GUHRING

Recondition **to original quality**

Re-grinding and Re-coating Service

GUHRING – YOUR WORLD-WIDE PARTNER

Maximize your cost savings

Utilize Guhring's tool reconditioning services

Even the most resilient tools wear out eventually. Guhring can recondition your tools back to original manufacturing specifications, allowing you to reproduce the performance of your new tools.

GUHR

Recondition to

Collection and delivery service

for in time logistics

Pickup and delivery service available in select markets.

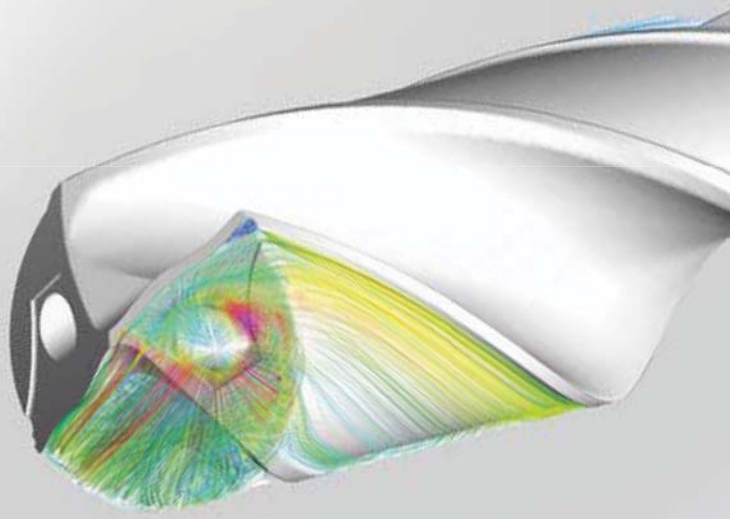
strategically located service centers

Nation-wide service network

In order to expedite our reconditioning process we have established 4 reconditioning centers across the U.S. Our service centers are equipped with state-of-the-art grinding and coating machines designed and manufactured by Guhring.

RING

original quality



Service with manufacturer's know-how

Thanks to our vertically integrated approach to cutting tool manufacturing, from the production of raw cutting tool materials to the in-house development and construction of grinding and coating machines, we have the necessary expertise across all aspects of new tool production as well as reconditioning. The uniform standards in production and service we set world-wide ensure that our tools consistently perform according to the expectations of our customers.

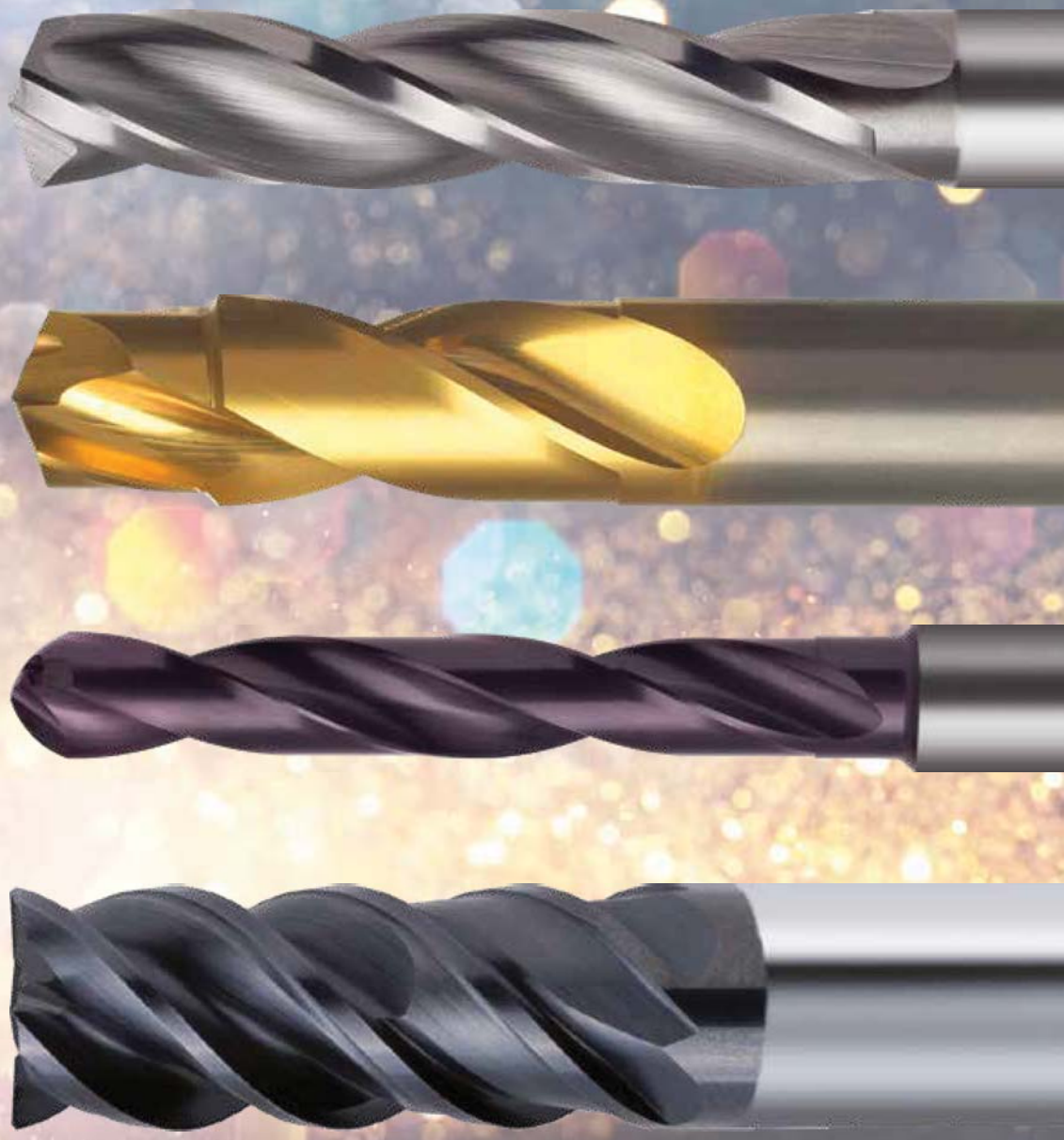
Quality is top priority:

As the worlds leader in precision rotary cutting tool manufacturing, Guhring is uniquely qualified to provide the highest quality reconditioned tools.

