Huddle up on MULTITASKING
Machines that turn and mill can be a winning combination

Also in this issue
› Go offline for productive tool presetting
› Benefit from heat treating parts in-house
› Turn raw materials into usable workpieces
Narrow Parting & Slitting

Slim Master

The Narrowest Indexable Insert for Parting & Slitting

GFT - Narrowest Insert

0.8-1.2 mm (.031-.047)

Cost Effective Insert

High Pressure Coolant

New Generation

Narrow Insert

Download ISCAR WORLD Now!

All ISCAR’s online apps, interfaces, and product catalogs in a single space.

www.iscarmetals.com

Member IMC Group

MACHINING INTELLIGENTLY

App Store  Play Store
The Threading Specialist!

FLO-LOCK
Full line of standard threading inserts and toolholders with chip control!

ON-EDGE

LAYDOWN
Wide array of standard thread geometries in both inch and metric sizes! Extensive offering also includes chipbreaker items, multitooth configurations, and pressed utility type inserts!

CHASERS
API Threading chasers!
• Buttress, WW, NPT, Rounds...

THREADMILLING
Indexable and solid threadmills!

FLO-SWISS
Swiss Tooling for external machining

FLO-MIN
Solid Tooling for internal machining

Call us! We have it!
Visit us at www.toolflo.com for the latest catalogs!
800-345-2815 or sales@toolflo.com

Come see our new state of the art facility!
Aerospace solutions from YG-1 cut your production time and slice through the most demanding materials, like 17-4PH, 15-5PH, 300/400 stainless steels, heat-resistant alloys and titanium. And new high-production mills, like the ALU-POWER HPC, take on the most daunting challenges in aluminum, all at maximum metal removal rates.

Have us evaluate your performance needs – call us at 800-765-8665, or go through your local YG-1 rep today.

We make everything you need for anything that flies. YG-1 and done.
Not everybody gets it.

Don't be that guy. Sign up today and start receiving the magazine for metalworking professionals.

Choose your option:

1. Text or email your completed form below to cte@stamats.com.
2. Go to ctemag.com, click the Subscribe button and follow the instructions.
3. Fax your completed form to 319-364-4278.

SUBSCRIBE NOW!

1. Do you wish to receive/continue to receive CUTTING TOOL ENGINEERING free of charge? ❑ YES ❑ No

2. Your job title (check one):
   1. ❑ Corporate Manager (Owner, Chairman, President, VP, GM or other corporate manager);
   2. ❑ Engineering Manager (Supervise Engineering Personnel);
   3. ❑ Engineering Department (Non-Supervisory Position);
   4. ❑ Production Manager (Supervise Production Personnel);
   5. ❑ Production Department (Non-Supervisory Position);
   6. ❑ Design, R&D;
   7. ❑ Purchasing;
   8. ❑ Quality Assurance, Control;
   9. ❑ Other (please specify)

3a. What is the primary end product manufactured (or service performed) at this location?
   1. ❑ Primary Metal Manufacturing
   2. ❑ Fabricated Metal Product Manufacturing
   3. ❑ Machinery Manufacturing
   4. ❑ Computer/Electronic Product Manufacturing
   5. ❑ Electrical Equip/Appliance & Component Manufacturing
   6. ❑ Transportation Equipment Manufacturing
   7. ❑ Furniture and Related Product Manufacturing
   8. ❑ Miscellaneous Manufacturing
   9. ❑ Wholesale/Trade/Durable Goods
   10. ❑ Other Manufacturing NEC

3b. If your company does NOT manufacture AT THIS LOCATION, specify company’s primary product or service performed. (please specify)

4. Number of employees at your company.
   A ❑ 1-9   B ❑ 10-19   C ❑ 20-49   D ❑ 50-99   E ❑ 100-249   F ❑ 250-499   G ❑ 500+

5. Which of the following market segment(s) does your company serve? (check all that apply)
   1. ❑ Aerospace
   2. ❑ Communications, Computers, Electronics
   3. ❑ Defense
   4. ❑ Energy
   5. ❑ Heavy Equipment
   6. ❑ Medical
   7. ❑ Transportation (including automotive)
   8. ❑ Other (please specify)
# Table of Contents

October 2019 Volume 71 Issue 10

## COVER STORY

**34 Maxing Out Multitasking**
Get the most from combination turn/mill machines. Cover image courtesy of Okuma America Corp.

## FEATURES

**46 Productive Presetting**
If you use a CNC lathe or machining center to set tool lengths, you may want to go offline.

**58 Hot House**
Heat treating parts in-house in a furnace or an oven offers advantages compared with outsourcing.

**68 First Cuts**
There are many ways to turn raw materials into usable workpieces.

## DEPARTMENTS

**8 Lead Angle**

**10 Letters to the Editor**

**12 Metalworking Product Review**

**18 Manager’s Desk**

**20 Machine Technology**

**24 Get With the Program**

**32 Machinist’s Corner**

**72 Productive Times**

**79Advertisers Index**

**80 Look-Ahead**

---

**Cover Story**

**34 Maxing Out Multitasking**
Get the most from combination turn/mill machines. Cover image courtesy of Okuma America Corp.

---

**FEATURES**

**46 Productive Presetting**
If you use a CNC lathe or machining center to set tool lengths, you may want to go offline.

**58 Hot House**
Heat treating parts in-house in a furnace or an oven offers advantages compared with outsourcing.

**68 First Cuts**
There are many ways to turn raw materials into usable workpieces.
Stop wasting time with products that slow you down. Never compromise accuracy again with Tsudakoma Rotary Tables. Built for speed and designed for ultimate precision, our rotary tables diminish user error and amplify productivity. Our Integration department will take care of all installations on-site, so you can start increasing production immediately. Let Koma bring your shop up to speed today.
You can use your smartphone to scan the QR code images below to instantly access the reports on ctemag.com. Or access the reports by entering the URLs listed into your web browser.

**FINDING THE RIGHT PARTNER**

Bill Cox, owner and president of Cox Manufacturing Co., shares why he recently made FANUC CNCs standard on his machines.

**3D IMPORT TARGETS SKILLS GAP**

Jordan Wade of M.C. Molds Inc. says Hurco Cos. Inc.’s 3D import feature blows his mind by easily generating a program or cutter path.

**OXIDATION BURNS ME UP**

The Grinding Doc addresses the formation of oxidation burn during a grinding operation.

Follow Us on [Facebook](http://cteplus.delivr.com/2qpvf) [Twitter](http://cteplus.delivr.com/2c5b6) [LinkedIn] [Instagram] [Pinterest]

Congratulations to Palmgren as the machine-maker and toolmaker celebrates its 100th anniversary this year. Part of C.H. Hanson Co., many of Palmgren’s original products—vises, cross-slides and rotary tables—still are manufactured. See this and more on CTE social media.
Two world leaders in industrial process fluids, Quaker Chemical and Houghton International, have come together as one company to keep our metalworking customers ahead in a changing world.

As Quaker Houghton, we are proud to partner with metalworking industries around the world that are driving a sustainable, more prosperous future. We work with your teams to deliver expertise, service, and advanced technology related to industrial process fluids.
Even as more and more eyeballs and advertising dollars move from the printed page to the computer screen, I remain convinced that trade magazines will continue to play a significant role in disseminating information and promoting products. Nonetheless, companies that produce printed business-to-business publications typically offer digital media as well. For example, in addition to the print version of Cutting Tool Engineering, CTE Publications Inc. has a digital version of this magazine, a website at www.ctemag.com, an e-newsletter, a digital app, a growing presence on social media and a YouTube channel with hundreds of videos.

Compared with using digital media alone, CTE has found that a combination of print and digital media is 39% more effective at connecting with our audience. CTE Publisher Dennis Spaeth stated that in his editorial in the premiere English version of IndustryArena eMagazine, which CTE produced in cooperation with Langenfeld, Germany-based publisher IndustryArena GmbH (www.industryarena.com). With more than half a million active members, IndustryArena also produces a quarterly German version and published an issue of an English version titled CNC-Arena in 2013.

The e-magazine highlights a cross section of articles CTE has published since Spaeth purchased the publication about a year ago, as well as a new article I wrote about upcoming North American trade shows and a few articles from IndustryArena. The topics include operating equipment and tools, software, industry 4.0, education and training, management, production, automation and robotics, and additive manufacturing.

A unique feature of the e-magazine is that a limited-edition print version complements the digital one. By the time you read this column, the 52-page print version of the e-magazine will have been distributed to attendees at the EMO Hannover 2019 trade fair in Germany, which took place Sept. 16-21. The German Machine Tool Builders’ Association organized the show.

The special print version doesn’t contain the 22 articles available in the digital edition but provides URLs and QR codes to access them online. The paper version primarily consists of two-page spreads of photos from the articles, along with author information, headlines and synopses. Kudos to IndustryArena’s Eva Fuchs for her eye-catching design and production work.

CTE will keep expanding in the digital realm. At the same time, however, you can be certain we will continue to publish Cutting Tool Engineering in print in the decades to come. That’s not a particularly bold statement if you happen to agree—as I do—with the following observation from a recent Forbes article about the future of print media: “Print advertising is still necessary if done strategically. Based on your customer demographics, some need the ‘touch and feel’ of engagement.”

about the author
Alan Richter is editor of CTE. Contact him at 847-714-0175 or alanr@ctemedia.com.
Today's manufacturers are creating larger and more complex parts than ever before. Complex parts require versatile, sophisticated machines built to handle the toughest jobs. Enter the MULTUS U5000, a highly flexible multitasking masterpiece with combined cutting, turning, milling and drilling capabilities.

