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

Author: Dr. Fei Yan
Shanghai Institute of Space Propulsion, China, yanfei_801@126.com

ULTRALIGHT PBO COMPOSITE OVERWRAPPED PRESSURE VESSELS FOR CHANGE'S 5 DETECTOR

Abstract

Three kinds of aluminum-lined Composite Overwrapped Pressure Vessels (COPVs) were designed and manufactured by Shanghai Institute of Space Propulsion (SISP) of China for aerospace applications for the Change's 5 detector (Che5). One of the most important mission goals of Che5 is to reduce the weight, while increasing their technical capabilities. These ultralight COPVs, which provide gaseous helium to the Che5 propulsion systems, are the key hardware components to reduce weight to achieve the mission goal. These vessels were designed and qualified per the design specifications.

All of the three COPVs consist of a thin-wall thick seamless 6061-T6 aluminum liner overwrapped with polybenzoxazole (PBO) fiber, the minimum volume is respectively 16 liters, 53 liters and 78 liters at the Maximum Expected Operating Pressure (MEOP) of 35MPa. The required minimum burst pressure is 70MPa and the maximum empty vessel weight is respectively 3.6 kilograms, 10.8 kilograms and 15 kilograms. Unique design, processing and inspection techniques were employed to assure program success. These COPVs were successfully qualified at the beginning of 2015, which demonstrated a minimum burst pressure of 75MPa and a minimum PV/W of 36 kilometers.

The design, fabrication, damage control, development, and qualification of the Che5 COPVs are presented.