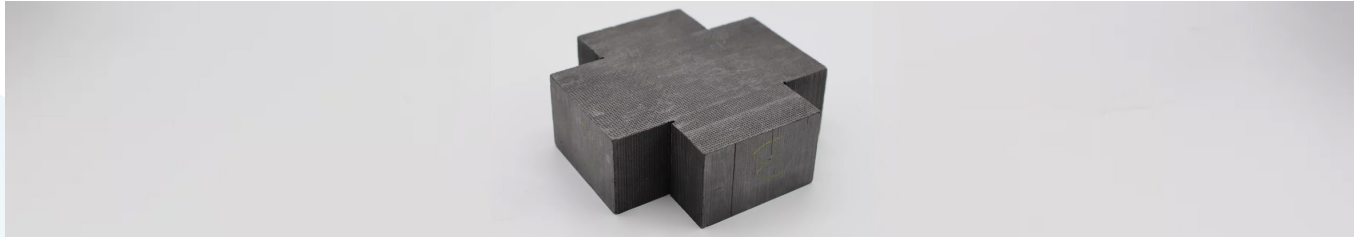


# 5D CARBON CARBON C/C (5DHZPF)



## QUICK SUMMARY

5D Carbon/Carbon (C/C) composites provide enhanced and tailorable ablative and mechanical performance compared to 3D C/C

- > For extended glide hypersonic vehicles, 5D C/C composites enhance load-bearing and structural capabilities

To meet domestic needs for current and future hypersonic programs, Textron Systems has created and demonstrated five-directionally (5D) reinforced C/C composites, named 5DHZPF, control surface applications. 5D C/C composites improve vehicle trade-offs and ultimate system effectiveness. C/C composites are critical structural materials. While orthogonally reinforced 3D C/C has typically been used in areas exposed to high heat, such as nose tips and leading edges, existing materials severely limit the range of design options on extended glide hypersonic vehicles. These extended-range hypersonic vehicles require greatly reduced (and preferably no) ablation for successful navigation of their complex trajectories. In comparison, earlier reentry vehicles required initial ablation to improve vehicle stability.

The tailorable weaving patterns and composite intermediate sized structures in 5D C/C relieve many of the design restrictions introduced when using 3D C/C, including load-bearing and structural limitations. Finally, 5D C/C fabricated billets use commercially available and well-characterized raw materials with established, low-cost manufacturing techniques, enabling cost-effective production at scale.

Mechanical	3D C/C			5D C/C		
	X≈Y	Z	45	X≈Y	Z	45
Tensile Strength, $\sigma$ (MPa)	226	172	34	128	172	128
Tensile Modulus, E (GPa)	83	71	10	48	69	48
Compressive Strength (MPa)	136	117	62	101	114	101
Compressive Modulus (GPa)	85	66	14	59	62	59

Additional information available