- Robust structural design means zero compromise on turning and milling accuracies
- Thermo-Friendly Concept provides consistently accurate machining
- Collision Avoidance System maximizes machine uptime
- 40 tools via the ATC with an option for 80, 120, 180
- Easy tool loading and improved spindle access

Okuma. Welcome to open possibilities.
IN WITH THE OLD

The following was written in response to Alan Richter’s Lead Angle column in the April issue about machining large parts and being attracted to vintage machine tools. I am just reading your article titled “Machining Large” in the April issue of CTE, and the picture reminds me of the machines I ran at the Chicago Transit Authority’s West Shop on Maypole Avenue. They had old, old lathes; a shaper; and several other old machines that we used to machine tons of different things. One had a table that held a full section of railroad rail, which—if I remember right—was 39’ long, and we actually had to mill down the rail with handmade tool steel cutting blocks to match the rail that we were connecting to in profile and height. Some of these rails we were replacing were produced in the 1920s and 1930s and were as hard and brittle as heck. There is nothing like a well-cared-for older machine. I could still hold some pretty tight tolerances with a machine that was over 70 years old and still worked great.

Chuck Oloffson
CAD detailer and former CNC and manual machinist

ALL RISE

The following was written in response to Alan Richter’s Lead Angle column in the June issue about cutting tool coatings.

I read with much interest your June article on the rise of cutting tool coatings. I graduated with a degree in chemistry from a local college, St. Vincent, 50 years ago and started as a process chemist at Kennametal Inc. in my hometown of Latrobe, Pennsylvania. In May of 1969, I was given an assignment to delve into deposition of TiC onto their grade K42, which later became KC75. This coating used a disproportionation reaction that reacted TiCl4 with titanium sponge and then pulled carbon from the substrate (the carbide base) to make TiC, along with a fairly large FEP-carbon-depleted zone, using a Japanese-reported technique. It all worked out well. While there was initial resistance to coating
addition to WC-Co tools—after all, KMT was in the business to sell the tools, and if it extended life three times, then less tools would be sold—a German company, Metallgesellschaft, introduced the coated insert, and then one had to get serious about this new product. I remember the metallurgist reporting his findings, noting that the coating was only 5µm to 10µm thick and wouldn’t last long enough to make a difference.

I soon became Kennametal’s technical manager of coatings and oversaw the project that took the coated product from 0% to 60% of cutting tools by the time I left KMT in 1981. It let a “kid” (yes, 50 years ago that kept me on track from the age of 22 to 34) see the world: KMT Ltd., their English facility; the KMT GmbH Berlin plant and two associated KMT companies, CaMe.S in Milan and Lempereur in Liege, Belgium; and Kennamex in Mexico City. It helped to expand my vision as an internationalist. In addition to KMT’s foreign locations, my group was responsible for the introduction of coatings to several domestic locations: Orwell, Ohio; Johnson City, Tennessee; and Roanoke Rapids, North Carolina.

What an education for a person. I was there at the right time learning the right technology. Bear in mind that we had little knowledge about how these coatings worked, what was the effect of high-purity gas, insert cleanliness prior to coating, hone size, easy measurement of coating thickness and adherence. KMT had a full-time engineer that provided necessary data to light the way, as well as a met lab providing the data to make beta backscatter checks acceptable as an NDE and look at TR strength issues. It also allowed us to move on to H2 reduction methods, additions of CH4 and N2 to make TiN and TiCN coatings, as well as control FEP formation with TiC, and eventually to get into alumina coating additions and cobalt-enriched cutting tools. Higher Co is good for ES, bad for EW but good if both properties can be maximized.

Anyway, thanks for highlighting this technology from the late ‘60s. It gave me a 45-year professional field to pursue.

Lou Pochet
Greensburg, Pennsylvania
TOOL FOR DEEP-HOLE DRILLING: Inovatools USA LLC’s Deepmax deep-hole drill has a front geometry with a 135° point angle for optimal centering of the drill. A special polishing technique creates smooth chip grooves to enhance chip removal. Four lands provide high-quality holes even with oblique outlets and when producing cross-holes. Drills are available for making holes 15, 20, 25 and 30 diameters deep.
Inovatools USA LLC; www.inovatools.eu

CRYOGENIC COOLANT TECHNOLOGY BOOSTS PRODUCTIVITY: Rego-Fix Tool Corp.’s Cryo-powRgrip applies CO₂ coolant. The system’s coolant lance diameters are tailored for individual applications and optimize CO₂ flow and placement. The design prevents CO₂ from pooling inside the holder, where it can cause the spindle to ice over, or on the workpiece, where it might create cold-affected zones.
Rego-Fix Tool Corp.; www.rego-fix.com

GRINDING WHEELS REDUCE COST PER PART: Saint-Gobain Abrasives Inc. offers Norton Winter Vitron7 CBN grinding wheels. They have a vitrified bond designed for external grinding of camshafts and crankshafts, as well as internal grinding applications for the automotive and bearing industries. The CBN grain particles are dispersed uniformly throughout the bond matrix for enhanced grinding efficiency.
Saint-Gobain Abrasives Inc.; www.nortonabrasives.com

TOOL SPOTS, DRILLS AND COUNTERSINKS: The 2+1 Spot-Drill-Countersink × 82° tool from Link Industries is for machining aluminum at up to 12,000 rpm. To enable faster drilling with a finer finish, the HSS tool has a 30° helix instead of a 7° to 8° helix, a self-centering point and a thin web. The tool has a unique geometry with a 2-flute drill transition in a “1-flute” through-hole.
Link Industries; www.linkcuttingtools.com
FIRST-CLASS MANUFACTURING
WITH P.B.S.® DIAMOND BRAZE TOOLS

P.B.S.® BRAZE ADVANTAGES

- REDUCTION in uncut fibers
- REDUCTION in matrix pull out
- INCREASED feed rates
- *50-75% reduced bench time
  * For mold making operations

Customized forms and shapes
- Fast, aggressive, and consistent

DESIGNED FOR AIRCRAFT STRUCTURE & COMPONENTS

AIRFRAME • INTERIOR • SKELETON • BRAKES

Carbon Fiber Reinforced Polymers (CFRP)
Ceramic Material • Fiberglass Reinforced Polymers (FRP)
Friction Material • Kevlar® • Honeycomb Core
Honeycomb Core/CFRP Laminates • Phenolic Resins

abrasive technology
www.abrasive-tech.com
WIRE EDM IS VALUE-PRICED: The S-EW3 from Beaumont Machine is a 5-axis servomotor wire EDM that provides approach control, corner control, automatic threading and training software. The machine has a 42-sq.-ft. footprint, including the filtration unit. Programmable reduced-power settings eliminate wire breaks on lead-in cutting. Automatic adjustment to power settings and the feed rate improve corner accuracy. 
Beaumont Machine; www.beaumontmachine.com

MODULE-BASED SYSTEM FOR MACHINE MONITORING: Marposs Corp.'s Genior Modular VM-03 provides predictive maintenance via vibration, gravity, temperature and condition monitoring, as well as simple process monitoring and dynamic collision and crash detection. The system can be integrated into machine tools, robots and other equipment, plus with the Genior modular tool and process monitoring system. 
Marposs Corp.; www.marposs.com
BE BOTH DYNAMIC & EFFICIENT WHEN
MILLING TITANIUM & EXOTIC ALLOYS

NEW!
788 SERIES

- New LXN Design, proprietary PCT technology proven in High Efficiency Milling.
- 7 Flute Variable pitch - helps reduce harmonics and increase metal removal rates.
- Improved with our X60 Carbide grade. Offers maximum protection against edge chipping which ensures consistent performance.
- Coated with Varianta Supral for wear resistance and an increase in lubricity.

Material Codes: P M S H

www.pct-imc.com || 562-921-7898

PRECISION CUTTING TOOLS
Member IMC Group
CMM FOR THE SHOP FLOOR: Mitutoyo America Corp.’s MiStar 555 CNC shop floor coordinate measuring machine operates on conventional electrical service and without compressed air. The machine has movement speeds of 606 mm/sec. and acceleration of 2,695 mm/sec.². The CMM features an open-structure design with a single-support moving bridge, enabling users to mount workpieces from the front, rear and right for installation.
Mitutoyo America Corp.; www.mitutoyo.com

DESKTOP TOOL HAS AUTOMATIC TOOLCHANGER: The Desktop Max ATC from ShopBot Tools Inc. has the same capabilities as the Desktop Max but with the addition of an ATC. The CNC machine has a 36”×24” cutting area. Two deck options are available: a universal vacuum hold-down deck or an aluminum deck, which can be partially or completely removed for a variety of endmilling and edge work.
ShopBot Tools Inc.; www.shopbottools.com
NACHI IS YOUR...

DRILLING...

Flat Bottom Drills
Coolant Thru and Non-Coolant Thru

Aqua Micro Drills
Coolant Thru and Non-Coolant Thru

& MILLING
SOLUTION...

5 Flute End Mills
Square End and Ball Nose

FOR THE MEDICAL INDUSTRY

www.nachiamerica.com
888-340-8665
October is usually a hectic month in both business and personal life. In the business world, an increase in trade shows, equipment dealing, employee training opportunities, community activities and various other functions presents lots of matters to manage, most of which seem slower in summer months. Among the many options and considerations, choosing which are most beneficial to your shop can strain your brain cells a bit more than in other months. Then add a very busy season for families, and you have a full plate of duties all the way around. Every weekend seemingly has a wedding, a school festival, a sports event, a community fundraiser or other such activity. It is a busy time indeed.