- Consistent honing processes
- High quality coatings applied in-house
- Tool etching for traceability
- State-of-the-art inspection equipment

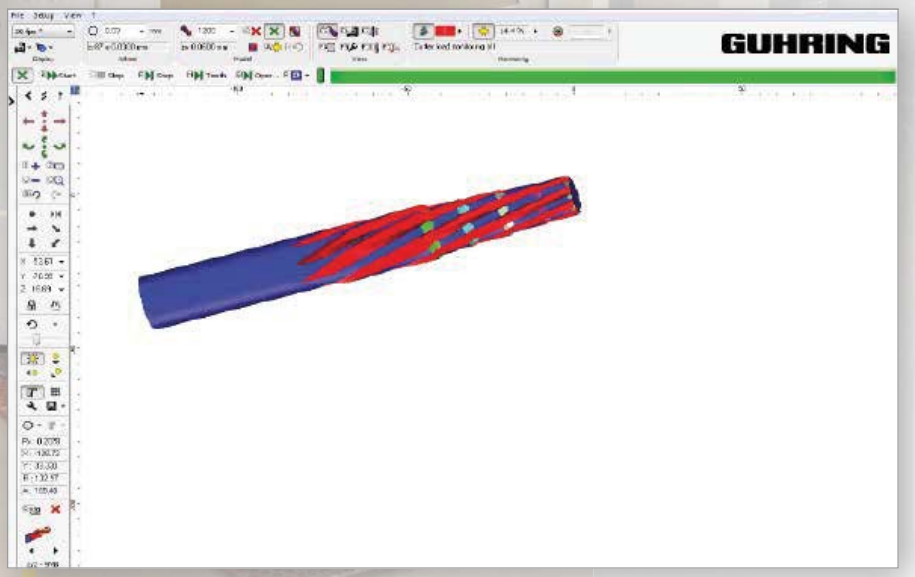
Tool Reconditioning

Re-grinding and re-coating



The Reconditioning Process

Worn cutting tools are reconditioned on new, state-of-the-art, 5-axis CNC grinding machines. Guhring is one of the few cutting tool manufacturers who designs and builds their own grinding equipment which allows us to build machines specifically designed around the strict requirements of our reconditioning process.

