AMERICAN MACHINIST
STRATEGIES AND INNOVATIONS FOR COMPETITIVE MANUFACTURING
March 2006

[cuttingtool digest]

Gaining an edge in insert performance

Conicity Technologies (www.conicity.com) of Cresco, Pa., a subsidiary of Weiler Corp., says its precision edge-preparation technology can be used as an alternative to chamfering for cubic boron nitride (CBN) and polycrystalline diamond (PCD) cutting tool inserts.

Chamfers were developed more than 20 years ago for these superhard tools to mitigate chipping. Typically these inserts are made with 20-degree T-lands, that produce 110-degree cutting edges on tools and bands along edges that are between 0.004 in. to 0.008-in. wide.

Bill Shaffer, executive vice president of Conicity, says these chamfers are a sub-optimal solution for tools because they limit tool life and diminish cutting performance and were developed before grinding wheel and effective edge-preparation technologies.

While he acknowledges that a chamfered tool has less of a propensity to chip, and thus, lasts longer, Shaffer says chamfering also introduces unintended consequences. Those tend to decrease tool performance and limit tool life.

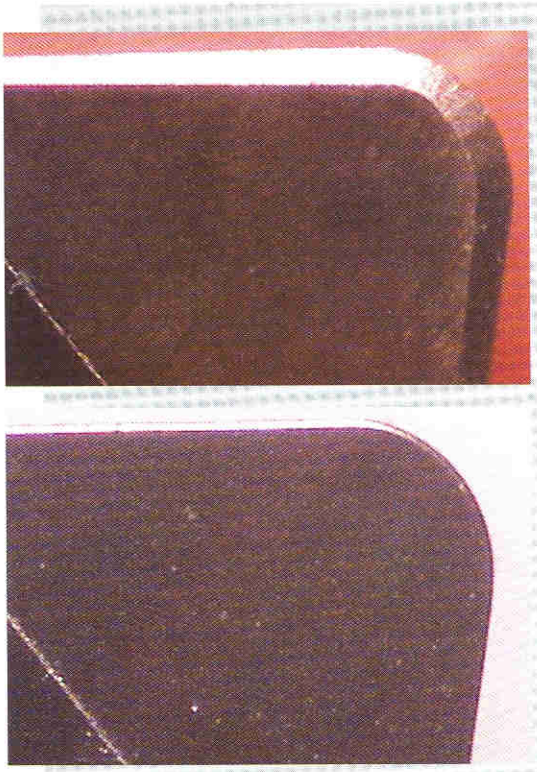
"The negative cutting surface created by the chamfer limits the natural chip flow, creating a pinching of the chips between the tool and workpiece. That action, coupled with the blunt cutting edge, significantly increases tool pressure and heat," Shaffer says.

Chamfered tools present a blunter edge angle — greater than 90 degrees — to the workpiece, so cutting is done at a negative rake angle. A 20-degree chamfer results in a "super" negative cutting angle, with a rake of only 70 degrees, Shaffer says.

The negative rake angle makes the tool plow through the workpiece, and either pinches or traps the chips it makes. "This occurs because the feedrate of a tool when cutting hardened materials typically is less than the width of the T-Land chamfer. It has also been found that in most hard turning applications, the feedrate normally does not exceed one half the width of the chamfer. This condition can be referred to as under-feeding," Shaffer says.

The result is that chips are not cleared from the tool and tend to dig into the surface of the chamfer, increasing pressure and producing the common cratering and, eventually, causing the tool to fracture in a horizontal plane.

He says his company's Engineered Micro-Geometry edge-preparation technology provides some of the same functions as chamfering but eliminates the chip-pinching problems caused by the



Conicity Technologies says correct edge prep for tool inserts (bottom) can provide better cutting than chamfered tool inserts (top).

