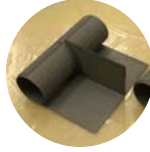
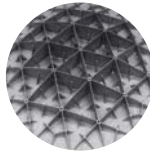


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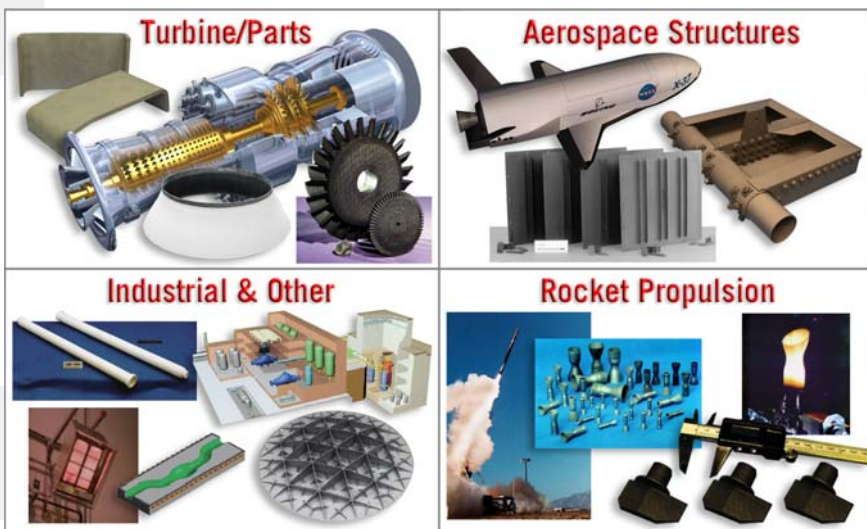
# Composites



### CMC Material Systems & Applications

MATERIAL	MI SIC/SIC	CESIC® MI C/SIC	CVI C/SCIC NOVOLTEX	CVI C/SIC (T300)
<b>Primary Application</b>	Turbine Engine Hot Section	Optics Components Instrument Structures Severe Environment Structures	Rocket Propulsion Hot Gas Path	RLV/SOV Airframe
<b>Typical Components</b>	<ul style="list-style-type: none"> <li>Vanes</li> <li>Blades</li> <li>Shrouds</li> <li>Liners</li> </ul>	<ul style="list-style-type: none"> <li>Light-weight IM Mirrors</li> <li>Optical Benches &amp; Structures</li> <li>Heat Exchangers</li> <li>Hi-Temp Hi Corrosion Structures</li> </ul>	<ul style="list-style-type: none"> <li>Hot Gas Valves</li> <li>Exit Nozzles</li> </ul>	<ul style="list-style-type: none"> <li>Control Surfaces</li> <li>TPS Panels</li> </ul>
<b>Temperature</b>	2200-2400F	Cryogenic to 2500F	3500-4500F	2800-3000F
<b>Life Requirements</b>	10,000+ hrs.	Unlimited for Optics	10-1000 sec	100+ hrs.
<b>Density</b>	175 lb/ft³	165 lb/ft³	135 lb/ft³	135 lb/ft³
<b>Benefits</b>	<ul style="list-style-type: none"> <li>Temperature Capability &gt; Super Alloys</li> <li>Lightweight</li> <li>Thermally Conductive</li> </ul>	<ul style="list-style-type: none"> <li>High Stiffness</li> <li>Low Weight</li> <li>Low CTE from Cyro to Room Temp</li> <li>Thermally &amp; Electrically Conductive</li> <li>Complex Shapes</li> <li>Low Cost &amp; Short Cycles</li> </ul>	<ul style="list-style-type: none"> <li>Erosion Resistant</li> <li>Weight Savings</li> <li>Complex Features</li> </ul>	<ul style="list-style-type: none"> <li>High Specific Strength</li> <li>High Stiffness</li> </ul>

Materials For A Wide Range Of Extreme Environments



### CMC Material Properties - MI Products

Property	Unit	Melt Infiltration (HiPerComp™)					
		PP-HN		SC-HN		SC-Sylramic	
		73°F	2200°F	73°F	2200°F	73°F	2200°F
In-plane Ultimate Tensile Strength (UTS)	ksi	48	33	52	39		45
Strain at Failure	%	0.9	0.3	0.7	0.5		0.5
In-plane Proportional Limit Strength	ksi	26	24	17	19		24
In-plane Tensile Modulus	Msi	41	35	28	21		26
Interlaminar Tensile Strength	ksi	6					
Interlaminar Shear Strength	ksi	20	18				7 (1500°F)
In-plane Thermal Conductivity	BTU/h-ft-°F	18	8	17	(6)		
Through-thickness Thermal Conductivity	BTU/h-ft-°F	13	7	10	(5)		
In-plane Thermal Expansion Coefficient	10 <sup>-6</sup> /°F	2.3	2.3	2.1	2.9		
Through-thickness Thermal Expansion Coefficient	10 <sup>-6</sup> /°F	2.3	2.3	1.7	1.5		
Density	g/cm³	2.8		2.7			2.8

### CMC Material Properties - CVI Products

Property	Unit	Chemical Vapor Infiltration					
		Novoltex		T-300		T-300, HT	
		73°F	2200°F	73°F	2200°F	73°F	2200°F
In-plane Ultimate Tensile Strength (UTS)	ksi	11	14	73	79	60	47
Strain at Failure	%	0.6		1.1	1.1	0.8	0.4
In-plane Tensile Modulus	Msi	11	10	10	17	12	21
Interlaminar Tensile Strength	ksi	8 (z direction)		2			
Interlaminar Shear Strength	ksi			5		4	
In-plane Thermal Conductivity	BTU/h-ft-°F	21	(12)				
Through-thickness Thermal Conductivity	BTU/h-ft-°F	18 (z direction)	(10) (z direction)	11	12 (570°F)		
In-plane Thermal Expansion Coefficient	10 <sup>-6</sup> /°F	2.0	(2.4)				
Through-thickness Thermal Expansion Coefficient	10 <sup>-6</sup> /°F	1.2 (z direction)	(2.2) (z direction)				
Density	g/cm³	>2.0		2.1		2.1	

The CMC material properties expressed herein are preliminary estimates based on technical data considered reliable by GE Energy. Such material property information is intended for persons having technical skill in CMC or related technologies and is provided without charge or obligation. Any use of the information is at the user's own risk and discretion. GE Energy makes no warranties, either express or implied, and assumes no liabilities in connection with any use of this information or with the long-term availability of the specific CMC materials described herein. Nothing herein shall be taken as an offer to license or a recommendation to infringe the intellectual property rights of others.

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