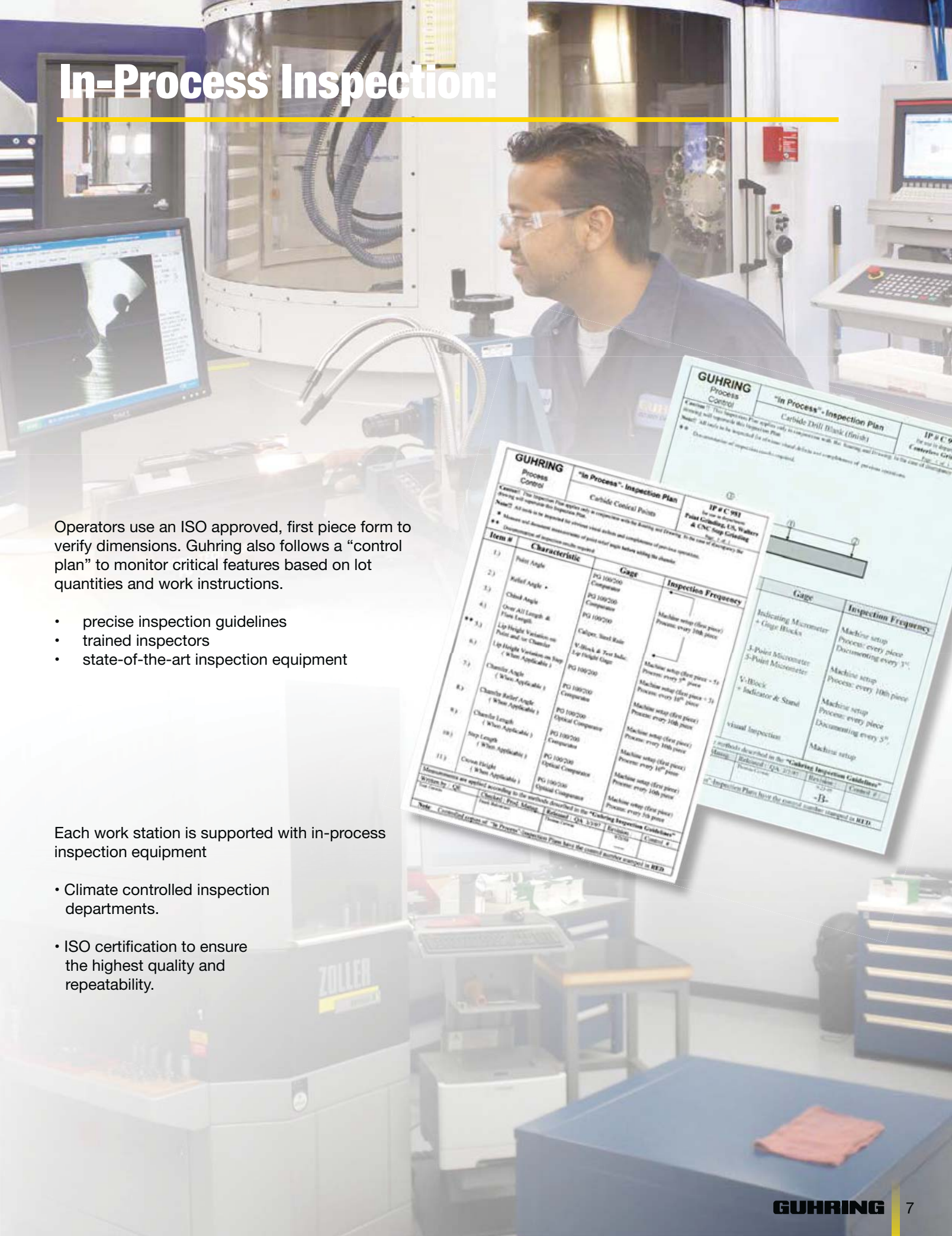


Tools are held in precision collets and fully supported with bushings throughout the grinding process to achieve near perfect run-out tolerances as well as superior surface finish. Not all reconditioning service providers can claim this level of precision and control.

Specialized tool grinding software:

- Numroto Platform
- Master database structure
- Uniform Grinding wheel system

In-Process Inspection:



Operators use an ISO approved, first piece form to verify dimensions. Guhring also follows a “control plan” to monitor critical features based on lot quantities and work instructions.

- precise inspection guidelines
- trained inspectors
- state-of-the-art inspection equipment

Each work station is supported with in-process inspection equipment

- Climate controlled inspection departments.
- ISO certification to ensure the highest quality and repeatability.

Routing Control:

02/28/2012

GUHRING INC.
JOB ROUTING

13299565

Reference:
Status: REL
Job Creation:
Basic Finish Date:
Released:
Qty Ordered:
1 Del. Date:

Item: 372111302
Description: X REGRIND
Customer:
Enduser:

2-08-115002-001R

Oper	WC Oper/Loc	Description	Standard Hours in Minutes Labor	Setup	Allot Time	Qty	Scrap	Date	Operator 1st Piece
0010	49104985 0002/0000	VAPOR HONE (GRAF)	1.7	9.0	10.7				

DRY BLAST (GLASS BEAD)
COATING DEPT.
REMOVE BAKED ON SLUDGE AND RETURN
TO RECONDITIONING
*** DO NOT CAP TOOLS! ***

0020	45606350 0002/0000	LASER ETCH	1.2	7.7	8.9

LASER ETCH PRODUCTION ORDER NUMBER

0030	48104842 0003/0000	PT GRD.+WEB THIN RT100	56.0	24.0	80.0

POINT PRINT #0968.148 X-POINT
PER PRINT: MIN OAL 91.694MM (3.61")
CUST MAT#:2-08-115002-001R 10.00MM-NANO
STEP

0040	49104985 0002/0000	VAPOR HONE (GRAF)	1.7	9.0	10.7

NOTCH SHANK END
TO IDENTIFY NUMBER OF REGRINDS

- Same procedures & processes used to manufacture new tools are implemented in the reconditioning of used tools.
- Tools are tracked and monitored by tool number and bar coded production sheets.
- Job routings are assigned, and each operation receives its own bar coding.
- Data collection at each station during the reconditioning process.
- Customer-specific tool routings are generated when necessary.

Laser Etching / Process Control:

All tools are laser marked with a unique production order number

- each tool is laser etched
- unique job number is affixed
- allows accurate data collection
- helps customer identify the number of regrinds per tool

All processes are tracked and recorded through our SAP® computer software. Information can be shared between all Guhring reconditioning facilities.

- concise data collection
- archived job information
- repeatability & traceability

SOBO < 372.140.446 > RECON CARB. RT100T COOLANT =>3.5

Routing | Get Times | + break down of complex time tables | sHeader Data | Bill of Material | CAD Data | open Logfile | tooldescr

Routing 1001 / 37001 Frm HB 0 Input/Order-Qty 10.000

Opr	A	Plnt	Mgru	Oper	Locat	WkCnt	Description	Setup	Run Time	Qt	TW	Qt	TF	E	Co/Pc	Curr	Sub Instruct 1
0010		1001	0190	0001	0000	45300190	PREP.RESHARP	0.600	0.636	Min	1.0	Tg			0.00	USD	SEE BELOW:
0020		1001	6350	0002	0000	45606350	LASER ETCH	7.330	0.089	Min	0.5	Tg			0.00	USD	LASER ETCH PRODUC
0030		1001	4842	0003	0000	48104842	PT GRD.+WEB THIN RT100	24.000	4.500	Min	5.0	Tg			3.36	USD	POINT GRIND: 0968
0040		1001	4800	0115	0000	48104800	SLOT GRIND		0.500	Min	3.0	Tg			0.00	USD	OPEN UP OIL HOLES
0050		1001	0260	0005	0000	45300260	FINAL INSPECTION	4.200	0.096	Min	1.0	Tg			0.00	USD	INSPECTION BY:(__
0060		1001	0122	0001	0000	48100122	BRUSH HONE CUTTING EDGE	3.000	0.384	Min	3.0	Tg			0.00	USD	
0070		1001	4985	0004	0000	42154985	DRAG HONE RT100X	9.000	0.125	Min	3.0	Tg			0.47	USD	TO FINISH HONE SI
0080		1001	0260	0026	0000	45300260	BRIEF INSPECTION	4.200	0.114	Min	1.0	Tg			0.00	USD	
0090		1001	7570	0001	0000	49107570	A COATING		0.453	Min	3.0	Tg			0.00	USD	ATTENTION !!! SPE
0100		1001	4985	0003	0000	49104985	WET POLISH (GRAF)POSTCOA	9.000	0.166	Min	3.0	Tg			0.00	USD	
0110		1001	0190	0099	0001	45300190	OTHER OPERATIONS	0.600	0.636	Min	1.0	Tg			0.00	USD	JOIN FINISHED TOO
0120		1001	0190	0010	0000	45300190	PACKAGE & LABEL	0.600	0.378	Min	1.0	Tg			0.00	USD	
0130		1001	0034	0004	0000	45300034	OUTPUT	0.600	0.001	Min	1.0	Tg			0.00	USD	

Tool Types Reconditioned:

- Drills & step drills
- Reamers
- End mills
- Thread mills
- Tool modifications (chamfer, radius, neck relief, shank flats, etc.)

