



GR Series: D2 CVD Diamond coated fractional end mills

High strength, high hardness solid carbide end mills for graphite & abrasive materials featuring extended LOC's and proprietary CVD diamond coating for long-run setups.



- Designed for graphite and abrasive non-metals
- Proprietary cemented carbide grade and D2 CVD diamond coating
- Our hardest, thickest, longest lasting diamond coating
- Maximum tool life and wear resistance for long production runs
- Tight diameter tolerances for CVD diamond
- Regular, Long (L), and Extra-Long (XL) lengths



Diam	LOC	OAL	Shank	2 flute Square D2 Coated		2 flute Ball D2 Coated		4 flute Square D2 Coated		4 flute Ball D2 Coated	
				EDP#	Price	EDP#	Price	EDP#	Price	EDP#	Price
.015	.075	1-1/2	1/8	10770	\$58.00	10782	\$60.00	12376	\$58.00	12377	\$60.00
.020	.100	1-1/2	1/8	10771	\$58.00	10783	\$60.00	12240	\$58.00	12242	\$60.00
.031	.155	1-1/2	1/8	10772	\$49.00	10784	\$51.00	10796	\$49.00	10808	\$51.00
1/32L	1/16	2"	1/8	00704	\$49.00	00706	\$51.00	12061	\$49.00	12089	\$51.00
1/32XL	1/4	2"	1/8	00705	\$53.00	00707	\$55.00	12063	\$53.00	12091	\$55.00
3/64	15/64	1-1/2	1/8	10773	\$45.00	10785	\$47.00	10797	\$45.00	10809	\$47.00
1/16	5/16	1-1/2	1/8	10774	\$45.00	10786	\$47.00	10798	\$45.00	10810	\$47.00
1/16L	1/4	2"	1/8	12062	\$48.00	12086	\$50.00	12065	\$48.00	12093	\$50.00
1/16XL	1/2	2"	1/8	12064	\$53.00	12088	\$55.00	12067	\$53.00	12095	\$55.00
5/64	25/64	1-1/2	1/8	12203	\$44.00	12217	\$46.00	12210	\$44.00	12225	\$46.00
3/32	15/32	1-1/2	1/8	10775	\$44.00	10787	\$46.00	10799	\$44.00	10811	\$46.00
7/64	35/64	1-1/2	1/8	12204	\$44.00	12218	\$46.00	12211	\$44.00	12226	\$46.00
1/8	5/8	1-1/2	1/8	10776	\$43.00	10788	\$45.00	10800	\$43.00	10812	\$45.00
1/8L	1/2	3"	1/8	12066	\$49.00	12090	\$51.00	12069	\$49.00	12097	\$51.00
1/8XL	1"	4"	1/8	12068	\$58.00	12092	\$60.00	12071	\$58.00	12099	\$60.00
9/64	45/64	2"	3/16	12205	\$66.50	12219	\$68.50	12212	\$66.50	12227	\$68.50
5/32	3/4	2"	3/16	12206	\$66.50	12220	\$68.50	12213	\$66.50	12228	\$68.50
11/64	3/4	2"	3/16	12207	\$66.50	12221	\$68.50	12214	\$66.50	12229	\$68.50
3/16	3/4	2"	3/16	10777	\$66.50	10789	\$68.50	10801	\$66.50	10813	\$68.50
3/16L	3/4	3"	3/16	12070	\$72.50	12094	\$74.50	12073	\$72.50	12101	\$74.50
3/16XL	1-3/8	4"	3/16	12072	\$83.50	12096	\$85.50	12075	\$83.50	12103	\$85.50
7/32	1"	2-1/2	1/4	12208	\$88.50	12223	\$91.50	12215	\$88.50	12230	\$91.50
1/4	1"	2-1/2	1/4	10778	\$88.50	10790	\$91.50	10802	\$88.50	10814	\$91.50
1/4L	1"	4"	1/4	12074	\$97.50	12098	\$100.50	12077	\$97.50	12105	\$100.50
1/4XL	1-1/2	6"	1/4	12076	\$148.50	12100	\$151.50	12079	\$148.50	12107	\$151.50
5/16	1"	2-1/2	5/16	10779	\$115.00	10791	\$119.00	10803	\$115.00	10815	\$119.00
3/8	1"	2-1/2	3/8	10780	\$146.50	10792	\$151.50	10804	\$146.50	10816	\$151.50
3/8L	1-3/8	4"	3/8	12078	\$164.50	12102	\$169.50	12081	\$164.50	12109	\$169.50
3/8XL	2"	6"	3/8	12080	\$247.00	12104	\$252.00	12083	\$247.00	12111	\$252.00
7/16	1"	3"	7/16	12209	\$178.50	12224	\$186.50	12216	\$178.50	12231	\$186.50
1/2	1-1/4	3"	1/2	10781	\$196.00	10793	\$204.00	10805	\$196.00	10817	\$204.00
1/2L	1-3/8	4"	1/2	11745	\$208.00	11746	\$216.00	11747	\$208.00	11748	\$216.00
1/2XL	2"	6"	1/2	12084	\$305.00	12108	\$313.00	12087	\$305.00	12115	\$313.00
5/8	1-3/8	3-1/2	5/8	12364	\$272.00	12367	\$282.00	12370	\$272.00	12373	\$282.00
3/4	1-3/8	4"	3/4	12365	\$358.00	12368	\$370.00	12371	\$358.00	12374	\$370.00
1"	1-3/8	4"	1"	12366	\$730.00	12369	\$745.00	12372	\$730.00	12375	\$745.00



