

new! GRER & GRERN Series: Extended Reach 4 flute micro end mills

High strength and hardness, 3" extra-long solid carbide end mills featuring LOC = 5X diameter & available standard neck clearance (GRERN).

1/8" shank



- Designed for machining electrodes & other reach applications • 3" OAL
- Proprietary cemented carbide grade & available AT, D1 or D2 coating
- Use D1 (PVD) or D2 (CVD) Diamond coating for graphite & abrasive non-metals
- Use AT coating for die steels and other hard metals
- Tight diameter tolerance of ± .0003 (except for D2 coated +.0005/- .001)
- "N" designates inclusion of extended clearance neck (GRERN)

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



Diam	LOC	LBS	OAL	Shank	GRER4UC 4 flute UnCoated			GRER4AT 4 flute AT Coated			GRER4D1 4 flute D1 Coated			GRER4D2 4 flute D2 Coated		
					Square EDP#	Ball EDP#	Price	Square EDP#	Ball EDP#	Price	Square EDP#	Ball EDP#	Price	Square EDP#	Ball EDP#	Price
.015	.075		3"	1/8	00127	00716	\$25.40	00672	00779	\$28.40	00015	00049	\$32.40	00813	00825	\$61.40
.015N	.075	.150	3"	1/8	00128	00717	\$31.80	00673	00780	\$34.80	00016	00050	\$38.80	00814	00826	\$67.80
.020	.100		3"	1/8	00129	00718	\$25.40	00674	00781	\$28.40	00017	00051	\$32.40	00815	00827	\$61.40
.020N	.100	.200	3"	1/8	00746	00719	\$31.80	00675	00782	\$34.80	00018	00052	\$38.80	00816	00828	\$67.80
.025	.125		3"	1/8	00747	00720	\$25.40	00676	00783	\$28.40	00019	00053	\$32.40	00817	00829	\$61.40
.025N	.125	.250	3"	1/8	00748	00721	\$31.80	00678	00784	\$34.80	00020	00054	\$38.80	00818	00830	\$67.80
.030	.150		3"	1/8	00749	00722	\$25.40	00679	00785	\$28.40	00021	00055	\$32.40	00819	00831	\$61.40
.030N	.150	.300	3"	1/8	00750	00723	\$31.80	00680	00786	\$34.80	00022	00056	\$38.80	00820	00832	\$67.80
.031	.155		3"	1/8	00751	00724	\$25.40	00681	00787	\$28.40	00023	00057	\$32.40	00821	00833	\$61.40
.031N	.155	.310	3"	1/8	00752	00725	\$31.80	00682	00788	\$34.80	00024	00058	\$38.80	00822	00834	\$67.80
.035	.175		3"	1/8	00753	00726	\$25.40	00683	00789	\$28.40	00025	00059	\$32.40	00823	00835	\$61.40
.035N	.175	.350	3"	1/8	00754	00727	\$31.80	00684	00790	\$34.80	00026	00060	\$38.80	00824	00836	\$67.80
.040	.200		3"	1/8	00755	00728	\$25.40	00685	00791	\$28.40	00027	00061	\$32.40	00825	00105	\$61.40
.040N	.200	.400	3"	1/8	00756	00729	\$31.80	00686	00792	\$34.80	00028	00062	\$38.80	00826	00106	\$67.80
.045	.225		3"	1/8	00757	00730	\$25.40	00687	00793	\$28.40	00029	00063	\$32.40	00827	00107	\$61.40
.045N	.225	.450	3"	1/8	00758	00731	\$31.80	00688	00794	\$34.80	00030	00064	\$38.80	00828	00108	\$67.80
.047	.235		3"	1/8	00759	00732	\$25.40	00689	00795	\$28.40	00031	00065	\$32.40	00829	00109	\$61.40
.047N	.235	.500	3"	1/8	00760	00733	\$31.80	00690	00796	\$34.80	00032	00066	\$38.80	00830	00110	\$67.80
.050	.250		3"	1/8	00761	00734	\$25.40	00691	00797	\$28.40	00033	00067	\$32.40	00831	00111	\$61.40
.050N	.250	.500	3"	1/8	00762	00735	\$31.80	00692	00798	\$34.80	00034	00068	\$38.80	00832	00112	\$67.80
.060	.300		3"	1/8	00763	00736	\$25.40	00693	00799	\$28.40	00035	00069	\$32.40	00833	00113	\$61.40
.060N	.300	1.0"	3"	1/8	00764	00737	\$31.80	00694	00800	\$34.80	00036	00070	\$38.80	00834	00114	\$67.80
.062	.310		3"	1/8	00765	00738	\$25.40	00695	00801	\$28.40	00037	00071	\$32.40	00835	00115	\$61.40
.062N	.310	1.0"	3"	1/8	00766	00739	\$31.80	00696	00802	\$34.80	00038	00072	\$38.80	00836	00116	\$67.80
.075	.375		3"	1/8	00767	00740	\$25.40	00697	00803	\$28.40	00039	00073	\$32.40	00837	00117	\$61.40
.075N	.375	1.0"	3"	1/8	00768	00741	\$31.80	00698	00804	\$34.80	00040	00074	\$38.80	00838	00118	\$67.80
.078	.390		3"	1/8	00769	00742	\$25.40	00699	00805	\$28.40	00041	00075	\$32.40	00839	00119	\$61.40
.078N	.390	1.0"	3"	1/8	00770	00743	\$31.80	00772	00806	\$34.80	00042	00076	\$38.80	00840	00120	\$67.80
.090	.450		3"	1/8	00771	00744	\$25.40	00773	00807	\$28.40	00043	00077	\$32.40	00841	00121	\$61.40
.090N	.450	1.0"	3"	1/8	00226	00745	\$31.80	00774	00808	\$34.80	00044	00078	\$38.80	00100	00122	\$67.80
.093	.465		3"	1/8	00227	00746	\$25.40	00775	00809	\$28.40	00045	00079	\$32.40	00101	00123	\$61.40
.093N	.465	1.25"	3"	1/8	00228	00747	\$31.80	00776	00810	\$34.80	00046	00080	\$38.80	00102	00124	\$67.80
.1245	.625		3"	1/8	00229	00748	\$25.40	00777	00811	\$28.40	00047	00081	\$32.40	00103	00125	\$61.40
.1245N	.625	1.5"	3"	1/8	00715	00745	\$31.80	00778	00812	\$34.80	00048	00082	\$38.80	00104	00126	\$67.80

