

GUHRING®



COATING SERVICES

HIGH PERFORMANCE THIN-FILM COATINGS FOR CUTTING TOOLS & WEAR PARTS

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The importance of advanced coatings in achieving dramatic gains in cutting tool and wear part performance cannot be overstated. Properly applied, coatings improve many tool and part characteristics. They increase surface hardness, lower the friction coefficient and thermal conductivity, and provide a chemically inert surface. Performance benefits include: significantly increased tool and part life, reduced friction and heat buildup, and high resistance to edge buildup, galling and fissure propagation. Applying the right coating can increase tool and part productivity from 100% to over 1000%!

TECHNOLOGICAL LEADER. As a cutting tool manufacturer, GUHRING offers a level of technical expertise without equal in the industry. GUHRING was the first to introduce TiN coating (Titanium Nitride) to cutting tools in 1980 and has remained a global leader in developing and applying new coating technology to improve both cutting tool and wear part performance. Today, GUHRING offers a full range of high performance thin-film coatings to meet customers' diverse needs, including:

- **TiN** (Titanium Nitride, or S-coat),
- **TiAlN** (Titanium Aluminum Nitride, or A-coat),
- **TiCN** (Titanium Carbonitride, or C-coat),
- **FIREX®** (special multilayer hard coating, or F-coat), and
- Other advanced hard, soft and combined coatings.

Each application presents different performance challenges, and GUHRING's advanced coating selection provides application-specific solutions, delivering higher hardness, increased heat and shock resistance, and greater lubricity as required. By effectively matching the right high performance coating to each application, GUHRING Coating Services maximizes tool and wear part productivity *and* cost effectiveness – providing *absolute* value for money.

STATE-OF-THE-ART EQUIPMENT.



- ✓ **LONGER TOOL & WEAR PART LIFE**
- ✓ **FASTER OPERATING SPEEDS & FEEDS**
- ✓ **SIGNIFICANTLY INCREASED PRODUCTIVITY**

Coatings are only as good as the process used to apply them. Advanced equipment, special training and experience are vital. GUHRING utilizes both state-of-the-art cathodic arc and reactive ion coating systems to deliver superior coating adhesion, uniform thickness and structure, and batch-to-batch reproducibility.

Advanced climate control systems maintain optimum facility air temperature, humidity and pressure, while removing dust and other airborne impurities. A custom-designed, fully automated ultrasonic cleaning system maximizes tool and part pre-coating cleanliness, while precision stereo dynascopes enhance both pre- and post-coating visual inspection. Coating adhesion and thickness are closely monitored utilizing calotest and other advanced measuring equipment.



UNIQUE APPROACH. What takes place in the coating chamber is widely considered the most critical step in the coating process. However, if tools and parts are not properly prepared, coating quality can be severely compromised. At GUHRING, we take the time to prepare each job properly. First, we clean each tool and part thoroughly in our special five-stage ultrasonic cleaning system. Second, we sort each job by tool and part size, geometry, and material type to promote optimum coating uniformity and thickness. Properly cleaned and sorted, the tools and parts are then placed in the coating chamber. We monitor the coating process closely to ensure that neither the structural integrity nor geometry of the tools and parts is altered.

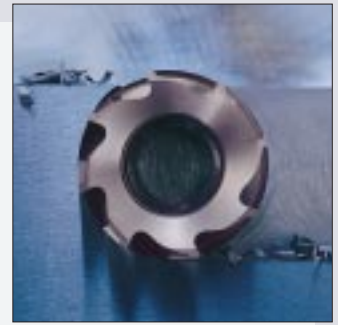
In sum, GUHRING's approach to coating combines high technology with personal attention to detail, resulting in a level of coating quality and service few can match.



TiN • S-coat *Titanium Nitride*

The gold S-coat is an excellent, all-around, cost-effective high performance coating which increases tool and part surface hardness to over 80 Rc, greater than tungsten carbide. As such,

S-coated tools and parts last up to five times longer than uncoated tools and parts, and can be run at more aggressive speeds and feeds. Among TiN coating providers, no competitor has been able to match the performance profile of GUHRING's S-coat.



TiCN • C-coat *Titanium Nitride*

The gray-violet C-coat achieves superior results when machining hard materials such as tool steels and steels over 40 Rc. Its multilayer structure provides an effective barrier to fissure propagation caused by dynamic stress, inhibiting surface fractures from propagating to the tool or wear part substrate. C-coat is recommended for high-shock applications such as tapping, interrupted cuts in drilling and milling, and heavy-duty forming operations such as punching and stamping.



TiAlN • A-coat *Titanium Aluminum Nitride*

The black-violet A-coat is recommended when extra hardness and heat resistance are required, as when machining abrasive materials such as cast iron and high silicon-content aluminum alloys. During cutting, an oxide (Al₂O₃) layer forms

over the A-coat, providing extremely high heat resistance. A-coat also performs equally well in high thermal stress conditions, such as high speed turning, near-dry and dry machining, and deep and small diameter holemaking where cutting fluids have difficulty penetrating.



