

NexGen

High Precision Tools

Composite Machining



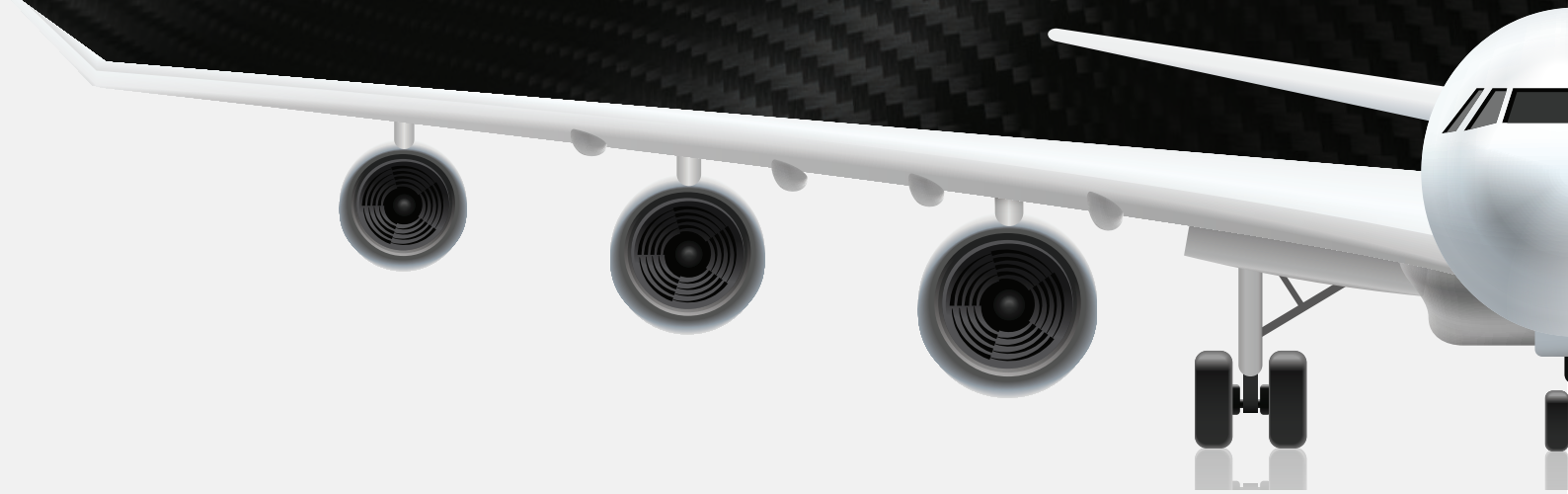
**Engineered for Precision
Built for Composites**



Challenges while Machining Composite Material

Machining composites presents several significant challenges, including delamination, uncut fibers, fiber tear-outs, uneven tool wear, and poor surface finish. These issues arise from the unique properties of composite materials, which behave differently under machining forces compared to traditional metals. The layered structure of composites, especially in materials like Carbon-Fiber Reinforced Plastics (CFRP) and Metal Matrix Composites (MMC), leads to variations in hardness, thermal expansion, and fiber orientation, all of which contribute to the difficulty in achieving smooth, precise surfaces. Without the proper tooling and techniques, these materials are prone to defects that can compromise both structural integrity and aesthetic quality, further underscoring the need for specialized machining solutions tailored to these advanced materials.

High Cutting forces | Abrasive Materials | Machined surface quality | Dimensional stability



AXIS offers State-of-the-Art Milling and Drilling solutions specifically engineered for the precise machining of complex materials such as Carbon-Fiber Reinforced Plastics (CFRP) and Metal Matrix Composites (MMC). With the increasing utilization of composites, particularly carbon fibers, due to their exceptional strength-to-weight ratio, thermal stability, and corrosion resistance, AXIS advanced tooling solutions ensure superior performance while minimizing tool wear, delamination, and potential material damage. These solutions are ideally suited for industries where precision and material integrity are critical, including Aerospace, Automotive and high-performance manufacturing sectors.