Specs (micro end mills cutting diameter < 1/8"):
Cutting Diam +.0003 / -.0003
Shank Diam +.0000 / -.0002
Radius ± .00015
SFR = Shrink Fit Ready



HSM's New Best Friend



SmoothConcricity®

Maximized Tool Concentricity Exclusively by Tool Alliance®

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:

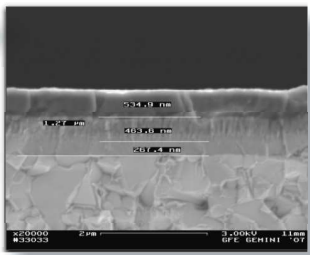
- Graphites • Aluminum-Silicon Alloys • Carbon Fiber Composites • Plastics • Green Ceramics
- Copper Alloys • Brass Magnesium • Hard Carbons • Fiberglass • High Silicon Aluminum
- Composite CFRP's • Metal Matrix Composites • Wood Composites
- Delrin • Kevlar • PEEK • Glass-Filled Composites



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.

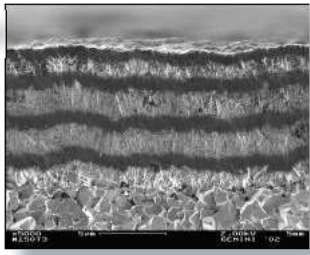
SmoothCoat®



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®



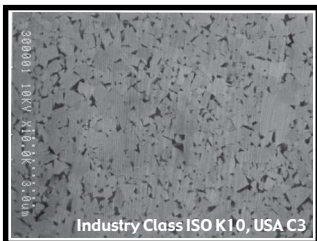
SmoothCoat® D2: RoundTool Lab's new generation of D2 is a "grown on" CVD diamond coating that offers the highest wear resistance in machining graphite and abrasive non-metals. Tool life can be increased by up to 50x that of standard uncoated carbide end mills. With long tool life and minimal wear, D2 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®**

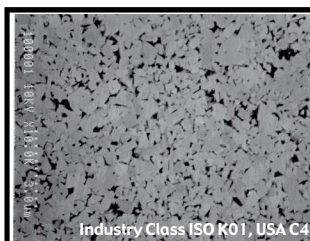
Components of Guaranteed Quality

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®

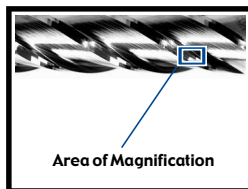


Ultra-Grain® 2
Cobalt Percentage: 8%
Grain Size (µm): ≤ 0.6
Hardness: 93.8 HRa
Fracture Toughness (K1c): 5.8
TRS (GPa): 4.0
Density (gm/cc): 14.6

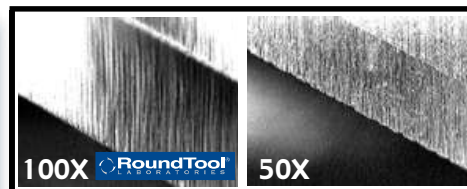
ULTRA-Grain®

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®**

35% tighter shank tolerance than h6!