Care should be taken to protect your tools when shipping to Guhring for Reconditioning and Coating services. Convenient shipping totes available upon request.

Diamond Tool Re-Tipping

• PCD & CBN tipped cutting tools can be re-tipped and re-ground.

• State-of-the-art EDM and grinding machines.

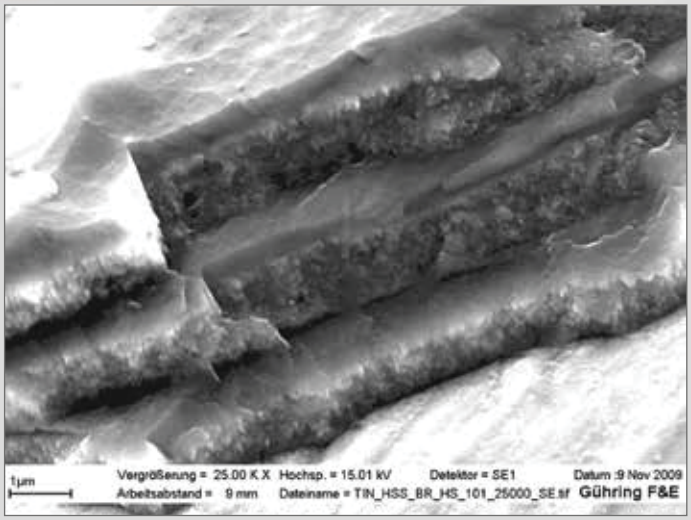
• Costs a fraction of the price of a new tool.

• Refurbished tools meet original manufacturing specifications.

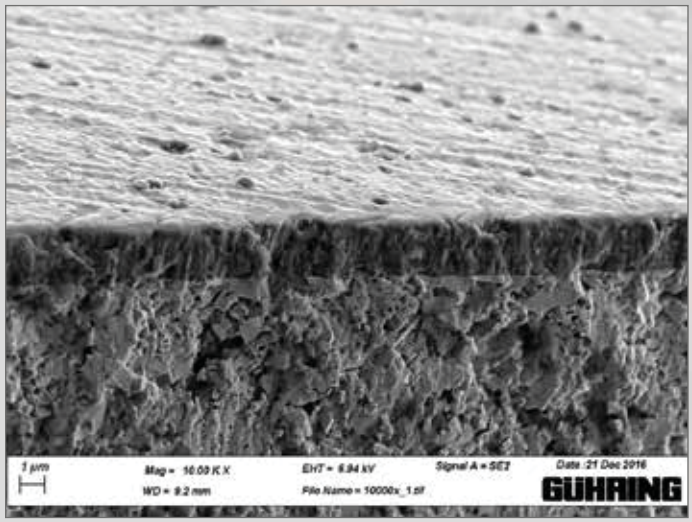
• It is recommended to ship tools in their original tubes and/or boxes when possible to prevent damage during the shipping process.

PVD Coatings

Fracture patterns are visualised via scanning electron microscopy (SEM) in order to make differences visible in the phase structure, morphology and structure dependent on process design and deposition conditions.

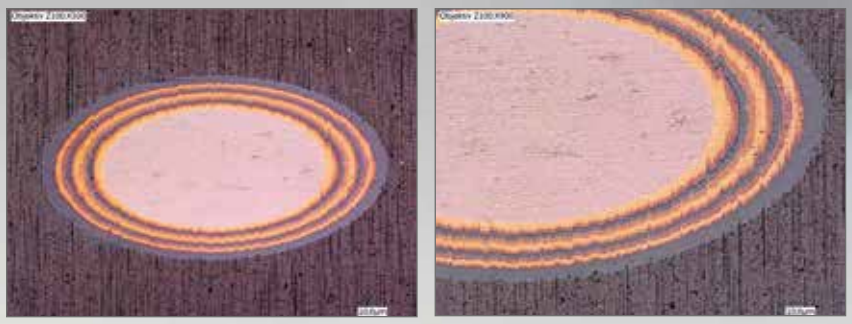


Fracture pattern, multi-layer coating, 25,000 x magnification

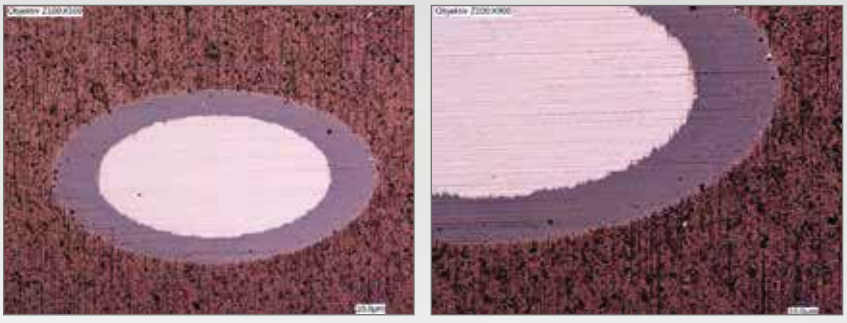


Fracture pattern, Arc-coating, 10,000 x magnification

A spherical calotte is ground into the surface to be inspected using a steel ball as well as an abrasive fluid.
The ground form is sectioned through the coating up to the substrate lying underneath. The procedure serves to determine the wear resistance, the coating thickness, and to evaluate the coating structure, and is therefore an important element of a quality inspection.



