

HVI Ballistic Limit Characterization of Fused Silica Thermal Pane

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ABSTRACT

Introduction

The Orion spacecraft's windows are exposed to the micrometeoroid and orbital debris (MMOD) space environments while in space as well as the Earth entry environment at the mission's conclusion. The need for a low-mass spacecraft window design drives the need to reduce conservatism when assessing the design for loss of crew due to MMOD impact and subsequent Earth entry. Therefore, work is underway at NASA and Lockheed Martin to improve characterization of the complete penetration ballistic limit of an outer fused silica thermal pane. Hypervelocity impact tests of the window configuration at up to 10 km/s and hydrocode modeling have been performed with a variety of projectile materials to enable refinement of the fused silica ballistic limit equation [1].

Figure 1 provides an image of a complete penetration impact of a fused silica specimen. The specimen was impacted at 0° obliquity by a 2.5 mm aluminum projectile traveling at 7.23 km/s [2].



Figure 1, Complete penetration of fused silica pane.

References

- [1] Cour-Palais, B.G., Hypervelocity Impact in Metals, Glass, and Composites, *International Journal of Impact Engineering*, 5, pp.221-237, 1987.
- [2] Davis, B. A., *et al.*, 2014. MPCV Window Impact Study, NASA, Test Plan – pre release.