Shrink Fit Ready



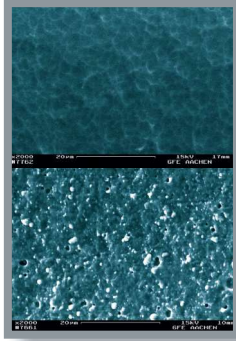
COMPONENT #3: The Tooling Process All the best physical ingredients are wasted unless they are pulled together in a comprehensive system that maximizes their respective attributes. Tool Alliance calls this process SmoothContricity®. Our customer base represents the leading edge of machine tool utilization, 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

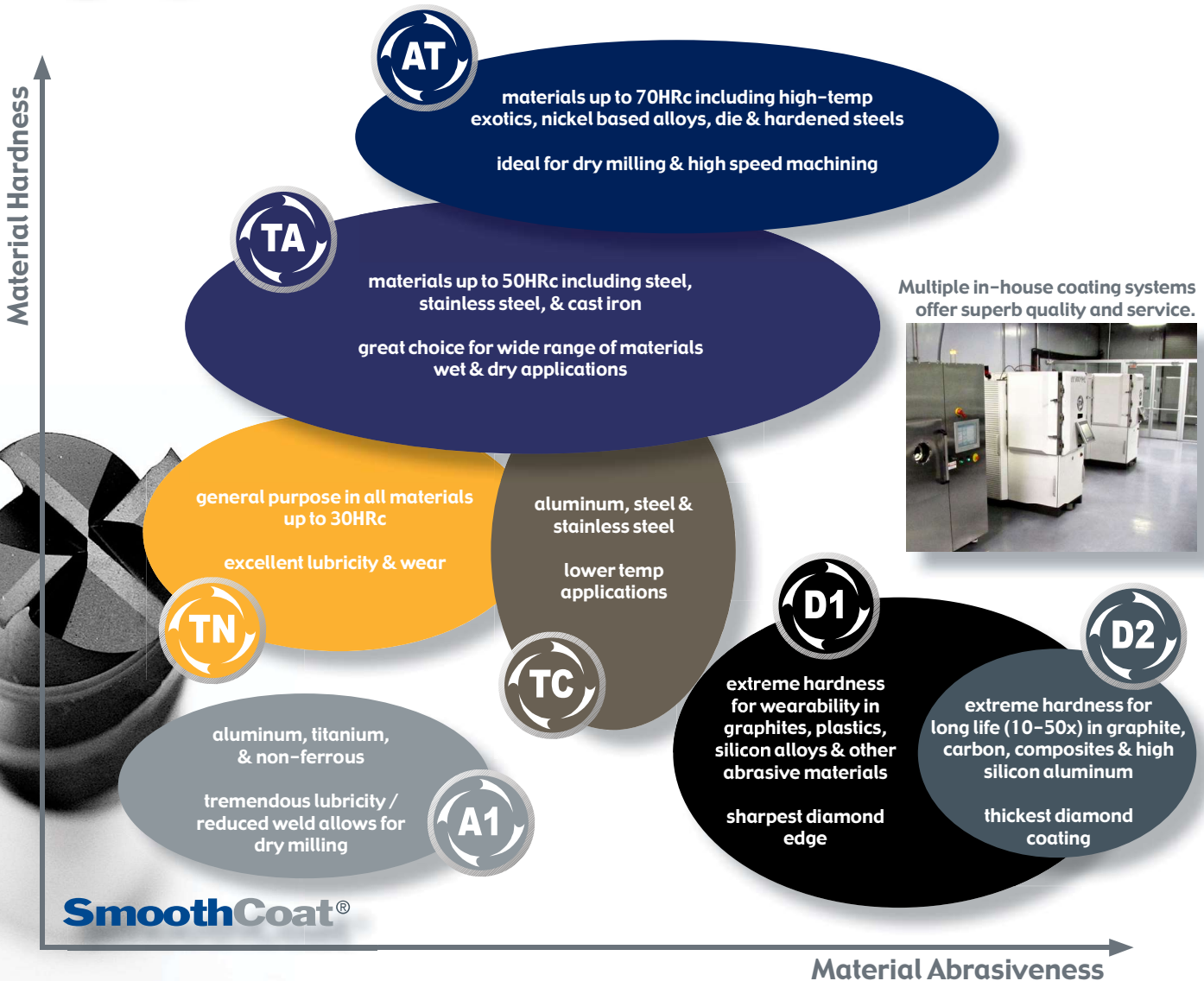


PVD Diamond



CVD Diamond

Standard Coatings available at respective "Coated" List Price



SmoothCoat®

Material Abrasiveness