CAMX
Composites and Advanced Materials Expo
October 26-29 / Dallas, TX

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Title:
Development of an Ablative 3D Quartz / Cyanate Ester Composite for the Orion Spacecraft Compression Pad

Abstract:

With the successful flight test of the Orion Multipurpose Crew Vehicle last December, NASA is well on its way to sending humans into deep space with the goal of putting astronauts on Mars in the 2030s. Orion will receive some upgrades for its next launch in 2018 including a newly developed 3D Quartz / Cyanate Ester composite material for the compression pad. The compression pads are ~10-inches in diameter and ~3-inches thick. The pucks are at 4 locations in the heat shield that serve as a part of the mechanism for holding the Crew and Service modules together during most mission phases prior to separation followed by Earth re-entry. Thus the compression pad has structural, aerothermal and thermal protection requirements.

This paper describes the approach used for developing the new 3D composite, including continuous 3D weaving on an automated loom followed by resin transfer molding. Mechanical, thermal and arc jet testing of the 3D composite are also described.