As an owner or a manager of a machine shop, taking advantage of abundant opportunities always should be considered and utilized when possible. Maybe it is the right time to attend a demonstration out of town, find better deals and upgrade that machine. Many opportunities are worth the time and effort. However, trying to handle it all, along with your normal managerial duties, sometimes can add stress and become overwhelming.

When we relocated our shop from a city to our local town, I was eager to meet people, be involved in the business community, help at my kids’ schools and sponsor teams and events—whatever was needed. I still do those things to a degree. But I’ve learned a method for dealing with this intense combination of business and personal life. It’s OK to select only a few activities. Instead of trying to be everywhere all the time, sometimes say no, which is a simple, concise word that can improve your life.

My kids are older now, but we remain in the community, our business is still here, and we continue to love and support the place. The difference between the past and present is I’ve understood and come to terms with the fact that it’s bad to say yes to everything, which makes managing a machine shop more difficult. The increased events and duties can take away valuable time from an already hectic work schedule, not to mention potentially resulting in less family time, something already in short supply.

I’ve known many shops and owners who were very quiet and didn’t care to engage with the community or business world. If that approach works for you, that’s certainly fine too. We chose to take a more visible approach as it reflects our company personality. But as the wise saying goes, all things in moderation.

You can’t attend every trade show, see every equipment demo and sponsor every vendor fundraiser. It’s refreshing to accept that idea and apply it without worry. Make your best choices, say no to the rest, and move forward. It’ll likely be a more enjoyable season.

Keith Jennings is president of Tomball, Texas-based Crow Corp., a family-owned company focused on machining, metal fabrication and metal stamping. Contact him at jennings4176@yahoo.com.
Now, you’ve really got a choice in EDM graphite for your most challenging machining operations. Mersen’s DS4, featuring the DarkStar ultra-fine carbon particle, is a proven winner that delivers unmatched EDM performance. It’s time to start saving money in EDM… ask your EDM distributor for DS4!

edm.mersen.com

Made in U.S.A.

Shaping the future of EDM

It’s Time to Make the Switch to Top Performing DS4 Ultra-Fine EDM Graphite

“Our detailed engraving of molds and stamping dies demands an EDM electrode that provides excellent durability and delivers sharp corners and fine quality. We’ve used Mersen’s DS4 ultra-fine EDM graphite for several years and it really performs… and saved us money.”

— Bob Held
Wisconsin Engraving
Featuring what the manufacturer calls cabinet-free technology, a novel drive can help users slash the amount of cabling on shop floors and prepare for industry 4.0.

In operations involving machine tools, drives work with motors in the performance of functions, such as part loading and unloading, tool handling, and lifting and lowering spindles. In a conventional setup, however, the drives are located in a control cabinet while the motors are with the machine. Drives and motors are connected to each other via power and communications cables. This means that 50 cables would be needed to connect 25 drives in the control cabinet to their corresponding motors on the machine.

This arrangement changes dramatically when machine tool users opt for the IndraDrive Mi servodrive from Bosch Rexroth Corp., Hoffman Estates, Illinois. Combining the drive and motor, the IndraDrive Mi is located on the machine rather than in a control cabinet. All the drives in a particular setup are connected in series through a single hybrid cable that transmits both power and communications signals.

Integration of the drive and motor into an individual unit greatly reduces the hardware in the control cabinet, according to Bosch Rexroth.

Also, “you don’t have to expend energy cooling off the drives with an air conditioning system,” said Joaquin Ocampo, product manager of motors and drives.

The setup can be cabinet-free with the addition of an IP65 power supply module, which eliminates the need for power supply components in the control cabinet. A cabinet-free arrangement can lower the amount of power and communications cables.
A CONTROL FOR EVERY GENERATION.

For over 50 years, Hurco has been empowering machinists of every generation with cutting-edge control technology that’s easy to learn and easy to use. See which one of our 65+ models of CNC machines is right for you—rigid and reliable CNC machines equipped with the control that makes shops more productive and more profitable.

Import STEP files directly to the Hurco control with the new 3D Import feature! Bonus: 3D Import includes 3D DXF technology that now displays all CAD geometry.

Go to: HURCO.com/3Dimport
cabling needed for an application by up to 90%, Bosch Rexroth reports.

Besides cabinet-free operation, the IndraDrive Mi features open-core engineering, simplifying communication between the programmable logic controller machine tool environment and PC users. “OCE allows programmers using C, Java or any other high-level PC language to control or obtain information from our products,” Ocampo said.

He said OCE makes it easy for users to monitor system parameters, such as torque, position and motor temperature, to see if they are in the proper range. This data can be accessed using a smartphone or tablet, and users can email alerts to proper personnel when data shows that something is wrong.

“We give them the ability to do that without knowing or writing PLC code,” Ocampo said.

For easier communication, the IndraDrive Mi also offers a multi-Ethernet option that supports four communication protocols: Sercos,
ProfiNet, EtherCat and EtherNet/IP.
As Ocampo sees it, one of the main advantages of the cabinet-free IndraDrive Mi is its ability to increase the flexibility of the manufacturing process, which makes the drive a good choice for firms trying to keep up with trends and become ready for future developments.

"Traditional manufacturing involves big batches, but it seems everybody wants something customized today," he said. To meet the demands of these customers, "our clients have to be able to adjust to orders of different sizes and different products. The IndraDrive Mi is vital for this because it can make a machine modular."

This means that manufacturing steps and the equipment required for those steps can be easily added or removed as needed, Ocampo said.

To meet the needs of a particular manufacturing application, for example, "you might just connect a module that has three (IndraDrive) MIs, and you’re good to go," he said. "Or if you don’t need that module for a particular product, you just disconnect it, and you’re good to go. That flexibility is part of the industry 4.0 factory of the future that we visualize, and we believe that the IndraDrive Mi is going to be a big part of that future."
MAKING WATERJET PRECISION POSSIBLE

By Joshua Swainston

An abrasive waterjet machine demonstrates its fullest advantages when it cuts complex geometries in a variety of materials. The software package that drives the machine makes the biggest contribution to waterjet utility and overall cost control. Waterjet machines initially used G code, but they exhibit special physics and geometric considerations that traditional cutting methods can't handle. To program the advancements in tapers, corner passing and a plethora of cutting models, some waterjet builders

The evolution of cutting models is displayed from the second to fourth generations of IntelliMax software.

Stainless Steel Drilling and Tapping
The Force M Drill and Blue Shark Tap for easy and reliable drilling and tapping in Stainless Steel.

The NEW Force M drill along with the Blue Ring Shark Tap is the perfect combination if you are looking for high performance drilling and tapping in Stainless Steel applications. Designed specifically for ease and reliability when cutting large numbers of holes.

When you add a Dormer product to your shop, you add our entire team including quality production facilities, reliable delivery and nationwide support. To learn more about how our Drills and Taps can increase your productivity go to www.dormerpramet.com

We proudly manufacture your team of brands

DORMER PRAMET
SAVE TIME • SAVE MONEY
SAVE YOUR MACHINES

Right the first time. Every time.
9000 Research Dr, Irvine, California 92618
(949) 753-1050 • info@cgtech.com
STAYING SHARP

Get With the Program

have moved to more integrated controllers.

A waterjet has three major components: the pump, nozzles and controller. Because a waterjet behaves differently from traditional CNC machine tools, the controller takes on paramount importance. Advanced cutting models enable the software to control the machine’s motion faster and more precisely to generate exactly the result that the programmer intended. With the right controller software, the waterjet OEM focuses on programming as a foundation of the machine tool rather than as an afterthought.

The best waterjet manufacturers develop their controller software in conjunction with their AWJ hardware. Using empirical data on how the jet stream acts in each configuration of nozzle, abrasive and material, software developers can account accurately for what happens at every point along a toolpath. From the data, programmers can produce cutting models to input the precise calculations that are critical to AWJ functionality. The
outcome is a combination of hardware and software that saves money with cutting time, cutting pressure, abrasive consumption, water use and the workpiece material all optimized in the controller’s cutting models.

Omax Corp.’s programmers have worked to hone AWJ cutting through several iterations of IntelliMax software. In the early 1990s, the first-generation software was built on the geometry of how an AWJ behaved. By the third generation, improved processing power and better code capabilities allowed a stronger understanding of corner production and motion control for enhanced cut quality and speed.

The current fourth generation of IntelliMax has benefited from further study of cutting models. Omax has conducted thousands of empirical tests on thousands of material samples to comprehend how an AWJ functions in each case. With the second generation of IntelliMax, an Omax machine could process a gear with eight teeth and a 26” toolpath in 30 minutes. The fourth generation can cut 20 teeth and a...
63" toolpath in the same amount of time.

Evolved software can make a huge difference in efficiency. For example, a 94-ksi intensifier pump with second-rate software cut a 40" toolpath of a Geneva wheel in 50 seconds and consumed 1 lb. of abrasive. A 60-ksi direct-drive pump paired with better software cut the same part in 41 seconds with only 0.68 lb. of abrasive. The time and abrasive savings are obvious, with the improved software complementing the efficient direct-drive pump.