SFR 35% tighter shank tolerance than h6!
Shrink-Fit Ready!



Specs (micro end mills cut diameter < 1/8" w/ D2 coat):
Cutting Diam +.0005 / -.001
Shank Diam +.0000 / -.0002
Radius ± .00075
SFR = Shrink Fit Ready



Specs (fractional end mills cut diameter ≥ 1/8" w/ D2 coat):
Cutting Diam +.0000 / -.0020
Shank Diam +.0000 / -.00025
Radius ± .0010
SFR = Shrink Fit Ready

Technical Data: GR Diamond Coated Series / D1 & D2

Speeds and Feeds for milling graphite and abrasive materials.

Use maximum spindle RPM to achieve up to 3000 SFPM.

- D1 & D2 coated GR Series will likely utilize your maximum possible spindle speed
- For reference, the chart below displays your achievable SFPM based upon your machining center
- Tool life should be 10-50 times that of uncoated carbide with improved accuracy and finish
- Long life allows unattended machining and part completion without tooling change
- Premium carbide substrate and special material preparation increases coating adhesion

Diam mm	100 SFPM	250 SFPM	500 SFPM	3000 SFPM	Roughing Feed Rate CPT	Finishing Feed Rate CPT	Roughing Feed mm per tooth	Finishing Feed mm per tooth
	30 M/min	75 M/min	150 M/min	900 M/min				
1/64 0.4	24000	60000	max rpm	max rpm	.0002 - .0005	.0002 - .0003	0.005 - 0.013	0.005 - 0.008
1/32 0.8	12000	30000	60000	max rpm	.0005 - .001	.0003 - .0006	0.013 - 0.025	0.008 - 0.015
1/16 1.5	6100	15300	30500	max rpm	.0008 - .002	.0005 - .0013	0.203 - 0.051	0.013 - 0.033
3/32 2.5	4100	10200	20400	max rpm	.001 - .0022	.0008 - .0015	0.025 - 0.056	0.020 - 0.038
1/8 3.0	3050	7640	15300	max rpm	.001 - .0025	.001 - .002	0.025 - 0.064	0.025 - 0.051
3/16 4.5	2050	5100	10200	61000	.002 - .0035	.001 - .0025	0.051 - 0.090	0.025 - 0.064
1/4 6.0	1500	3820	7640	45800	.0025 - .0045	.001 - .0035	0.064 - 0.114	0.025 - 0.090
5/16 8.0	1220	3050	6120	36700	.003 - .005	.001 - .004	0.076 - 0.127	0.025 - 0.102
3/8 10.0	1020	2550	5100	30500	.003 - .006	.001 - .004	0.076 - 0.152	0.025 - 0.102
7/16 11.0	875	2200	4365	26200	.004 - .008	.001 - .005	0.102 - 0.203	0.025 - 0.127
1/2 12.0	765	1900	3820	23000	.005 - .012	.001 - .006	0.127 - 0.305	0.025 - 0.152

Metric dimensions and recommendations displayed in blue type. M/min = surface meters per minute. SFPM = surface feet per minute. Feed rates displayed in chip load per tooth.

