

Introducing CRG's 3D Printable Thermal Insulation

Traditional Thermal Protection System (TPS) fabrication is labor intensive, highly specialized, and size limited; and as such, is slow, expensive, and complex. CRG has combined the value of automated processing with benefits of high-temperature materials that are capable of enduring the extreme environments of atmospheric entry. This solution supports manned missions to Mars as well as re-entry to Earth from low-earth orbit (LEO). CRG's automated, high-temperature alternative to traditional TPS fabrication reduces labor needs, cost, and touch-time.

Using unique AM techniques and materials, CRG's 3D printable thermal insulation offers enhanced performance, faster and simpler production, and increased tailorability compared to traditional TMS fabrication.



Automated Processing

By reducing labor intensive tasks using additive manufacturing, material can be produced more rapidly



Simpler Construction

By achieving complex geometries, this technology decreases subsystem complexity and reduces build times



Tailorable Formulation

Tunable performance design allows the customer to achieve a material amongst various properties and configurations



Complex Geometries

AM allows for the fabrication of complex geometries not typically achievable via traditional fabrication methods



Improved Quality

Using an automated fabrication process, variability in TPS properties are reduced, increasing part QC



Improved Material Properties

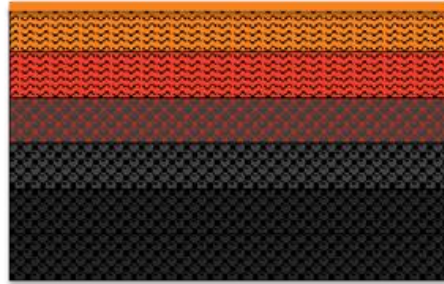
CRG's insulation material offers low thermal conductivity, density, and CTE along with high glass transition temperatures and char yields

Enabling Low-Cost, High Quality TPS

via automated and tailorable additive manufacturing techniques



Automated Additive
Fabrication



Heterogeneous Heat
Shields



Tailored, Conformable
Thermal Insulation

Example Properties

Density:	$< 0.7 \frac{g}{cc}$
Room Temperature Thermal Conductivity:	$< 0.2 \frac{W}{mK}$
CTE:	$< 14 \cdot 10^{-6} / ^\circ F$
Tg:	$> 300^\circ C$
Char Yield:	$> 80\%$

3D Printable Thermal Insulation Status:

Technology Readiness Level: 1 2 3 4 5 6 7 8 9

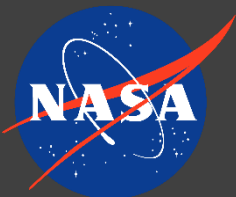
Manufacturing Readiness Level: 1 2 3 4 5 6 7 8 9 10

Accomplishments:

Developed and demonstrated formulation for heat shield insulation

Developed and demonstrated additive manufacturing processes

Cure cycle refined for 3D printed thick structures



Interested in CRG's thermal insulation materials?
Contact us at sales@crgrp.com



Patented Technology – www.crgrp.com/patents/