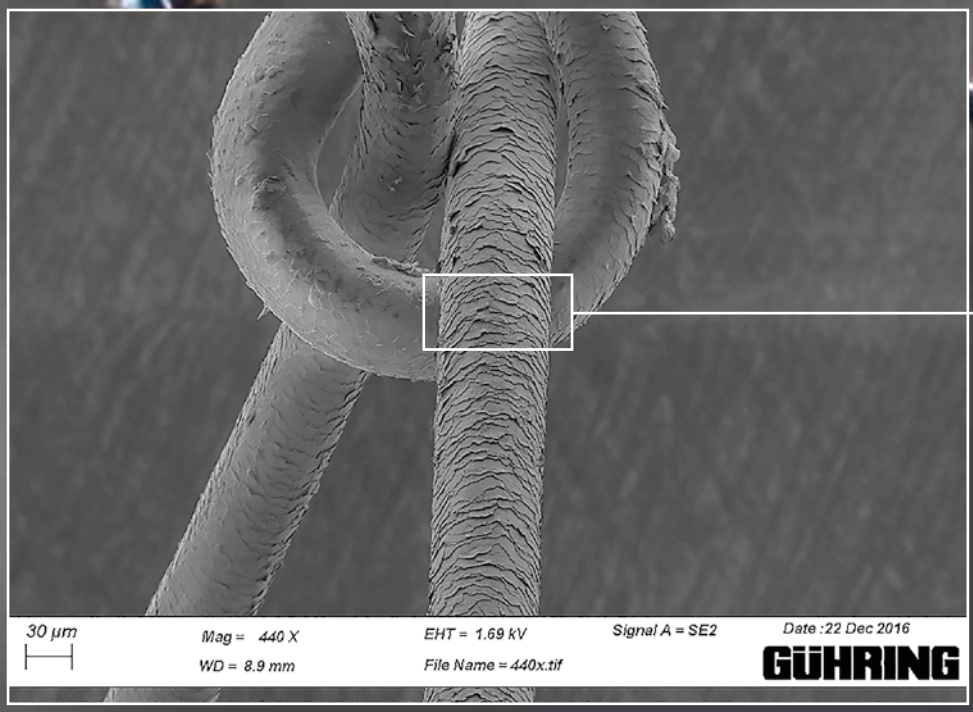
Calotte grind in a multi-layer coating



Calotte grind in a nano-structured coating

No matter how fine: Coatings can be adapted.

Features such as composition, micro-structure and hardness have a direct influence on wear resistance, cutting forces, surface quality and cooling lubricant consumption. Therefore the coating is adapted to the specific application. Regardless of the application, even an extremely thin coating layer can provide a significant benefit.