Features and Benefits

Nano Crystalline Diamond Structure
Improved surface roughness for better chip evacuation

Precisely Controlled Dimensions
Better process capability



Optimised Geometry
Eliminate delamination and uncut fibers

NexGen Coatings
Reduced Tool wear

CFRP Applications

Aerospace



Renewable Energy



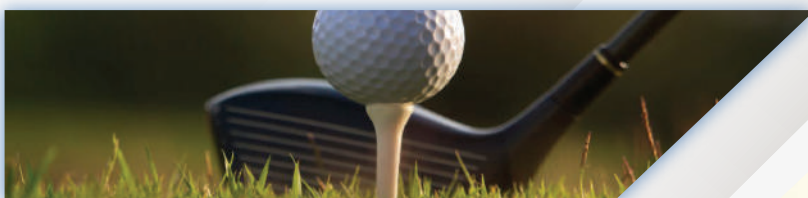
Automotive



Defence



Sports Goods



Yacht



Tools for Composite Machining

Article	Tool Drawing		Series	Dia Range (mm)	Helix
P0661D			CFRP Chip Breaker Router	3.00 - 20.00	St. Helix Right Cut
P0681D			CFRP Chip Breaker Router	3.00 - 20.00	Right Helix Right Cut
P0671D			CFRP Chip Breaker Router	3.00 - 20.00	Left Helix Right Cut
P0901D			CFRP Diamond Cut Router Drill End	2.00 - 20.00	Right Helix Right Cut
P0401D			CFRP Diamond Cut Router Drill End	2.00 - 20.00	Left Helix Right Cut
P0801D			CFRP Diamond Cut Router Safe End	2.00 - 20.00	Right Helix Right Cut
P0501D			CFRP Diamond Cut Router Safe End	2.00 - 20.00	Left Helix Right Cut
P1011D			CFRP Diamond Cut Router Burr End	2.00 - 20.00	Right Helix Right Cut
P1021D			CFRP Diamond Cut Router Burr End	2.00 - 20.00	Left Helix Right Cut
P0701D			CFRP Diamond Cut Router Ball End	2.00 - 20.00	Right Helix Right Cut
P0711D			CFRP Diamond Cut Router Ball End	2.00 - 20.00	Left Helix Right Cut
P0111D			CFRP Diamond Cut Router Flat End	2.00 - 20.00	Right Helix Right Cut
P0121D			CFRP Diamond Cut Router Flat End	2.00 - 20.00	Left Helix Right Cut
B9721D			CFRP 4F Ball Endmill	6.00 - 20.00	Right Helix Right Cut
E1171D			CFRP 4F Endmill with Corner Radius	6.00 - 20.00	Right Helix Right Cut
P1001D			CFRP Compression Router	6.00 - 20.00	Right Cutting

T660			INDrill CFRP	0.50 - 20.00	Right Helix Right Cut
T0311			Calibration Drill	2.00 - 20.00	Straight Helix Right Cut
T4991			Kevlar Drill	2.00 - 20.00	Right Helix Right Cut

Composite Type			Machining Operations						Machining Type	
CFRP	GFRP	Honey Comb	Slotting	Side Milling	Surface Milling	Profiling	Roughing	Finishing	Hand	CNC
●	●	◐	●	●	●	○	●	●	○	●
●	●	◐	●	●	●	○	●	●	○	●
●	●	◐	●	●	●	○	●	●	○	●
●	●	○	●	●	○	○	●	●	●	●
●	●	○	●	●	○	○	●	●	●	●
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●	●	○	◐	●	◐	○	●	●	●	●
●	●	○	◐	●	●	○	●	●	●	●
●	●	○	●	●	○	●	●	●	●	●
●	●	○	○	●	○	○	●	●	●	●
●	●	○	○	●	○	○	●	●	●	●
●	●	●	●	●	○	●	◐	●	○	●
●	●	●	●	●	○	◐	◐	●	○	●
●	◐	●	◐	●	◐	○	○	●	○	●

Composite Type				Machining Type	
CFRP	GFRP	Kevlar	Honey Comb	Hand	CNC
●	●	○	○	●	○
●	●	○	●	●	○
○	○	●	○	●	○



Description : ● Optimal ◐ Suitable ○ Not Suitable



NexGen CVD Diamond Coatings

CVD Diamond-coated tools offer several key benefits when machining Carbon-Fiber Reinforced Plastics (CFRP). The coating's exceptional hardness significantly extends tool life by resisting wear, even when cutting through abrasive carbon fibers.