Software progress moves beyond standard AWJ operations. Taper compensation software and hardware, which are options for some waterjets, can position the nozzle at an angle calculated by the software to exactly offset the taper. The taper doesn’t disappear—it simply moves to a scrap area of the material, leaving the part with precisely square edges. With a tilting head, the controller can quicken even straight sections of the toolpath just a little bit by tilting into the cut to improve surface finish with less need to reduce cutting speed. For operators, a click of an interface button enables taper compensation.

When considering waterjet controller software, think about how your business and machine tool will evolve with you. Some OEMs provide free software upgrades so a waterjet always works to the best of its ability.

If you had bought an AWJ with progressive software 20 years ago and made no improvements to the

STAYING SHARP

Get With the Program

— Continuous to interrupted cutting & abrasive materials
— Increased tool life & increased production
— Excellent toughness & wear resistance
— Optimized CBN grain size distribution
— Latest binder technology

FIVES, HIGH-PRECISION TOOLS FOR HARD TURNING

CITCO CiBN577a, the PcBN cutting tool solution

Visit us at SOUTH-TEC, Oct. 22-24, 2019
Booth 639

www.fivesgroup.com
— Cutting Tools | Abrasives
cuttingtools.abrasives@fivesgroup.com
Concord Twp., Ohio - South Beloit, Illinois — USA

machine other than regularly updating its software, you would have noticed your manufacturing time accelerating tremendously with each software upgrade. These increases in speed would have saved money with electricity, water and other consumables. In addition, the growth in software capabilities would have made it possible for you to take on more waterjet cutting work.

In another 20 years, how will your software have improved your waterjetting?

A test part shows corner passing and speed in the fourth generation of Intellimax software.

www.fivesgroup.com
We’ll find you a highly-qualified service technician faster than you can say “advanced analytics-aided, service-matching, algorithm-enabled, communication technology and productivity platform.”

Discover the most convenient way to identify and engage highly-qualified industrial machinery maintenance and repair service providers. Learn More at TheUpApp.com
As you likely know, I’ve been in manufacturing a long time—actually, for over 42 years. I started out loading trucks for a steel supply house in Chicago back in 1977. Not too long after, I learned how to run manual saws and power hacksaws. I picked up how to use manual mills and lathes shortly thereafter. Subsequently, I learned how to run turning centers and machining centers. Those were the days of paper tape and punch cards.

After the early years, I became a CNC programmer, applications engineer and robotics programmer and dabbled in design engineering for a short time. All this was in a five-year time frame. I then was hired as a technical applications engineer for robots and thermal spray systems in Wisconsin. I worked with clients in the medical and dental fields, aerospace, offshore oil platforms and even automotive.

From there, we moved to Maine where I worked as a metal fabrication designer in the medical field. While in Maine, I also worked at a general machine shop programming various parts for different customers. As a manufacturing engineer, I then went to a company that machined parts for the energy field, and I also did more aerospace work.

We came back to Wisconsin after 16 years, and I took some fill-in contract work for a year. I then worked for a company in Illinois while living in Wisconsin. I was the manufacturing engineer and later the machine shop manager.

In 2001, I started writing for a magazine called Cutting Tool Engineering. Maybe you’ve heard of it? LOL. I also wrote for a trade magazine in India for a year.

After working in manufacturing for all this time, I have pulled the plug. I am just shy of 67, and I have retired—sort of. I am no longer in manufacturing. My wife and I have settled in central Wisconsin and are the proud owners of a bowling alley with a bar and grill. We are having the time of our lives. It’s a little more work than we expected, but we are having fun in our golden years.

I would like to take this opportunity to thank my past and present readers for supporting my column and the magazine. To all of you who sent letters to the editor agreeing or disagreeing with my views, I thank you. I could not have chosen to write for a more informative technical trade magazine. I would like to thank Don Nelson, my former editor and former publisher of CTE. Without his support, I doubt I could have started writing, let alone for almost 19 years. I remember the first article he asked me to write. He wanted 1,500 to 2,000 words. I thought that more was better, so I wrote over 6,000 words. We needed a little editing, to say the least. The editor for years now has been Alan Richter. I appreciate all he has done for me over these years. It also has been a privilege writing alongside the other writers in this fine magazine.

So to every one of you, thank you for tolerating my rants and praises about the industry and people in this industry all these years. I consider you my friends and hope you continue to support this magazine. Take care, and may God bless.

Sincerely,
Michael Deren

about the author

Michael Deren was a manufacturing engineer/project manager and a regular CTE contributor. Contact him at mrderen52@gmail.com.
UNLEASH YOUR MANUFACTURING POTENTIAL

DISCOVER WHAT WE CAN DO TOGETHER

The latest machine tool technologies and digital solutions enable your shop to redefine its capabilities and leave the competition behind. Educational resources for your team and support for your most challenging applications keep quality and throughput high. And with access to the industry’s best, you gain the ability to work with peers to push the whole industry forward.

With Mazak as your partner, your shop can stay ahead, with cutting-edge technology and innovation to achieve all these goals and more. Your shop has limitless potential – find out how to unleash it and discover true manufacturing success with Mazak by your side this November at DISCOVER 2019.

DISCOVER 2019
National Technology Center | Florence, KY
NOVEMBER 5-7 & 12-13

Learn more at MazakUSA.com/DISCOVER2019
If you turn and mill workpieces, it’s time to take a hard look at so-called multitasking machines. Capable of both turning and milling, these machines eliminate the need to move workpieces that require both operations from one machine to another, as well as any error that results from the transfer. In addition, multitasking machines reduce setup time and positioning fixtures.

“You’re not making any money when you’re moving parts from one machine to the other,” said Joe Wilker, advanced multitasking manager at Florence, Kentucky-based Mazak Corp. “The only time you’re making money is when the material is in the machine and you’re making chips. So what we say is, pick up the raw material one time, put it in a machine, machine it complete, put it in a box, and ship it. That’s
Maxing Out Multitasking

the concept of multitasking: a single platform for all your machining needs.”

Machining firms that employ multitasking have a variety of choices to make involving both the equipment they use and their approach to this machining strategy. Making the right decisions can help them go beyond the inherent advantages of combining turning and milling in a single platform and truly excel at multitasking.

Not Right for All

Before making these choices, however, potential customers must determine whether multitask
maching is correct for their situations. For one thing, multitasking might not fit into the budget of every company that wants to utilize it. A multitask machine is more expensive than a turning center and a basic vertical machining center combined, and the cost is on par with some 5-axis VMCs, said David Fischer, lathe product specialist at Charlotte, North Carolina-based Okuma America Corp.

Another consideration is the kind of parts a manufacturer makes. “We have heavier-duty multitasking machines, but for the most part they’re made for a lot of finesse and creating complex geometries,” said Robert Appleton, deputy general manager of application engineering at Doosan Machine Tools America Corp., Pine Brook, New Jersey.

So a multitasker might not be the better choice for machining simple parts or extremely heavy parts that require more rigid turning and not much milling. “If you’re making something like a tube for an oil well, you’re
Probably better off with a larger single-purpose machine than you are with a multitasking machine,” Appleton said.

Additionally, multitasking is generally better for small and medium lot sizes because multiple stand-alone machines can apply more spindles to the task.

“If you’re going to do 150 to 200 parts, multitasking is a no-brainer,” Wilker said. “But if you want to do 1,500 in a week’s time, it may make sense to use stand-alone machines. Our Integrex machine might only have a milling spindle and a lower turret, which means it has only two tools in the cut at any given time. But if you use (several) stand-alone machines, you could have three or four spindles going at the same time doing different features.”

A Changed Landscape

If part manufacturers move ahead with multitasking, they will discover that the landscape has changed dramatically in two decades.

“In the early days, a lot of sacrifices were made in order to do both turning and milling on a single machine,” Fischer said. “But across the industry, the technology has progressed and machine designs have changed radically over the last 20 years, so users are making much fewer trade-offs.”

Consider, for example, a basic Okuma turret lathe with milling capability that was on the market 20 years ago.

“These types of machines did minimal milling work and 85% turning,” Fischer said. “But over the years, the systems have improved so that now they can do significant milling.”

‘You’re not making any money when you’re moving parts from one machine to the other.’

Maxing Out Multitasking

Easy to use software
Up to ± 2 µm repeatability
Shop floor ready (thermally stable design)
Industry 4.0 ready
Reduce set-up times by as much as 70%
Modern turning works in any direction.

PrimeTurning™ and Y-axis parting are new turning methods revolutionizing the industry. By making use of the opportunities given by modern CNC machines and challenging conventional machining directions, the gains in productivity and tool life can reach levels unlike ever seen before.

Find out where these innovations will lead you.

#turningreinvented
www.sandvik.coromant.com/turningreinvented
Maxing Out Multitasking

For one, he said, the horsepower and torque of milling machines have increased, allowing heavier cuts. Other significant upgrades include improved software and servo systems, which have boosted accuracy for machining intricate parts. In addition, controls have become easier to use, making complex multitasking machines more accessible to operators.

With Okuma’s Multus multitask machines, “there are virtually no trade-offs at all,” Fischer said. “The turning capabilities are as good as any lathe of comparable size, and the milling capabilities are as good as any mill of comparable size.”

Impact on Tools

The Multus features a turret that rotates around a B-axis so tools can be used in multiple orientations, allowing the creation of side holes, for example. The machine holds up to 180 tools, Fischer said. Even if users can’t put all the tools for their jobs in the machine at the same time, the control can monitor up to 999 tools.

“So if you have to switch out some tools between jobs, the control is managing that to significantly reduce setup time,” he said.