Human hair

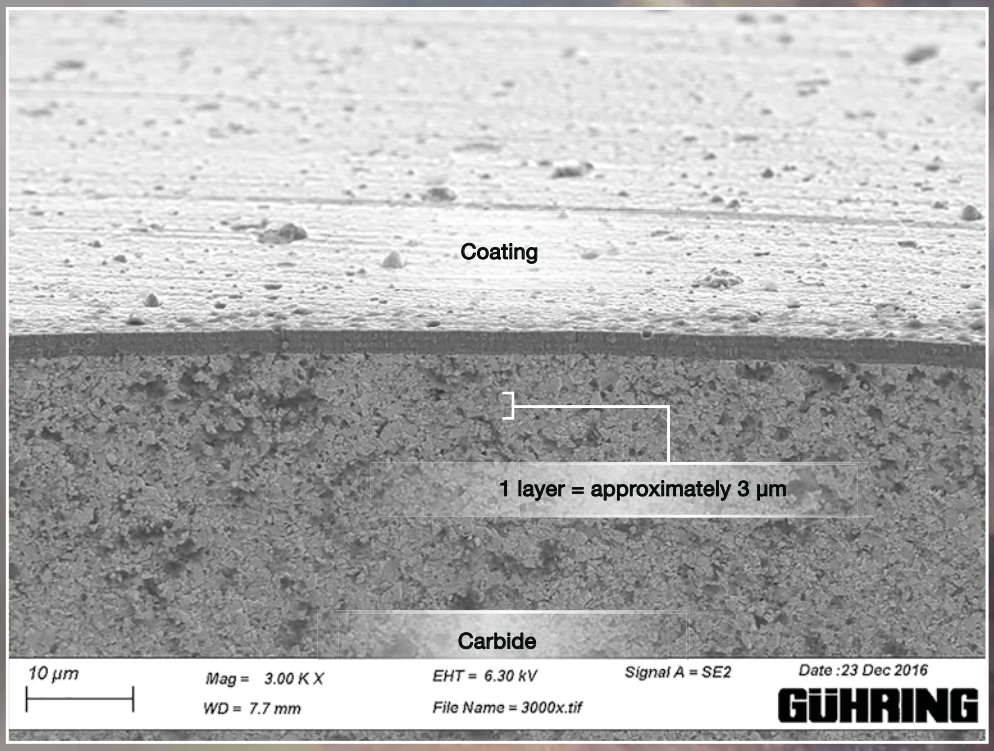
440 x magnification

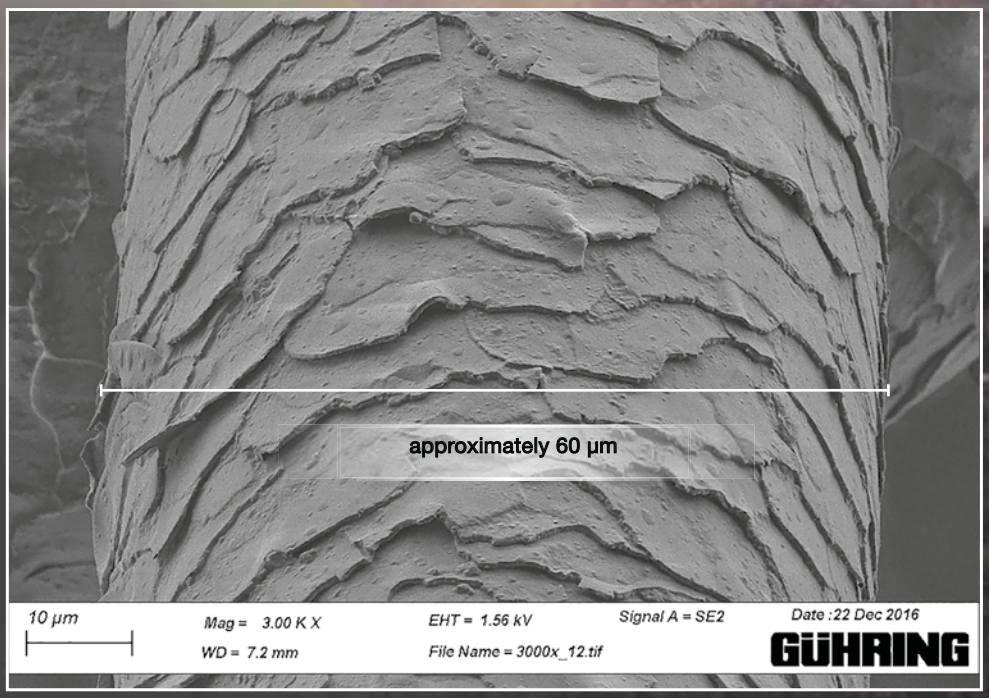
Thin coating, enormous effect

1 hair | 20 coatings

Fracture pattern Arc-PVD coating on carbide substrate

3000 x magnification, approximately 0.003 mm





Human hair

3000 x magnification, approximately 0.06 mm

Application of Guhring coatings

	DRILLING			MILLING		
	CARBIDE		HSS	CARBIDE		HSS
	conv. coolant	MQL		conv. coolant	MQL	
C-steels, Free-cutting steels, Mn-steels P	Endurum nano-Ra nano-FIREX	Endurum nano-Ra nano-FIREX	nano-FIREX	Endurum FIREX nano-Ra	FIREX Endurum nano-Ra	FIREX
Steel, low-alloyed P	nano-FIREX Endurum nano-Ra	nano-FIREX Endurum nano-Ra	nano-FIREX TiN	FIREX nano-Si nano-A	FIREX nano-Si nano-A	FIREX TiCN
Steel, alloyed P	nano-Si nano-FIREX TiAlN	nano-Si nano-FIREX TiAlN	nano-FIREX TiN	FIREX nano-A nano-Si	FIREX nano-A nano-Si	FIREX TiCN
Steel, hardened, <55 HRC P	nano-Si nano-FIREX TiAlN	nano-Si nano-FIREX TiAlN		nano-Si nano-A TiAlN	nano-Si nano-A TiAlN	
Steel, hardened, 55–65 HRC P	nano-Si nano-FIREX TiAlN	nano-Si nano-FIREX TiAlN	bright	nano-Si nano-A	nano-Si nano-A	
Steel, stainless and acid-resistant M	nano-A Sirius Endurum	nano-A Sirius Endurum	Sirius nano-FIREX TiN	nano-A Sirius FIREX	nano-A Sirius FIREX	FIREX
Cast iron K	nano-Si nano-FIREX nano-A	nano-Si nano-FIREX nano-A	nano-FIREX	nano-Si FIREX nano-A	nano-Si FIREX nano-A	FIREX TiCN
Nickel-based alloys (i.e. Inconel) S	nano-A nano-Si nano-FIREX	nano-A nano-Si nano-FIREX	nano-FIREX	nano-A nano-Si Zenit	nano-A nano-Si	FIREX
Titanium / titanium-alloys S	Zenit nano-A	Zenit nano-A	nano-FIREX	Zenit nano-A	Zenit nano-A	FIREX
Cobalt-chromium-alloys S	nano-A nano-Si nano-FIREX	nano-A nano-Si nano-FIREX		nano-A nano-Si FIREX	nano-A nano-Si FIREX	
Precious metals S	nano-A	nano-A		nano-A	nano-A	
Aluminium-wrought alloys N	bright	bright		bright Zenit	bright Zenit	bright
Aluminium-cast alloys (<12% Silizium) N	bright Zenit	bright Zenit	bright Zenit	Zenit	Zenit	bright
Aluminium-cast alloys (≥12% Silizium) N						
Copper / bronze / brass N			TiN			TiN
Ceramics N						
Plastics, not reinforced N						
Plastics, fiber-reinforced N	nano-Si	nano-Si		nano-Si	nano-Si	
Graphite N						

***Note:** The overview shows the general application recommendations for Guhring coatings. Prioritization is from top to bottom.*