FIREX® • F-coat *Special Multilayer*

Developed by GUHRING in cooperation with Platit of Switzerland, the red-violet F-coat comprises distinct, alternating ultra-thin coating layers and combines the performance benefits of popular single-layer coatings – the universal applicability of TiN, the hardness and heat resistance of TiAlN, and the shock resistance of TiCN. With hardness exceeding 90 Rc, F-coat sets a new standard in cutting tool and wear part performance enhancement. F-coat also displays excellent coating interface characteristics.

KEY CHARACTERISTICS OF GUHRING HIGH PERFORMANCE COATINGS

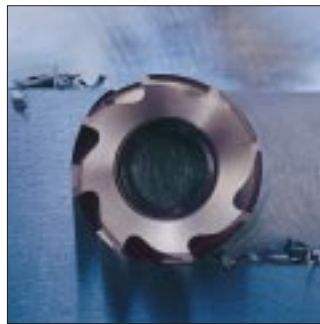
HIGH PERFORMANCE COATINGS	TiN • S-coat Titanium Nitride	TiAlN • A-coat Titanium Aluminum Nitride	TiCN • C-coat Titanium Carbonitride	FIREX® • F-coat Distinct, alternating layers
Identifying Color	Gold	Black Violet	Gray Violet	Red Violet
Coating Process	PVD Physical Vapor Deposition	PVD Physical Vapor Deposition	PVD Physical Vapor Deposition	PVD Physical Vapor Deposition
Coating Temperature	935 °F 500 °C	900 °F 480 °C	935 °F 500 °C	900 °F 480 °C
Layer Structure	Mono	Mono plus Al ₂ O ₃ layer	Multi	Multi
Thickness (µm)	1.5-3.0	1.5-5.0	4.0-7.0	1.5-5.0
Microhardness (HV 0.05)	2200	3300	3000	3500
Friction Coefficient vs. Steel	0.40	0.30	0.25	0.25
Thermal Conductivity (kW/mK)	0.07	0.05	0.10	0.05
Maximum Operating Temperature	1100 °F 595 °C	1470 °F 800 °C	840 °F 465 °C	1470 °F 800 °C
Primary Applications	All	Drilling, tapping, turning & dry high speed machining	Drilling, tapping, milling, forming & interrupted cutting	All
Workpiece Materials for Cutting Applications	Universal	Cast iron, Stainless steel, Al alloys & Ti alloys	Tool steels & Steels >40 Rc	Universal
Key Characteristics/Benefits	Broad application Cost effective	High hardness High heat resistance	High toughness High shock resistance	Broad application Very high hardness Very high heat resistance

Other high performance coatings are available, including Guhring's patented MOVIC® soft coating which acts as an integrated lubricating agent reducing friction and wear and extending tool and part life. All above coatings are applied at Guhring's Brookfield, Wisconsin plant, while MOVIC® coating is applied in Europe. Lead times and prices for MOVIC® are quoted per application.

GUHRING HIGH PERFORMANCE COATINGS SELECTION GUIDE

The table below provides general recommendations for optimum tool and part performance with GUHRING high performance TiN, TiAlN, TiCN and FIREX® coatings. GUHRING COATING SERVICES coats many types of tools and wear parts, including drills, reamers, taps, countersinks, turning inserts, end mills, milling cutters, hobs, milling inserts, punches, dies, forming tools, gears, pistons, die casting molds and components, and plastic injection molds and components. Coatings can be applied to high speed steel, stainless steel, tool steel, carbide and many other materials.

	TiN • S-coat Titanium Nitride	TiAlN • A-coat Titanium Aluminum Nitride	TiCN • C-coat Titanium Carbonitride	FIREX® • F-coat Distinct, alternating layers
CUTTING TOOLS – Continuous Chip Drills • Reamers • Taps • Countersinks • Turning Inserts	✓	✓	✓	✓
CUTTING TOOLS – Interrupted Cut End Mills • Milling Cutters • Hobs • Milling Inserts	✓		✓	✓
PUNCHES, DIES & FORMING TOOLS	✓		✓	✓
WEAR PARTS	✓		✓	✓
DIE CASTING MOLDS & COMPONENTS PLASTIC INJECTION MOLDS & COMPONENTS	✓	✓		✓



GUHRING®
No one offers more

For technical assistance and pricing information, contact:

GUHRING COATING SERVICES P.O. Box 643, Brookfield, WI 53008-0643
Tel (262) 784-6730 (800) 776-6170 Fax (262) 784-9291
Shipping Address 1445 Commerce Avenue, Brookfield, WI 53045

