CARBON COMPOSITE OVERWRAPPED TITANIUM LINED GAS BOTTLE AND ITS QUALIFICATION FOR HIGH PRESSURE GASEOUS HYDROGEN SCRAMJET APPLICATIONS

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Abstract

Composite Overwrapped Pressure Vessels (COPVs) are used for storage of high pressure gases in aerospace and commercial applications. A thin metallic liner is provided inside the COPV to achieve required leak tightness. Compatibility of liner raw material and storage medium forms an important design parameter to ensure safe usage of the COPV for any application. Titanium alloy Ti6Al4V is one of the prime candidates for liner realization considering its unique advantages. The material is being used extensively, for aerospace applications, including in ISRO for storage of Helium and Nitrogen gases. A requirement to qualify the Ti6Al4V lined COPV for storage of Hydrogen gas was met with. A unique design approach was attempted to overcome Hydrogen Environment Embrittlement (HEE) prone nature of Titanium alloys. Design assumptions were validated through a series of development and qualification tests. Based on successful qualification tests, the COPV was cleared for GH_2 storage and successfully used in flight.

Keywords: Ti6Al4V, Hydrogen Environment Embrittlement, GH_2 Storage Gas Bottles, Rapid Expulsion Test, Rupture Test