	TAPPING			THREAD MILLING		FLUTELESS TAPPING			REAMING		
	CARBIDE		HSS	CARBIDE		CARBIDE		HSS	CARBIDE		HSS
	conv. coolant	MQL		conv. coolant	MQL	conv. coolant	MQL		conv. coolant	MQL	
P			TiCN TiAlN TiN	TiCN	TiCN	TiCN TiN	TiCN TiN	TiCN TiN	Endurum nano-A	Endurum nano-A	TiN
P			TiCN TiAlN TiN	TiCN	TiCN	TiCN TiN	TiCN TiN	TiCN TiN	nano-A Endurum	nano-A Endurum	TiN
P			TiCN TiAlN TiN	TiCN	TiCN	TiCN TiN	TiCN TiN	TiCN TiN	nano-A Endurum		TiN
P			TiCN	TiAlN	TiAlN				nano-A	nano-A	
P	TiCN			TiAlN	TiAlN				nano-Si		
M			Sirius[1] TiAlN[2] TiN	TiCN	TiCN	TiCN TiN	TiCN TiN	TiCN TiN	nano-A	nano-A	TiN
K	TiAlN TiCN	TiAlN	TiAlN TiCN TiN	TiCN	TiCN	TiCN TiN	TiCN TiN	TiCN TiN	nano-Si	nano-Si	TiN
S			TiCN TiAlN	TiCN	TiCN	TiCN	TiCN	TiCN	nano-A		TiN
S			TiCN TiAlN	TiCN	TiCN	TiCN	TiCN	TiCN	Zenit nano-A		TiN
S	bright		bright	TiCN	TiCN				nano-A		TiN
S									nano-A	nano-A	TiN
N	bright	bright	bright	bright	bright						
N	TiCN	TiCN	TiCN	TiCN bright	TiCN bright	TiCN	TiCN	TiCN			
N	TiCN	TiCN	TiCN	TiCN	TiCN						
N	bright	bright	bright	bright					bright		
N											
N	bright		bright	bright	bright						
N	TiCN	TiCN		TiCN	TiCN						
N											

[1] *for through hole,* [2] *for blind hole*

Detailed information on the individual coatings can be found from page 19.


highlights

Y

nano-Si

Hard machining specialist

S

Sirius

Stainless steel specialist

R

nano-Ra

Steel specialist

Z

Zenit

Titanium specialist

E

Endurum

Steel drilling specialist

Hard Coating

Hard machining specialist

nano-Si

Y

Main application

Drilling / milling / reaming of hardened steels and cast iron

- ***structure***
  multi-layer, nano-structure
- ***color***
  bronze
- ***hardness***
  5500 HV 0.05
- ***application temperature***
  < 1470°F
- ***coating material***
  TiAlSiN-based

With a hardness of 5500 HV Guhring's internally developed nano-Si coating is one of the hardest nitride coatings on the market. Guhring was able to achieve this extraordinary coating hardness thanks to the special nano composite structure with a TiAlN and TiAlSiN layer structure. In these nano composite structures extremely fine TiAlN-crystals [<10 nm] are embedded in a glass-type silicon nitride matrix. This results in an extremely high hardness, that is retained even at high temperatures. As there are no continuous grain boundary networks in this structure, the diffusion of chip material is heavily impeded by the coating. Therefore, the nano-Si coating provides an especially high wear-resistance and at the same time a high diffusion resistance.

Hard Coating

Titanium specialist

Zenit

Z

Main application

Drilling / milling of titanium-alloys

- ***structure***
  multi-layer, nano-structure
- ***color***
  pale gold
- ***hardness***
  2500 HV 0.05
- ***application temperature***
  < 1290°F
- ***coating material***
  TiAlN-ZrN based

With the pale gold Zenit multi-layer system the aluminum content of established coatings was specifically reduced and partly replaced with Zircon. This causes a minimized chemical reaction when coming into contact with titanium alloys. Thanks to the special structure of the coating system the reaction tendency between material and coating should be significantly reduced. Furthermore, this coating also brings significant benefits for the machining of cast aluminum (<10% Si) and wrought aluminum alloys. The focus here is primarily the prevention of built-up edges between coating and material.

Hard Coating

Stainless steel specialist

Sirius

S

Main application

Tapping in stainless steels (through holes only)

Drilling / milling in stainless steels

M

Stainless

- ***structure***
  multi-layer, nano-structure
- ***color***
  pale gold
- ***hardness***
  3400 HV 0.05
- ***application temperature***
  < 1650°F
- ***coating material***
  TiAlSiN-based with ZrN cover coating

When drilling in stainless the cutting edges of cutting tools are subjected to extreme stresses. A coating that's especially mechanically wear resistant with a low friction coefficient prevents damage to the cutting edges. Another benefit is a very low chemical interaction with stainless steels. The tough, hard TiAlN functional coating guarantees a very high wear resistance. The zirconium nitride cover coating significantly improves chip evacuation as the chemical reaction between coating and workpiece is reduced. Therefore, SIRIUS offers the best features for the machining of stainless materials.

Hard Coating

Steel specialist

Endurum

E

Main application

Drilling carbon, free-cutting and manganese steel at low and medium cutting speeds

P

Steel

- ***structure***
  multi-layer with nano-layers, nano composite
- ***color***
  copper
- ***hardness***
  4000 HV 0.05
- ***application temperature***
  < 1470°F
- ***coating material***
  TiAlSiN based

Thanks to a nano-layer structure as well as reduced aluminum content Endurum was specifically adapted for the drilling of low-alloyed steels such as carbon, free-cutting and manganese-alloyed steels. By adding silicon it forces a nano composite structure causing higher hardness. In addition, thanks to the composition the reaction tendency is significantly reduced. Particularly for low and medium cutting speeds it is the first choice for drilling operations.

Hard Coating

Stainless steel & beyond

nano-A

Main application
Drilling/milling of stainless steels

- ***structure***
  multi-layer, nano-structure
- ***color***
  dark grey
- ***hardness***
  3800 HV 0.05
- ***application temperature***
  < 1650°F
- ***coating material***
  TiAlN / AlTiN layers

The TiAlN based nano-A coating has proven itself especially in the machining of stainless steels, but it is sometimes also applied for drilling and milling of cast iron, titanium, and nickel-based and cobalt chrome alloys. Its nano-layered structure delays the fracture growth.