Typical Applications for D1 & D2 Diamond:

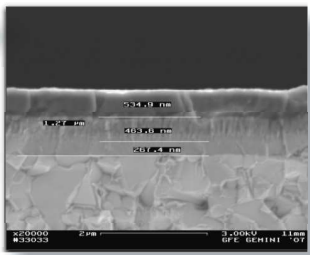
- Graphites • Aluminum-Silicon Alloys • Carbon Fiber Composites • Plastics • Green Ceramics
- Copper Alloys • Brass Magnesium • Hard Carbons • Fiberglass • High Silicon Aluminum
- Composite CFRP's • Metal Matrix Composites • Wood Composites
- Delrin • Kevlar • PEEK • Glass-Filled Composites



About our D1 & D2 Diamond Coatings:

RoundTool Laboratories Diamond Coated End Mill Series are a perfect match on graphite molds for EDM. Our D1 and D2 coatings offer industry leading wear resistance when subjected to the abrasive properties of EDM graphite parts. RoundTool offers two versions of diamond; D1 is a PVD applied diamond while our D2 is a CVD application. Supporting both Series is a carbide end mill specially designed and manufactured with graphite milling in mind. While other companies simply coat standard off-the-shelf end mills, the GR-D1 and GR-D2 represent customized engineering featuring higher helix & heavier core, which in turn offer freer cutting and less deflection. These two series have also achieved great success in other applications featuring highly abrasive materials.

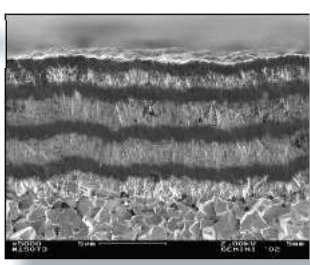
SmoothCoat®



SmoothCoat® D1: RoundTool Lab's new generation of D1 raises the bar on PVD diamond coatings. D1 PVD Diamond is a smooth amorphous diamond coating that also maintains an extremely upsharp cutting edge. D1 offers the highest value proposition in a large majority of applications. Short, medium, and long running jobs all benefit from D1's unique attributes, and small diameter end mills particularly are complimented by the smooth & thin coating structure. These end mills will produce the finest finish and most accurate cut of our diamond selection. D1 end mills also have a quick turnaround time with our in-house coating facility.

Type: PVD Color: Shiny Black Thickness per side: 1.75 - 2.5 microns

SmoothCoat®



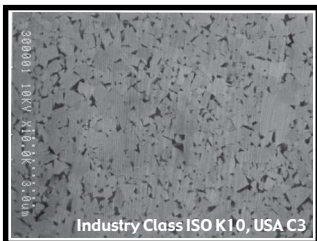
SmoothCoat® D2: RoundTool Lab's new generation of D2 is a "grown on" CVD diamond coating that offers the highest wear resistance in machining graphite and abrasive non-metals. Tool life can be increased by up to 50x that of standard uncoated carbide end mills. With long tool life and minimal wear, D2 coated end mills improve part accuracy and workpiece tolerance levels. D2 end mills have a longer lead time due to the amount of time spent in the coating vessel physically growing the diamond crystalline structure.

Type: CVD Color: Flat Dark Grey Thickness per side: 4-6 microns

1 **ULTRA-Grain®**

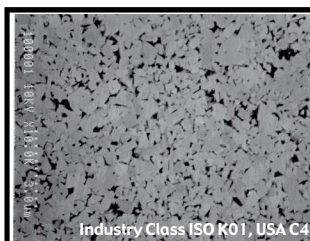
Components of Guaranteed Quality

COMPONENT #1: Carbide Substrate From being the first Company to introduce MicroGrain carbide to the mass-market round tool industry through the present day, Tool Alliance® has consistently innovated new powder and grade combinations for demanding applications. We recognize that our material is the very first Significant Characteristic. By creating partnerships with a limited number of tungsten powder and cemented-carbide material suppliers, we are able to guarantee that our customers receive precision-tolerance tools ground from only the purest, finest grades available worldwide. The following photographs of Ultra-Carb® 1 and Ultra-Grain® 2 respectively demonstrate the complexity of the compound we commonly refer to as Cemented Carbide. Taken at magnification of 10,000 X through an SEM (Scanning Electron Microscope), the visible grains are tungsten while the cobalt binder appears as dark shadows. The largest tungsten grains appearing in the Ultra-Carb photo are less than one micron in size. Note that these grades are two samples representing more than a dozen different substrates we use throughout our product lines, each having a particular application niche. Compared to other industry participants, you will find that Tool Alliance offers the best month-to-month and year-to-year consistency in carbide grain structure.