No matter which multitask machine you choose, buy the biggest magazine you can afford, Wilker said. This capability allows users to have more jobs queued up and ready to go.

Additionally, Fischer said a large
Energize your productivity
and experience outstanding predictability with XSYTIN®-1,
the revolutionary phase-toughened ceramic insert grade.

Energetize your productivity
and experience outstanding predictability with XSYTIN®-1,
a revolutionary phase-toughened ceramic insert grade.
Maxing Out Multitasking

Automatic toolchanger holds more backup tools. This is particularly helpful when machining abrasive materials, which quickly wear out tools. When this happens, having backup tools in the magazine allows the machine to continue running.

Appleton said Doosan equips most of its large multitaskers with Coromant Capto C6, a modular quick-change tooling system. Doosan is “very happy” with this system’s accuracy and repeatability between tool changes, he said.

All Doosan multitasking machines can accommodate FANUC Focas and MTConnect. Focas is a set of library files that can access

Mazak’s Variaxis i-Series 5-axis multitask machine (below) cuts a complex curve in a single setup.
almost all the information inside a FANUC CNC. MTConnect is a technical standard for retrieving process information from shop floor equipment. The combination allows manufacturers to monitor processes and make necessary adjustments, Appleton said.

Although multitask machines are mainly for small and medium lot sizes, some users may wish to boost the volume from medium to the medium-to-high range. Wilker said one option for doing so is simultaneous machining performed by an upper milling spindle and a lower turret for turning. While the lower turret machines one side of a part, the upper spindle can machine another side.

Users of multitask machines may also want to check parts for accuracy with a touch probe before removing them from the machine. By measuring parts in line, the probe can spot those that are out of tolerance more quickly than an offline measurement system, thereby preventing more bad parts from being made.

---

**Take control of your deep hole drilling**

Star SU offers stocked carbide tip and solid carbide single flute gundrills

- 24-hour delivery, stock sizes from Ø.039" to Ø.750"
- 72-hour custom delivery, stock sizes from Ø.0937" to Ø1.508"
- Solid carbide twist drills available 30x Ø or to custom lengths
- Solid carbide gundrills: standard and custom designs available
- Two fluted gundrills: milled flutes or double crimp
- Retipping and resharpenering services
- Advanced technical support available

For pricing, sizes or to request a quote, give Star SU a call or visit our website:

248-474-8200  www.star-su.com

---

Mazak
Maxing Out Multitasking

However, measuring parts during the machining process increases cycle time—a sacrifice that some users would rather not make. These users “want their machine to make parts and chips, so they’ll take a part out of the machine and measure it while the machine is making another part,” Wilker said.

Conventional or Conversational

As for programming, Mazak’s Integrex multitask machines offer two options: conventional EIA/ISO programming done using a CAD/CAM system and so-called conversational programming done using a feature called Mazatrol. Mazatrol asks the operator questions about the raw material, cutting tools, feature dimensions and other elements the control needs to know to properly machine a part. When asked a question—for example, “What is the OD of the raw material?”—the operator simply enters the value using a touch screen. Personnel at small job shops can quickly complete this process at the control in much less time than it would take to write an EIA/ISO program to give the same information to a machine, Wilker said.

Mazatrol, which some shops use exclusively, is “definitely preferred from a user-friendliness standpoint,” he said, but the situation is different for some of the bigger machining operations. “They may use Mazatrol when they’re making...”

continued on Page 78

contributors

Doosan Machine Tools America Corp.
973-618-2500
www.doosanmachinetools.us

Mazak Corp.
859-342-1700
www.mazakusa.com

Okuma America Corp.
704-588-7000
www.okuma.com
Longer tool life. Faster speeds and feeds. No delamination. For composites, the AMAMCO Tool Slow Spiral Router, with its custom configurations and CVD diamond coating, can save you both tools and materials.

Call to see if we can configure one for your composite application.

800.833.2239 www.amamcotool.com
If you use a CNC lathe or machining center to set tool lengths, you may want to go offline.

By Kip Hanson

My first article about tool presetting appeared in Cutting Tool Engineering just over two decades ago. Call me Capt. Obvious, but it’s clear that a great deal has changed since then. Five-axis machining centers and multitask machines are now commonplace. And then there’s the big kahuna, industry 4.0, which is changing manufacturing as we know it.

What hasn’t changed is the desire to reduce setup times and avoid expensive crashes due to human error. Considering how quickly machine tools move, their high price tags and their ever-increasing complexity, reducing setup times and preventing crashes are more important than ever. One of the best ways to address these concerns and simultaneously bring much-needed order to the tool crib is offline tool presetting.

Changing Directions

Several industry experts have good news: Compared with the pre-Y2K period, a huge

Haimer USA’s VIO 20|50 linear Microset presetter.
EXPERIENCE THE ECONOMY OF QUALITY

Invest in world-class BIG KAISER tooling, workholding and measuring systems to increase tool life, reduce cycle time and eliminate scrap.

BIG KAISER delivers the most accurate and efficient tooling solutions – guaranteed.

BIG KAISER APP
LEARN MORE AT: bigkaiser.com/bkapp

BIG KAISER
SEE US AT SOUTHTEC 2019
BOOTH 1419

Tool Holders | Boring Tools | Cutting Tools | Workholding | Tool Measuring | bigkaiser.com
number of shops have adopted presetting strategies. The bad news is that a lot of shops still haven’t, preferring instead to waste time and increase risk by using CNC machine tools as overpriced presetters.

Andrew Esposito, sales manager at East Windsor, Connecticut-based Koma Precision Inc., said after eight years of representing the Elbo Controlli line of tool presetters, his team developed a Koma Precision-branded system based on the company’s extensive presetting knowledge. The Prime system was made to Koma Precision’s specifications by a company in Italy and designed as an entry-level noncontact unit for the U.S. marketplace.

Koma Precision offers several other presetter models as well. Features such as autofocus, label printing, network capability and advanced software capabilities are available. Each feature and tier drives up the price point, leading many shops to wonder which system is right for them.

“I would suggest that any presetter is better than no presetter at all,” Esposito said. “So start with whatever you can afford, and work up from there. That’s the
Koma Precision's Prime is an entry-level noncontact tool presetter.

beauty of the Prime, in that it’s quite affordable and easy to use.”

That is good advice, but he’s not the only person to imply that many shops new to presetting tend to underbuy on their first machines before purchasing one with greater capabilities once they see the many benefits. That’s OK because a starter machine often is relegated to the shop floor where it can be used for quick measurements after tools break, for instance.

A return on investment calculation is in order for any equipment purchase, and tool presetters are no different. There’s no need to do math in this case, though—the websites of Koma Precision and other suppliers provide ROI calculators that can prove quickly that even a small shop doing a handful of setups each day frequently recoups investment in months.

about the author

Kip Hanson is a contributing writer for CTE. Contact him at 520-548-7328 or kip@kahmco.net.
“You’re always met with some skepticism early on in the sales process,” Esposito said. “But once you walk someone through it—even using very conservative values—it’s easy to show that payback is quite fast.”

What’s not illustrated by these calculators, however, is risk avoidance. Eliminating just one crash due to a fat-fingered tool offset is easily enough to pay for most presetting systems. He said this is why it’s important to opt for the automatic upload feature on any presetter purchase.

“It doesn’t add much to the price,” he said. “But it can sure help avoid having a bad day.”

Closing the Loop

Matt Brothers, industry 4.0 technology center manager at Zoller Inc., Ann Arbor, Michigan, also wants to change the minds of shops slow to arrive to the presetting party. He agrees on the need to start

Drill with confidence

Star SU’s solid carbide drills are built to your specific design providing precision and quality results.

- Engineered and manufactured to order
- Helical or straight flute
- High performance geometries
- Advanced coating options
- Reconditioning services available

For more information or to request a quote, give Star SU a call or visit our website:

248-474-8200   www.star-su.com
with whatever systems they can afford but is quick to point out some of the less obvious benefits of a tool presetter, such as more effective tool management, simplified programming and reduction of labor costs.

“By implementing a tool management system as part of or soon after a presetter installation, shops are suddenly able to centralize all of their tool-related data into a single database,” he said. “The software can talk to the machine tools, collecting real-time information on tool life, what jobs those tools are used on, their location within the facility and so on. It can share tool lengths and diameters, cutter geometries and assembly dimensions with the CAM system. For those shops with a (quality management system), tool inspection data can be collected from the presetter and used as part of the receiving process. There’s much more to it than tool presetting, even though that remains a very important piece of the overall strategy.”

If you wanted only a simple

---

**It’s cool.**

Lots of machinists your age still wet the bed.

Wet machine beds, soggy clothes, and slippery floors are a common problem in many machine shops, but don’t despair because there’s a solution!

Ditch your flood coolant and try a Minimum Quantity Lubrication (MQL) system from Unist! Wake up to the many benefits of a dry machine bed including clean, dry chips, longer tool life, and no more smelly flood coolant on your skin, clothes or floors!

[unist.com/mql]

---
presetter to cut setup times without having all this other stuff thrown at you, don’t despair. Continuous improvement is a journey, and offline tool presetting is but the first step. You might need a little aid taking it, however. Unless a shop has a software developer on staff, establishing communication with the shop’s various systems means working with a presetter supplier to leverage those systems’ application programming interfaces to get them talking to one another.

This isn’t as difficult as it might sound. Brothers said Zoller already has done so with most commercial CAM and enterprise resource planning systems and has a software development team ready to write whatever interface is required. This team helped develop the company’s »pilot« software version 1.17, which he said includes the ability to handle large datasets—needed for some of the aforementioned functionality—along with enhanced management of 3D tool models.