Hard Coating

Steel specialist

nano-Ra R

Main application

Drilling/milling of carbon, free-cutting as well as low-alloyed steels

P
Steel

- ***structure***
  multi-layer, graded
- ***color***
  pale gold
- ***hardness***
  3300 HV 0.05
- ***application temperature***
  < 1470°F
- ***coating material***
  TiN/TiAlN based
  with ZrN cover coating

Guhring's nano-Ra coating relies on a proven TiN and TiAlN multi-layer structure combined with a ZrN based cover coating. The multi-layer structure guarantees good values of hardness and toughness reducing the mechanical wear. The cover coating minimizes the chemical reaction between the coating and the material to be machined, thereby reducing the development of edge build-up and the adhesion of the material to the cutting edge as much as possible.

Hard Coating

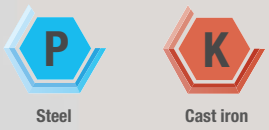
Well-rounded champion

FIREX® / nano-FIREX®

F

Main application

Drilling/milling of steel and cast iron



Steel | Cast iron

- ***structure***
  multi-layer, nano-structure
- ***color***
  red-violet
- ***hardness***
  3000 - 3300 HV 0.05
- ***application temperature***
  < 1470°F
- ***coating material***
  TiN / TiAlN nano layers

FIREX coating was introduced at the end of the 90‘s. Its further development, nano-FIREX was brought to market in 2008. Along with titanium and nitrogen, the coating also contains aluminum, and distinguishes itself with a higher hardness and improved thermo-chemical resistance. It is suitable for coating both HSS and carbide. Today it is the #1 choice for drilling and milling in steels.

Hard Coating

Low friction, high hardness & toughness

TiCN

C

Main application
Tapping/forming/thread milling

- ***structure***
  monolayer
- ***color***
  grey violet
- ***hardness***
  3000 HV 0.05
- ***application temperature***
  < 750°F
- ***coating material***
  Titanium Carbonitride

Due to the additional embedding of carbon, TiCN distinguishes itself with a higher toughness and hardness, and a reduced friction coefficient compared to TiN. With its high wear resistance it is very well suited for abrasive threading applications.

Hard Coating

Superhard coating for steels and cast iron

TiAlN

A

Main application

Drilling, milling and threading in alloy steels or cast iron

Steel, alloyed or hardened

Cast iron

- ***structure***
  monolayer
- ***color***
  black violet
- ***hardness***
  3300 HV 0.05
- ***application temperature***
  < 1470°F
- ***coating material***
  Titanium Aluminum Nitride

The TiAlN coating with it's titanium-aluminum structure displays similar characteristics to FIREX and nano-FIREX. Due to it's single-layer structure it is especially suitable for coating micro-precision tools.

Hard Coating

Universally applicable, time-tested

TiN

S

Main application

For HSS and carbide tooling in drilling and tapping applications

- ***structure***
  monolayer
- ***color***
  gold
- ***hardness***
  2400 HV 0.05
- ***application temperature***
  < 1100°F
- ***coating material***
  Titanium Nitride

Guhring introduced the world's first TiN coated twist drill in 1981. Today, TiN is still utilized as a universal, cost efficient coating that can be applied for drilling, milling, and tapping on both HSS and carbide cutting tools.

Soft Coating

Lubricating top-layer

MolyGlide

Main application

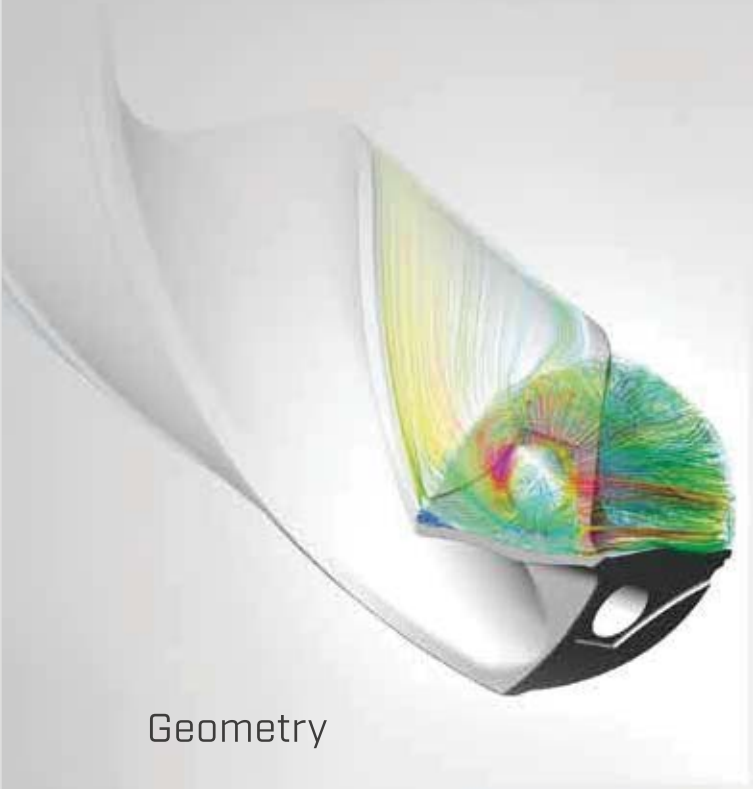
Minimizes friction and adds lubricity, especially in dry machining

Stainless | Steel | Copper/Bronze/Brass iron

- ***structure***
  monolayer
- ***color***
  silver
- ***friction coefficient (fetting)***
  0.10
- ***application temperature***
  < 1470°F
- ***coating material***
  MoS_2 - based

MolyGlide is used in applications where increased lubricity or a very low coefficient of friction will be beneficial, for example, when machining aluminum or other "gummy" materials. This unique MoS2 coating is sometimes referred to as Teflon®-like in that nothing sticks to the coating. MolyGlide can be applied on uncoated surfaces such as injection mold parts, or on top of any hard coatings to provide an extra layer of lubricity.

IN-HOUSE GUHRING



Geometry

Tool material

Coating

Machinery and plant engineering

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