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

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A COMPETITIVE THERMAL PROTECTION SYSTEM FOR HYPERSONIC VEHICLES.

Abstract

Hypersonic flight has been object of scientific studies for years. Military applications were the first applications. But now the next future for hypersonic flight are commercial applications. This requires an increase of the safety and comfort of the flight mission which make the re-entry phase longer than astronauts re-entry missions. From this point of view the vehicle thermal protection system (TPS) is one of the most critical point of the entire mission. Many are the key parameters for this system, among them one of the most challenging is the design and materials. In fact the determination of the best material for TPS passes thorough years and years of development. Materials match is another aspect not to be ignored and a theoretical and experimental study is required. The aim of this paper is to present the development of an innovative thermal protection system suitable for a hypersonic vehicle. The innovation of this system is to be a thermal insulation which can allow to put down the temperature of over 1000C in few centimetres and to be a structure which can bear thermo-mechanical loads. The study and development of this TPS is promoted, in the frame of ASA B2 (Advanced Structural Assembly Phase B2) project, by the Italian Space Agency (ASI) which is envisioning a prominent role to technologies and projects involving atmospheric re-entry capabilities. In this paper the structure is presented showing, by numerical and mission environment simulations, its capacity to withstand with I-XV requirements. The structure is a sandwich structure composed by four tiles. One of the innovations 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 and Carbon/Silicon Carbide combined with carbon foam materials let the structure to be not only lightweight but also to be reusable and to keep its mechanical properties during the overall mission.