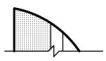
COATINGS & SUBSTRATES CHART

Coating/ Substrate:	TiN Titanium Nitride -C1	AlTiN Aluminum Titanium Nitride -C3	AlTiN Nano Aluminum Titanium Nitride Nano -C6	CBN Cubic Boron Nitride
Application/ Benefits:	• General purpose coating for machining ferrous materials.	• High performance coating in ferrous materials. • Excellent high temperature resistance and hardness. • Maintains high surface hardness at elevated temperatures improving tool life and allowing faster feed rates. • Produces aluminum oxide layer at high temperature which reduces thermal conductivity, transferring heat into the chip. • Excellent in dry machining, machining titanium alloys, inconel, stainless alloys and cast iron. • Not recommended for use in aluminum and aluminum alloys.	• Premium coating in ferrous materials. • Latest generation AlTiN coating mixed with silicon to produce a unique nanocomposite coating. This structure improves hardness, heat resistance, and toughness over traditional AlTiN coatings. • Superior results, extended tool life and reduced cycle times over traditional AlTiN coatings in demanding applications where setup minimizes runout and vibration. • Not recommended for use in aluminum and aluminum alloys.	• Solid CBN tipped endmills designed for finishing hardened steels 52Rc to 68Rc. • Use only in applications with light, consistent depth of cut. • Run at high RPM and feed rates. • CBN can withstand high temperatures and its hardness is second only to diamond.
Materials:	**Ferrous Materials & Exotic Metals**			
	General Purpose Ferrous Materials	Alloy steels, stainless steels, tool steels, titanium, inconel, nickel and other aerospace materials	Hardened steels, hardened stainless, nickel based alloys, tool steels, titanium alloys, inconel and other aerospace materials	Finishing hardened steels 52Rc to 68Rc
Color:	Gold	Dark Gray / Black	Blue / Black	Black
Structure:	Mono-layer	Multi-layer	Nano Composite Multi-layer	Solid Cubic Boron Nitride
Hardness (GPa):	21.7	35.5	45.0	65.0
Coefficient of Friction:	0.5	0.6	0.5	0.2
Coating Thickness (microns):	2 - 5	2 - 5	1 - 4	Solid CBN Tip
Max. Working Temp:	1000° F	1400° F	2100° F	2500° F

PLEASE NOTE: Information and test results were compiled from multiple sources and testing methods. Data presented is intended to be a general application guideline for comparing various coatings / substrates.

COATINGS & SUBSTRATES CHART

ZrN Zirconium Nitride -C7	**TiB_2** Titanium Diboride -C8	**Amorphous Diamond** Diamond-Like Coating -C4	**CVD Diamond** Crystalline CVD Diamond	**PCD Diamond** Polycrystalline Diamond
• High hardness, lubricity and abrasion resistance. • Improves performance over uncoated carbide in a wide variety of non-ferrous materials. • Less expensive alternative to diamond.	• Primary benefit over other non-ferrous coatings is extremely low affinity to aluminum. • Prevents build-up on cutting edge, chip packing and extends tool life. • Recommended in Aluminum Alloys and Magnesium Alloys. • Not ideally suited for abrasive varieties of these alloys.	• A PVD amorphous diamond coating which improves lubricity and wear resistance in non-ferrous materials. • Coating is thin relative to CVD diamond, preventing edge rounding. • Sharp edges improve results (performance and finish) over CVD in certain abrasive, non-ferrous materials (copper, brass, high silicon aluminum). • Low temperature threshold makes diamond unsuitable for ferrous applications.  Thin coating maintains sharper edge.	• True Crystalline CVD diamond is grown directly into a carbide end mill. • Dramatically improves hardness. • Hardness improves abrasion resistance and extends tool life up to 50x and allows higher feed rates than uncoated carbide. • Ideal for machining Graphite, Composites, Green Carbide, and Green Ceramics. • Diamond layer approx 5 times thicker than Amorphous Diamond, improving wear resistance. • Low temperature threshold makes diamond unsuitable for ferrous applications.  Thicker diamond layer for increased wear resistance.	• PCD diamond is manufactured as a carbide backed flat wafer. The wafer is brazed to a carbide body to form an end mill. • PCD has excellent hardness and abrasion resistance, and is the thickest diamond layer we offer. • Sharply ground cutting edges and thick diamond layer combine the sharp edge benefits of Amorphous Diamond with the abrasion resistance of CVD Diamond. • Low temperature threshold makes diamond unsuitable for ferrous applications.  Thickest diamond layer ground to sharp edge.
Non-Ferrous & Non-Metallic Materials				
Abrasive non-ferrous alloys such as Brass, Bronze, Copper and Abrasive Aluminum Alloys	Aluminum Alloys, Magnesium Alloys	Abrasive Plastics, Graphite, Carbon Fiber Materials, Composites, Aluminum, Copper, Brass, Bronze, Carbon, Gold, Silver, Magnesium, Zinc	Graphite, Composites, Green Carbide, Green Ceramics	Abrasive Plastics, Graphite, Carbon Fiber Materials,Composites, Aluminum, Copper, Brass, Bronze, Carbon, Gold, Silver, Magnesium, Zinc, Green Carbide, Green Ceramics
Light Gold / Champagne	Light Gray / Silver	Charcoal / Gray	Gray	Gray / Black
Mono-layer	Mono-layer	Mono-layer	True Crystalline CVD Multi-Layer	Polycrystalline Diamond (Carbide Backed)
24.6	27.5	78 - 88	88 - 98	88 - 98
0.5	0.45	0.1	.05 - .3	.05 - .2
2 - 5	1 - 3	.5 - 2.5	8 - 10	.010" - .030" Solid PCD Layer
1100° F	900° F	750° F	1100° F	1100° F

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