Zoller developers and engineers also created »cora«, short for collaborative robotic assistant, which is displayed at the showroom in Ann Arbor. He said »cora« is a self-contained tool measurement system. It picks, cleans, assembles, clamps, measures and stores tools and tool assemblies, then automatically places them into a tool cart for dispatch to the shop floor.

contributors
Haimer USA LLC
630-833-1500
www.haimer-usa.com

Koma Precision Inc.
800-249-5662
www.komaprecision.com

Zoller Inc.
734-332-4851
www.zoller-usa.com

Machine flexibility starts here

CNC Grinding Machines for:

• PCD & Carbide Inserts
• Rotary Tool & Cutter
• Special Profile Inserts
• Custom Tool or Part

Call: 951.808.0973

or visit: MachineControlTechnologies.com
sales@machinecontroltechnologies.com

America’s Most Cost Effective And Flexible Tool Grinding Machines
Xtra-tec® XT
Performance and reliability extend your perspective.

Power and reliability in equal measure – a unique experience.
Xtra-tec® XT – the next generation of Walter’s highly successful range of milling tools boasts a remarkable new design feature: The pocket position design for the Tiger-tec® indexable inserts has been modified to deliver considerably more power at the same high level of process reliability.

A new perspective on productivity: Xtra-tec® XT – Xtended Technology from Walter.

walter-tools.com
If you still struggle with the basics of tool presetting, you may not feel ready for an automated tool crib. But know that this level of industry 4.0 wizardry is used by shops every day, and they all started somewhere.

**Realizing Consistency**

Brendt Holden, president of Haimer USA LLC, Villa Park, Illinois, agreed that a great deal of low-hanging fruit exists throughout the manufacturing industry, with tool presetting among the most profitable to pick. This is especially true for the shops most reluctant to jump on board.

“Everywhere we go,” he said, “we hear people say, ‘Well, we’re a small job shop. We don’t need a tool preset.’ But in my mind, they’re the ones that need it the most.”

At OMG we pride ourselves on continuous innovation and quality customer service. Our experience, highly professional approach and wide range of cutting edge products means that we can offer you the best solution for your application. We guarantee everyone will be completely satisfied with our products and service. Especially you.

**Productive Presetting**

OMG North America
802 Clearwater Loop
Post Falls, ID
Email: info@omgamerica.com
Phone: 866-440-8519
www.omgamerica.com
most. They’re doing lots of different part numbers in smaller production runs and probably feeling the unskilled labor pinch the most. Yes, larger shops definitely need a presetting solution also, but it’s often the small ones that will see the most benefits.”

In addition to shorter setup times and risk avoidance, Holden listed such benefits as greater market share due to increased efficiency, improved machine utilization, less scrap, a higher level of process consistency and longer tool life.

That last benefit might be a head-scratcher for some people, but offline presetting actually can extend tool life. Because optical presetters rotate a toolholder during the measurement process—for drills and milling cutters at least—the operator immediately can see any tool runout. As almost all machinists know, runout is a tool killer. Presetters give an opportunity to eliminate this undesirable development outside the machine while it’s busy making parts.

### UNIVERSAL MILLING CUTTER PROGRAM

**SELECTMILL** cutting geometries are optimized to achieve high metal removal rates and long tool life in universal applications. In addition, nearly all the end mills in the **SELECTMILL PROGRAM** have Guhring’s proven FIREX® coating for extended tool life.

- Guhring developed geometries for maximum performance
- Precision ground on specially developed machinery
- The best fine grain carbide substrate, produced by Guhring
- A complete end mill program suitable for most material types

**Unique in PRICE AND EFFICIENCY**

Most industry experts recommend balancing toolholder assemblies for spindle speeds above 8,000 rpm.
Productive Presetting

And don’t forget the other possibilities of an offline strategy. Holden said presetting opens the door to radio-frequency identification tagging of toolholders or to using Haimer’s new HQR-Connect QR coding system, both of which help ensure that the toolholder always ends up in the correct pocket.

Taking tool setting offline also makes shrink-fit toolholders easier to implement. And because some tool presetters also incorporate toolholder balancing, which most experts agree should be done for any tool rotating at 8,000 rpm or higher, tool life and spindle wear and tear are less of a concern.

‘It’s easy to show that payback is quite fast.’
ACCELERATED GROOVING

4 Cutting Edges for High Precision Grooving & Parting-off

Innovative insert pocket protects unused corners

Inserts available in 2 sizes and in a variety of edge preparations and chipbreakers

TC*27 Up to depths of 0.252*

TC*18 Up to depths of 0.138*

Tungaloy America | info@tungaloyamerica.com | 888.554.8394
www.tungaloy.com/us
Heat treating parts in-house in a furnace or an oven offers advantages compared with outsourcing.

By Alan Richter

Time, money and control. Those are three critical elements for any successful manufacturer of precision metal parts. Bringing the heat treatment process in-house by purchasing an appropriately sized furnace or oven benefits part manufacturers in all three.

Which one is most important depends on whom you ask. “I would say that a lot of our customers are starting from the perspective of managing the turnaround time to heat-treat their parts first and foremost,” said Robert Hauser, sales manager at Lucifer Furnaces Inc., Warrington, Pennsylvania. “For larger operations, managing cost becomes an equally important issue.”

He added that typical turnaround time can be as long as two to three weeks when sending parts to a commercial heat-treat company. In contrast, a job shop could heat-treat a small part in as little as 15 minutes in-house if it has the right equipment.

David Harrell, account manager at Knights Corp., Bentonville, Arkansas, which offers Dragon Fire heat-treat furnaces, indicated time and cost as...
Milling Cutter for Aluminum Components

HFC Cutters
- **Increase in Productivity**
  High speeds and feeds with PCD inserts
  Light weight aluminum cutter body
- **Tooling Cost Reduction**
  More insert pockets than the competition
  Insert regrind and re-balance program

Wixom, MI | Toll free: 866-900-9800 | ctinfo@ntktech.com | www.ntkcuttingtools.com
the two biggest benefits for machine shops that perform heat treating in-house. “The third parties, costwise, are going to charge minimums,” he said. “If you just have one or two pieces, they are going to charge an extra $150 to $200 as a minimum.”

Gaining more control of the heat-treat process tops the list for buyers of Grieve Corp.’s furnaces and ovens, according to Yuriy Pospelov, national sales manager at the Round Lake, Illinois, company. “They have more control as they bring heat treating in-house, and they can do it whenever they want,” he said.

Test Run
One option to determine if a manufacturer’s equipment will achieve results similar to those of a commercial heat treater is to have the manufacturer heat-treat a prospect’s part. “Prospects want to see what happens when they put their parts in an oven or furnace for several hours,” said Frank Calabrese, vice president of sales at Grieve. “They send it here, and we run the tests for them.”

Grieve doesn’t analyze the results of the tests but leaves it to the customer to decide if a part has the proper properties, such as hardness and color, after heat treatment.

Harrell pointed out that Knights primarily conducts tests when someone isn’t certain about a specific material or process guidelines are not available. “If it is a standard tool steel, it is a very straightforward process, very much like following a recipe to bake a cake. People see the process’s simplicity, and that’s the reason we don’t do more test parts.”

Hauser concurred that most prospective customers already have
Ramp up MRR and achieve high-quality surface finishes consistently with the new Niagara Cutter™ multi-purpose ST540 family of 5-flute end mills.

The KMTG-27 fire box furnace from Knights is equipped with a guillotine-style door.
adequate knowledge about heat treating and are looking for an equipment manufacturer to help them select the right unit for an application. “Not to oversimplify it, but heat treating is basically time and temperature based on part size and the type of material.”

One important reason for testing parts is when someone is considering purchasing a piece of equipment with a protective atmosphere and wants to get a better picture of what that atmosphere yields on the final result.

Such a chamber would accommodate an inert atmosphere, typically using nitrogen or argon, rather than a regular air atmosphere. To effectively contain an inert gas and keep oxygen from reaching the parts so they don’t oxidize and discolor, the heat-treat unit must have a gas-tight construction, Calabrese explained. This construction includes seams that are welded continuously and a special inert gas fitting.

“It is made to be gas-tight so the atmosphere doesn’t leak out and air doesn’t leak in,” he said.

A worker heat-treats a part in a furnace from Lucifer Furnaces (below). Lucifer’s Model HS82GT-K18 dual-chamber, space-saving furnace (right) is for hardening and drawing HSS and ceramics.
Another way to minimize oxidation while managing equipment costs is to wrap parts in high-grade stainless steel foil, Hauser noted. “They can prevent the scale and oxidation without investing in inert atmosphere equipment, which is considerably more expensive than an air atmosphere chamber.”

System Sizing
Sources agreed that most machined metal parts must be heat-treated or stress-relieved in some manner. “It could be both, or it could be one or the other,” Calabrese said, adding that stress relieving essentially involves annealing or tempering a part, such as a spring, to make it stronger, less brittle and more flexible while slightly reducing its hardness.

When considering bringing the heat-treat process in-house, most people also concurred that companies shouldn’t try to purchase a furnace or an oven to accommodate all the part sizes and materials they need to heat-treat. Instead, selecting a piece of equipment suitable for about 80% to 90% of the parts produced is the most economical approach.

