paper the structure is presented showing its capacity to withstand with I-XV requirements. The patented structure is a sandwich structure composed by four tiles. One of the innovation of this TPS is the opportunity to be installed/uninstalled externally without the necessity to have an access from the inner part of the vehicle. The use of advanced carbon/carbon materials let the structure to be not only lightweight but also to be

reusable and to keep its mechanical properties during the overall mission. Another key factor for the ASA Panel reusability is its oxidation resistance. The application of a good in quality coating has been tested and studied in order to guarantee the material chemical stability. FEM codes will here compared with experimental test results in order to study the chemical, thermal and mechanical properties of the ASA Panel.