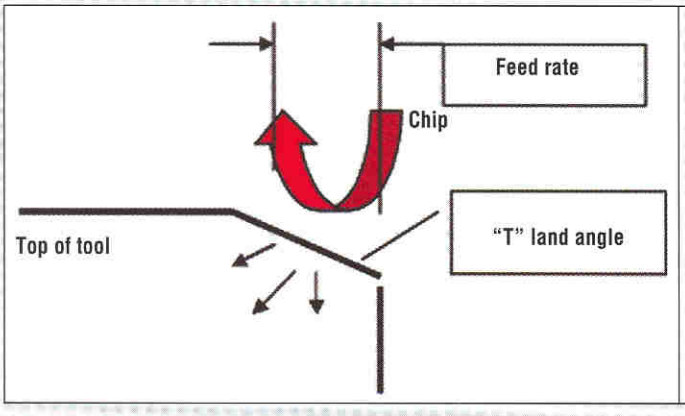
negative rake angle of a chamfer.

The technology applies a specific geometrically shaped rounded edge — radius, oval or waterfall-shaped — that makes the cutting edge stronger. (A radius edge preparation is shown in the bottom photo at right.)

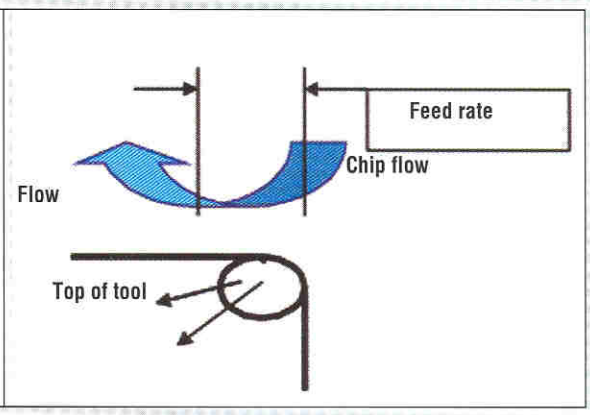
The specific geometrically shaped rounded edge gives the edge of the cutting tool its best condition to attack the workpiece material, Shaffer says.

The chip flow on the tool with the Engineered Micro-Geometry radius edge prep allows chips to escape the cutting zone and reduces the angle of incidence with the cutting tool, Shaffer says. That reduces the tool pressure and tool temperature and increases the life of the tool, he adds.

When using radial-style edge prep, the tool feedrate will always be greater than the size of the edge prep. Therefore, the 90-degree rake angle of the tool effectively clears the cut chips without trapping material between the cutting tool and the workpiece (see drawings below). ■



Chip flow from chamfered tools (Figure B) display an extreme change in chip direction, causing the cut chip to dig into the surface of the chamfer.



Conicity says radial style edge prep provides a 90°-rake angle for the tools, and clears cut chips. (Figure C)

Conicity Technologies offers a standard line of CBN tools with radial edge preparations instead of T-lands. As described in the above article, these tools cut with less pressure and heat than conventional tools. Tool geometries, which are not listed here, are available on request.

CBN Inserts	Product Type	Grades CCBN6	CCBN8
	CCGW 21.51	C3000	C3005
	CCGW 21.52	C3010	C3015
	CCGW 32.51	C3020	C3025
	CCGW 32.52	C3030	C3035
	CNGA 431	C3040	C3045
	CNGA 432	C3060	C3065
	DNGA 431	C3080	C3085
	DNGA 432	C3100	C3105
	TCGW 21.51	C3120	C3125
	TCGW 21.52	C3130	C3135
	TCGW 32.51	C3140	C3145
	TCGW 32.52	C3150	C3155
	TPG 221	C3160	C3165
	TPG 222	C3170	C3175
	TPG 321	C3180	C3185
	TPG 322	C3190	C3195
	TPG 432	C3200	C3205
	VNGA 331	C3210	C3215
	VNGA 332	C3230	C3235

CBN Mini Tip Inserts	Product Type	Mini Tip	Mini Tip Double Ended
	CNGA 431	C3050	C3055
	CNGA 432	C3070	C3075
	DNGA 431	C3090	C3095
	DNGA 432	C3110	C3115
	VNGA 331	C3220	C3225
	VNGA 332	C3240	C3245

All Mini Tip Inserts are grade CCBN-30, which is ideal for hard turning.

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