“Oftentimes what happens is when someone tries to accommodate every part size or load weight, they oversize the equipment, and it gets too expensive to bring that equipment in-house,” Hauser said. When a shop properly sizes heat-treat equipment, it should see a return on investment within six
months to a year even if only heat treating once or twice a week, according to Harrell. “It doesn’t have to be high volume for these to very easily justify themselves.”

At Lucifer Furnaces, prices start at around $2,000 for a small bench-top box furnace, for example, and range to $160,000 or more for a large unit, Hauser noted.

Typically, when a company manufactures metal aerospace components, it must meet the AMS20750E specification, which covers pyrometric requirements for thermal processing equipment used for heat treatment. “In order to deliver on that spec, it takes some customization of our equipment,” Hauser said.

That customization includes modifying the high-temperature chamber so there are different zones of heat inside it to better control temperature distribution throughout and silicon-controlled rectifier power supplies instead of magnetic contactors to provide a steadier state of power to the heating elements. And in recirculating ovens, Lucifer Furnaces usually

The No. 934 from Grieve is an 850°F cabinet oven that has 6” insulated walls, an aluminized steel exterior and a stainless steel interior.
supplies a wire-on-rod element design to expose more of the elements in the airflow and seals the front of the oven chamber, Hauser said. “In addition, there is a whole list of specific instrumentation that’s required to meet the AMS specification.”

A gas-fired system costs more initially than an electrically powered one, Calabrese noted, but gas is cheaper than electricity in some areas, and a gas unit offers faster recovery and heats up quicker. “A big electric model would take, say, two hours to heat up; a gas model would be 1½ hours.”

Of course, if a shop doesn’t have a gas line running into its facility, it purchases an electric model. Lucifer Furnaces is one builder of heat treatment equipment that focuses exclusively on electric-powered furnaces and ovens, Hauser said.

As a shop’s production capacity increases, one or more small contributors

Grieve Corp.
847-546-8225
www.grieveCorp.com

Knights Corp.
800-775-1730
www.knightsfurnace.com

Lucifer Furnaces Inc.
800-378-0095
www.luciferfurnaces.com

GET A TOOLROOM WORTH OF VERSATILITY IN ONE SOLID MILL

Rough and finish a wide range of workpiece materials without having to maintain an array of different end mills for each with the universal Niagara Cutter™ ST540 family of 5-flute end mills.

Visit SECOLOCATOR.COM to find your authorized Niagara Cutter™ distributor today.
Lead Generation

You know you need it.

Breathe new life into your business with CPR

CTE Prospect Report

Get LEADS delivered right to your INBOX!

Enroll in a CTE Prospect Report plan today.

Get 25 leads
Get 75 leads
Get 76+ leads
STEEL CARBIDE DIAMOND

Contact your CTE sales team for details!

Scott Beller
East
847-714-0183
scottb@ctemedia.com

Marc Condon
Central/West
847-714-0170
mcondon@ctemedia.com

Dave Jones
Central/West
708-442-5633
dmj_jonesmedia@yahoo.com
furnaces can be added. “From multiple perspectives, including cost, we can do several small furnaces for what they’d be looking at for a large furnace,” Harrell said.

Torch Timeout

Some part manufacturers that are already heat treating in-house opt to purchase their first oven or furnace. That’s because they are using a propane or acetylene torch for the task and want to heat-treat in a safer and more consistent, precise manner.

“Heat treating with a torch is very common,” Harrell said. “Besides our customers who are coming from commercial heat treaters, that is a big piece of where our customers are coming from.”

However, for many toolrooms and job shops, a torch is a low-cost option when time is of the essence. “If push comes to shove and they need something heat-treated fast, they will pull out a torch and heat-treat it as opposed to sending it to their commercial heat treater and waiting weeks,” Hauser said.

Sales of heat treatment equipment to part manufacturers remain steady and a market with significant growth potential. Calabrese estimates that only 25% to 30% of those types of companies have heat treatment equipment in-house.

As more metal parts are 3D-printed, the market is expected to expand. That’s because after a part is printed layer by layer, it must be heated to unite those layers into a coherent mass, Harrell noted. “It is not a full-on heat-treat application. It is more of a sintering application.”

Lucifer Furnaces is also noticing more interest from additive manufacturers, Hauser said. “We have seen an increase in requests from customers who make metal parts through additive manufacturing and are looking for the last piece of the puzzle, which is to heat-treat their parts after they are made.”

Regardless of how a metal part is produced, heat treatment routinely plays a role. “I have not come across an industry that does not in some fashion either need to utilize the service of a heat treater or bring it in-house,” Hauser said.

catemag.com
For more information about heat treatment equipment from Lucifer Furnaces Inc., view a video presentation at www.ctemag.com by scanning the QR code on your smartphone or entering this URL on your web browser: cteplus.delivr.com/23zp9
There are many ways to turn raw materials into usable workpieces.

By Christopher Tate

Raw materials for machining and fabrication arrive in various sizes and shapes. Rarely do raw material dimensions conform to necessary workpiece dimensions, which means that most jobs require some type of cutting activity to produce a workpiece.

Sawing is the most common way to cut a workpiece from a larger portion of material, and the bandsaw is probably the most popular saw at machine shops. Bandsaws come in two varieties: vertical and horizontal. Vertical saws orient the blade perpendicular to the floor whereas horizontal saws have a blade parallel to the floor. Horizontal saws are best suited for bar stock, tubing and structural materials, like angle iron. Vertical saws are better suited for fine work, such as trimming or shaping features in a workpiece, before finishing on another machine tool. Vertical saws are sometimes fitted with CNC tables and used to cut bigger plates into smaller workpieces known as plate saws.

Cold Cuts

Although they are versatile and productive, bandsaws don't always provide the desired accuracy. When that is important, especially with miter cuts, cold saws may be the better choice for cutoff operations. Cold saws use circular HSS or carbide-tipped blades that resemble the circular saw blades found at a wood shop. Being more rigid and less susceptible to walking in the cut, solid blades enhance accuracy.

Abrasive waterjet cutting has few limitations, making it the most universal method for cutting flat stock.
High productivity, slim cost

The NEW Carmex Slim MT delivers improved thread milling performance for an economical price

The new Carmex Slim MT indexable Mill-Thread inserts and toolholders include multiple straight flutes for machining long threads from small to large diameters.

Features include:
• Advanced carbide and coating combination for extended tool life and improved productivity
• Most inserts are double sided
• Nickel coated holders for high wear resistance
• Unique clamping mechanism
• Large variety of holders and inserts

For high-precision mill threading in an affordable package, find out about the Carmex Slim MT line—the mill-threading tools that deliver both efficiency and economy.

Contact your Carmex representative or visit www.carmexusa.com

Carmex Precision Tools Ltd.
The optimal tools for your industry™
Cutting with a cold saw blade is similar to milling, so well-built cold saws have a firm way system, much like knee mills, to ensure that blades are supported sufficiently. The rigid blades and sturdy construction make cold saws more accurate than bandsaws. However, depending on the application, a cold saw might be less productive than a high-quality bandsaw.

Most flat stock is not cut on a saw. Flat materials provide distinct sawing challenges, particularly when materials are thin. Numerous other ways exist to cut flat stock, such as shear and plate.

Cutting flat materials into rectilinear shapes is best done with a shear. Shearing is performed by firmly holding material against a stationary blade while another blade moves against the material, ultimately cutting, or shearing, it. Shearing metal is no different from using scissors to cut fabric. Shears are fast, accurate and inexpensive to operate. Unfortunately, cutting complex shapes is all but impossible with shears.

Thickness also can be challenging. Although shears that can cut 1"-thick material are available, few shops can handle anything over ¾". Shears capable of cutting material over ½" can be expensive, and sheared edge deformation increases with material thickness, which reduces accuracy. So shearing may not be the best choice for thick plates.

Cutting thicker-plate materials and creating complex nonrectilinear shapes require such processes as abrasive waterjet, laser, plasma arc and oxy-fuel. These cutting processes typically are incorporated into CNC tables, many of which are as simple to use as a computer printer.

Molten Metal
Laser, plasma arc, oxy-fuel and similar methods are thermal cutting processes that provide sufficient energy to create a small, molten pool, which is expelled by compressed gases or gravity, along the toolpath. Laser cutting is the most accurate of the processes but the most expensive, and refractive materials, like aluminum, can reflect laser energy back into the machine and damage it. With added safety precautions, lasers offer the ability to safely cut nonmetallic materials, which is a bonus.

Plasma arc cutting is accurate but less so than laser cutting. Unlike
with a laser, plasma arc cutting is not hindered by refractive materials. However, material must be conductive, so nonmetallics, such as plastic, are out of the question.

Oxy-fuel cutting is often the best thermal option for material over 1”. Oxy-fuel cutting systems are inexpensive when compared with other technologies and, like plasma and laser, are less challenged by thick materials. Efficiency does come with drawbacks. Flame-cut parts are less accurate than parts cut by waterjet, laser or plasma and may require significant cleaning before use. Oxy-fuel cutting thick material is also dirty as it creates large amounts of slag. Plus, a great deal of flammable, compressed gas must be kept on hand.

AWJ cutting has few limitations, making it the most universal method for cutting flat stock. It cuts anything that fits under the head and in the stream of water and garnet. Waterjet controls have seen substantial advances in the past decade, and issues with tapered kerf and poor surface finish have been eliminated, making waterjet cutting almost as accurate as laser cutting. Waterjet cutting is also environmentally friendly, producing no noxious gas, slag or hazardous waste to dispose of. Shops that cut a lot of complex shapes and wide varieties of materials may find waterjet cutting the best choice.