Ultra-Carb® 1
Cobalt Percentage: 6%
Grain Size (µm): ≤ 0.8
Hardness: 93.5 HRa
Fracture Toughness (K1c): 6.6
TRS (GPa): 3.8
Density (gm/cc): 14.90

ULTRA-Carb®

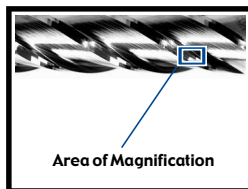


Ultra-Grain® 2
Cobalt Percentage: 8%
Grain Size (µm): ≤ 0.6
Hardness: 93.8 HRa
Fracture Toughness (K1c): 5.8
TRS (GPa): 4.0
Density (gm/cc): 14.6

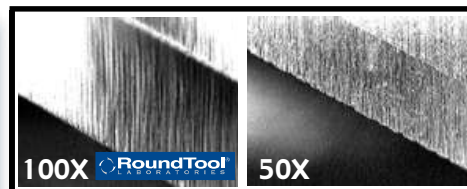
ULTRA-Grain®

2 **SmoothGrind®**

COMPONENT #2: The Grinding Process After selecting the best material available, Tool Alliance has perfected the manufacturing technology to optimize 100% of its physical properties. We call this process SmoothGrind®. Years in development, SmoothGrind is the result of a proprietary combination of material, abrasive, coolant, machine-tool, software, and grinding method technologies that produce cutting tools with superior qualitative characteristics. Sharper and longer lasting cutting edges, enhanced work piece finishes, and improved lubricity are just some of the benefits brought to you by the latest solid carbide rotary tooling advances from Tool Alliance. The following photographs display a RoundTool end mill primary relief featuring SmoothGrind (left) versus a major competitor's product (right). To fully demonstrate the difference, the RoundTool end mill is shown at double the magnification. Note the straight line of our end mill's primary relief in comparison to the jagged edge of the competing product. Keep in mind the competitive end mill is a very good product that has a large following, yet the difference is substantial.



Area of Magnification



SmoothGrind® Competitor's

3 **SmoothContricity®**

SFR 35% tighter shank tolerance than h6!



Shrink Fit Ready



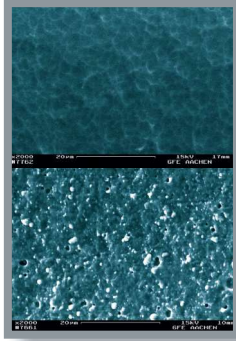
COMPONENT #3: The Tooling Process All the best physical ingredients are wasted unless they are pulled together in a comprehensive system that maximizes their respective attributes. Tool Alliance calls this process SmoothContricity®. Our customer base represents the leading edge of machine tool utilization, and SmoothContricity ensures that optimum results are obtained using qualitative features; minimal run-out (TIR), industry-leading tolerances on diameter & radius, and 100% Shrink Fit Ready (SFR) shanks. Combined, these attributes allow our consumers to reach full machining potential and position the cutting tool as a systematic contributor to process consistency and repeatability.

4 **SmoothEdge®**



COMPONENT #4: The Edge Preparation Process

Our cutting edges are literally too sharp for certain materials. For our carbide inserts and now increasingly for our solid carbide round tools, proper edge preparation can yield huge productivity improvements to "out of the box" tool application. Using a treatment we call SmoothEdge® and performed on machine tools developed in our own R&D lab, we've taken the mystery out of tool "break-in" and provided a consistency that can be counted on time and again. The process ranges from SmoothEdge 1, a micro-blasting treatment using extremely fine aluminum oxide powder (this procedure is standard with any non-micro coated product) to SmoothEdge 5, which adds a double cycle of honing & lubricity treatments. All five will sound and run smooth from the first cut and protect your tooling investment from unnecessary potential for chipping during your initial tooling paths. Big productivity gains can be achieved in certain applications as well due to improved chip formation and evacuation. Learn more about SmoothEdge at toolalliance.com.



Our coating @ 2,000X (top).
Everybody else's (bottom).

SmoothCoat® 5

COMPONENT #5: The Coating Process The challenge of finding a coating method to leverage 100% of the inherent assets of our carbide grade and grinding technologies was difficult. What we finally discovered was such a perfect fit and so logical for our product lines that we invested heavily into the process we now call SmoothCoat®. Much more than simply the standard arc-deposited PVD coating, SmoothCoat involves sputter multi-layering and a multi-step prep & post operation called Micro-Blasting. The advantages of this procedure include relieving of tensile stresses underneath the cutting edge, increased stability of the coating surface, and perhaps most importantly, elevating SmoothGrind even another notch by leveling and activating the cemented carbide substrate. The result is a smooth, shiny, tough, and durable surface that can withstand tomorrow's machining requirements and outlast competitive coatings. Additionally, we've made it a standard feature on thousands of our standard catalog items. Our coating services are performed within our own factories for quality & extremely quick turnaround times.