This leads to smoother, more precise cuts by reducing issues like delamination and fiber pull-out, resulting in a superior surface finish. Additionally, diamond coatings help minimize heat buildup, preventing material damage and tool degradation.

With improved cutting efficiency and durability, diamond-coated tools support higher machining speeds and maintain consistent quality, making them ideal for handling challenging composite materials.



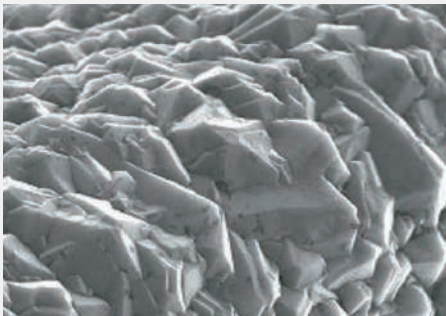
Features and Benefits

High hardness ~10,000 HV 0.05
Long tool life 5 - 20x

Reduce Friction
Smooth chip flow

High Heat Resistance
Improved process capability

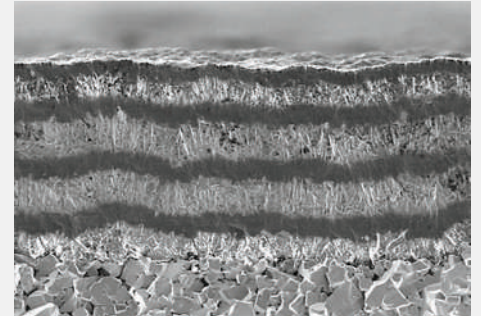
High Dimensional Accuracy
Increased feed rate



Microcrystalline Diamond Coating



Nano-Crystalline Diamond Coating



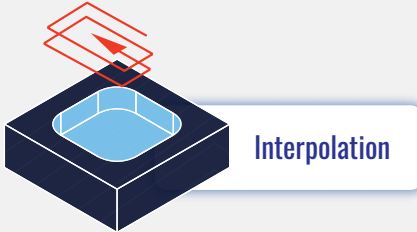
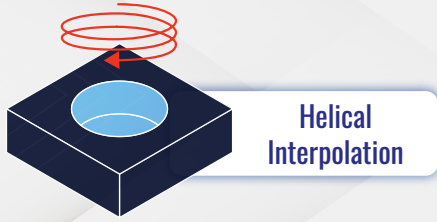
Multilayer Diamond Coating

In composite machining, the use of CVD diamond coatings significantly enhances tool performance and product quality. Composites like carbon fiber-reinforced polymers (CFRP) and glass fiber-reinforced polymers (GFRP) are extremely challenging to machine due to their abrasive fibers, which cause rapid wear on traditional carbide or high-speed steel tools. CVD diamond-coated tools excel in these demanding applications by offering superior wear resistance, drastically extending tool life and reducing the frequency of tool changes, which leads to less downtime and higher productivity.

Additionally, the low coefficient of friction of CVD diamond coatings reduces cutting forces, minimizing heat generation and preventing issues like material burning, fiber pullout, or delamination—common problems in composite machining. The thermal conductivity of diamond helps in maintaining lower cutting temperatures, which is critical for maintaining the integrity of temperature-sensitive composite materials. This also reduces the need for coolant in dry machining processes, making the operation more environmentally friendly and cost-effective. Overall, CVD diamond coatings ensure precise, high-quality machining of composites, improving the efficiency and economics of the manufacturing process.



Wide Range of CFRP Operations



Engineered for Precision, Built for Composites



NexGen
High Precision Tools

Composite Machining



AXIS
Tools for **m**ICRO **m**ACHINING



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