

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

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THERMO MECHANICAL ARCHITECTURE DEVELOPMENT OF LIQUID HYDROGEN TANKS
FOR UPPER STAGES WITH USE OF CRYOGENIC HELIUM MACHINE

Abstract

The next generation of upper stages is considered to be based on cryogenic propellants (liquid hydrogen and liquid oxygen). So, the issues of their thermo structural development and verification at the operating temperature became important. Modern design and manufacturing technologies give us fuel tanks with almost perfect structure. If we take into account the hardening of materials at low temperatures, it also gives us added value for mass reduction. But these almost perfect structures must be verified with exact simulation of all essential operational factors, especially temperature. So, hydrogen tanks should be tested being cooling down to the temperature of 20 K. Testing at higher temperatures (even in liquid nitrogen environment) does not take into account some changes of material properties. This can lead to increase in weight of the tank design. Experimental cryogenic and life cycle development of cryogenic propellant tank (both for ELV and RLV) would require development of new specialized test benches. For this purpose, an effective method of a large tank cooling up to 20 K for cryo structural testing has been proven. Gaseous helium is considered to be used as the refrigerant coolant