RoundTool Lab's Standard Coating Availability Coating selection usually included within the EDP but for indicated Series it is added as a suffix to the EDP#.

Other Tool Alliance coatings:



Uncoated



AlTiN HSN²



TiB₂



TiCN

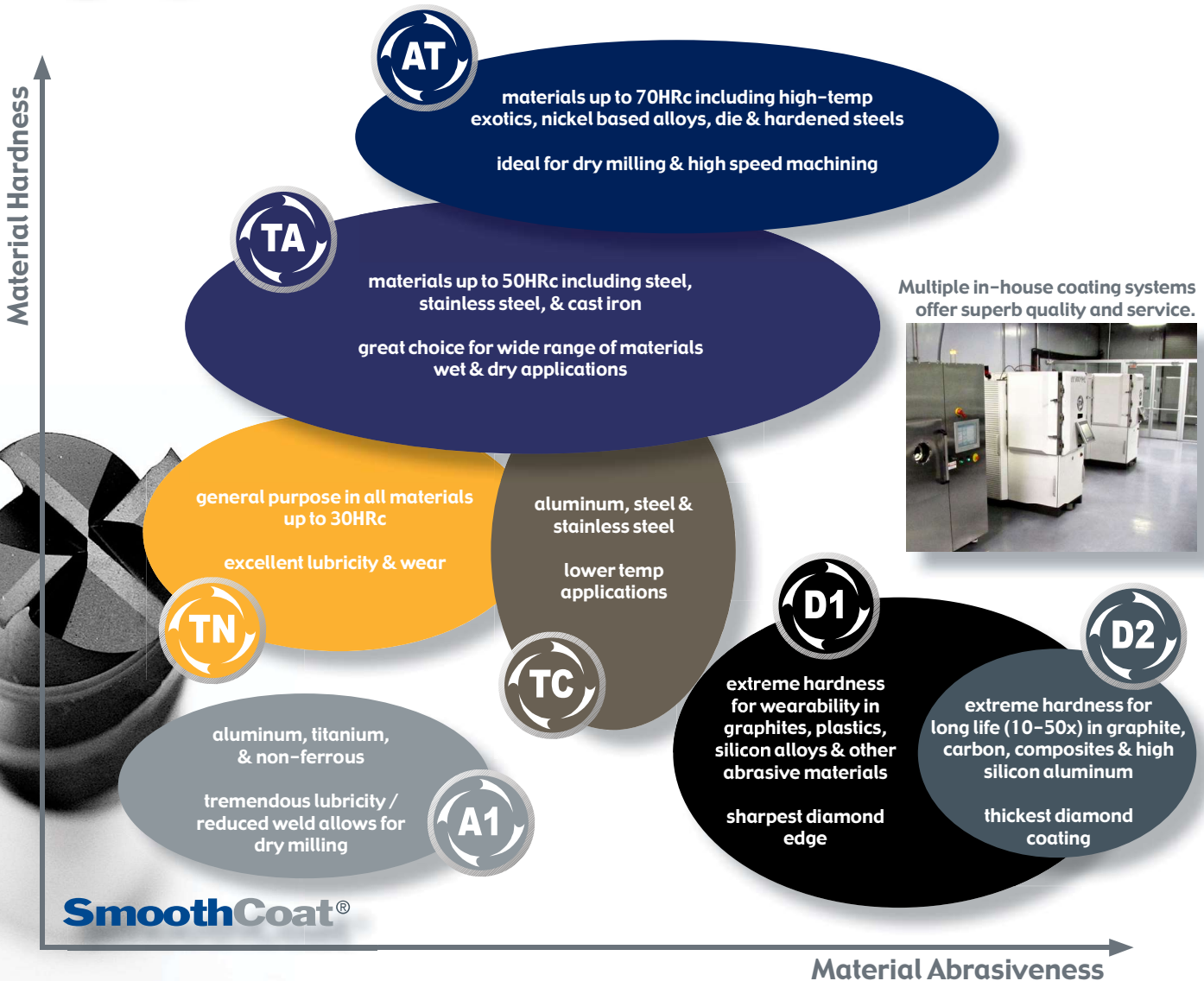


PVD Diamond



CVD Diamond

Standard Coatings available at respective "Coated" List Price



SmoothCoat®

Material Abrasiveness