All these cutting processes and machines are the most common at shops, but others, such as iron workers, power hacksaws and abrasive chop saws, can be just as effective. As with everything in machining, the most efficient cutting methods depend on the shop and application.
“Where’s the tool? Who hasn’t put it back in the right place? There must be another one somewhere.” This is how Alexander Böthel from Adelmann Metallbearbeitung GmbH described the banter that was almost a daily occurrence and made work unnecessarily difficult. But that changed in February 2018.

Adelmann, Boxberg, Germany, is a contract manufacturer that specializes in the laboratory equipment sector using CNC turning and milling, waterjet cutting and other processes. The company manufactures prototypes, single parts, small batches and large-volume runs of up to 5,000 units in diameters up to 240mm.

Adelmann purchases some of its cutting tools from Arno-Werkzeuge Karl-Heinz Arnold GmbH, Ostfildern, Germany. (Arno-Werkzeuge USA LLC is in Harvard, Illinois.)

Since its start in a garage in 2001, Adelmann has grown to occupy a 2,000-sq.-m facility. The increase in business and additions to the machine pool resulted in a considerable buildup in the number of tools. However, this also meant a drastic rise in tool search times. Furthermore, tools were stored in a locked cabinet. When an employee required a new tool, the foreman had to unlock the cabinet and issue the tool accordingly. “The employee had to explain what job he wanted the tool for,”
Böthel said, “It was bothersome for both the employee and for us foremen. But it was the only possibility to keep at least a little control over the use and location of tools.”

Stocks had to be updated by hand in a list to keep track of items, he added. Twice a month, the cabinets were checked, which took about two hours each time. Machines were frequently down when the right tool was not available. Even test gauges and thread gauges went missing. As a
workaround, tables were posted on a magnet board to indicate the location of test equipment. But this method was prone to error. A change was therefore urgently needed. Adelmann determined that a tool management system was the best solution. Three suppliers presented systems. The choice was made after a visit to Arno-Werkzeuge to see the flexibility of its StoreManager Duo.

The carousel system has over 360 individual compartments combined with four large drawers for managing measuring equipment and bigger items. The other suppliers did not have this capability. The system stores and reorders tools from Arno, as well as other suppliers. Arno offers its latest StoreManager Duo model through a lease purchase agreement, which allows Adelmann to test the system for two years to see whether it meets the company's needs. The monthly rent includes service and maintenance costs, and a free hotline is available to respond to urgent questions.

Arno and Adelmann have collaborated for about 10 years. The level of trust between the companies is high, especially in the advice from Simon Lang, Arno's sales engineer for tool management systems.

Besides time savings, the main argument in favor of a tool management system is tool traceability. Every employee can check tool availability and location on the system's cabinet or a networked PC. The StoreManager Duo can assign various rights to each employee.

The constant availability of tools is another advantage that boosts
Decision-makers READY FOR SELECTION
Rent our list and reach metalworking’s TOP INFLUENCERS!
4 out of 5 CTE readers are managers.
9 out of 10 CTE readers are involved in purchasing products.

CUTTING TOOL ENGINEERING
Contact Julie Distenfield at julied@ctemedia.com for more information about CTE list rental.

Contact Julie Distenfield at julied@ctemedia.com for more information about CTE list rental.
productivity. For example, if a tool breaks, an employee can fetch a tool from the system at any time.

Since the system was introduced, a lot has changed about restocking. If the stock level drops below a predefined minimum quantity, Böthel receives a message. Once a week, he checks the order proposals and sends the prepared orders.

“Although I still have to order by hand, the whole thing hardly takes five minutes,” he said. “It’s an enormous work saving.”

The next step is automated order dispatch. The system at Adelmann works autonomously, meaning that communication is via email or an online shop. “However, it can be connected to the ERP system at any time,” Lang said. “Data is then transferred by CSV file.”

The storage times and replacement cycles of individual tools indicate whether they should continue to be

Alexander Böthel (left) and Simon Lang in front of Adelmann’s two StoreManager Duo units.
stored and reordered in the StoreManager or relocated to an open long-term store.

Storage times also signify where potential savings can be made, what tools are used most and where tests for new tools make no sense at all.

“Storing certain data in the system—for example, cutting data for specific materials—is absolutely no problem and is an additional service,” Lang said. “It’s a simple aid that really helps employees.”

“It saves time in work planning, work preparation and programming; it makes for a smoother workflow,” Böthel said, adding that it ensures reliable work processes in advance and that costs are easier to calculate.

Initially, the number of different tools was grossly underestimated. It did not take long to fill all 360-plus compartments and four drawers. Adelmann had thought one cabinet would be enough but quickly determined that was way off and purchased a second unit. A master cabinet with a monitor can connect to and manage two additional cabinets.

After six months in use, there were only 16 locations free on the carousel and two free drawers. If Adelmann ever wants to upgrade to the StoreManager Pro with up to 2,160 carousel compartments, it would be simple to transfer all the previous data and processes, according to Arno. All systems have equal access to the SQL database. Even an expansion at a different location would pose no difficulty.

“An employee who cannot find a drill in his local StoreManager can send a request over the system (to learn) whether the drill is stocked in one of the other StoreManagers in the network,” Lang said.

‘Where’s the tool? Who hasn’t put it back in the right place? There must be another one somewhere.’
a simple part, but (for the most part) they have a staff of CAD/CAM people programming their machines."

In some cases, this is necessary because Mazatrol can handle only up to 4-axis programming.

“When you get into 5-axis contouring-type programming, you need a CAD/CAM system to generate the toolpath,” Wilker said.

Wherever conventional programming is done, to optimize multitasking, those doing the job should be knowledgeable about more than just a single machining operation.

“Programmers need to be a little more ‘multitasking’ in terms of what they do,” said Jeffery Sturtevant, key aerospace accounts manager at Doosan. “You need people who know good milling practice, good turning practice and how to combine both of them.”

The Multus multitask machine from Okuma has an automatic toolchanger and is available with an optional subspindle and lower turret.

---

### Cutting Tool Engineering

#### Owner

**Name:** Megan Kommes  
**Complete Mailing Address:** Northfield, IL 60093-1213

---

### OIL MIST & SMOKE IN YOUR SHOP?

Low-Cost, Highly Efficient Mist and Smoke Collectors Designed Specifically for the Metalworking Industry

www.mistcollectors.com  
Tel: 1-800-645-4174

---
Ad Index

<table>
<thead>
<tr>
<th>ADVERTISER NAME</th>
<th>PAGE #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Technology Inc.</td>
<td>13</td>
</tr>
<tr>
<td>AMAMCO Tool</td>
<td>45</td>
</tr>
<tr>
<td>ARCH Cutting Tools</td>
<td>49</td>
</tr>
<tr>
<td>Bal-Tec</td>
<td>74</td>
</tr>
<tr>
<td>Beckett Packaging, a div. of MOCAP</td>
<td>48</td>
</tr>
<tr>
<td>BIG KAISER Precision Tooling Inc.</td>
<td>47</td>
</tr>
<tr>
<td>Bluco Corporation</td>
<td>36</td>
</tr>
<tr>
<td>Carmex Precision Tools LLC</td>
<td>69</td>
</tr>
<tr>
<td>CGTech</td>
<td>25</td>
</tr>
<tr>
<td>Clausing Industrial Inc.</td>
<td>37</td>
</tr>
<tr>
<td>Dormer Pramet</td>
<td>24</td>
</tr>
<tr>
<td>Fives Landis Corporation</td>
<td>30</td>
</tr>
<tr>
<td>Fixtureworks</td>
<td>73</td>
</tr>
<tr>
<td>Genevieve Swiss Industries Inc.</td>
<td>56</td>
</tr>
<tr>
<td>GMN Bearing USA</td>
<td>14</td>
</tr>
<tr>
<td>Greenleaf Corporation</td>
<td>40-41</td>
</tr>
<tr>
<td>Guhring Inc.</td>
<td>55</td>
</tr>
<tr>
<td>GWS Tool Group</td>
<td>29</td>
</tr>
<tr>
<td>Haier USA LLC</td>
<td>38</td>
</tr>
<tr>
<td>H.B. Carbide</td>
<td>23</td>
</tr>
<tr>
<td>Hurco Cos. Inc.</td>
<td>21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADVERTISER NAME</th>
<th>PAGE #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iscar Metals Inc.</td>
<td>Cover 2</td>
</tr>
<tr>
<td>J.W. Done Co.</td>
<td>60</td>
</tr>
<tr>
<td>Knoll America Inc.</td>
<td>71</td>
</tr>
<tr>
<td>Koma Precision Inc.</td>
<td>5</td>
</tr>
<tr>
<td>Kyocera Precision Tools Inc.</td>
<td>Cover 3</td>
</tr>
<tr>
<td>Machine Control Technologies Inc.</td>
<td>52</td>
</tr>
<tr>
<td>Marposs</td>
<td>42</td>
</tr>
<tr>
<td>Mazak Corporation</td>
<td>33</td>
</tr>
<tr>
<td>MERSEN</td>
<td>19</td>
</tr>
<tr>
<td>Microcut</td>
<td>76</td>
</tr>
<tr>
<td>MIKRON TOOL</td>
<td>27</td>
</tr>
<tr>
<td>MissileLock.com</td>
<td>26</td>
</tr>
<tr>
<td>Mitte-Bite Products LLC</td>
<td>75</td>
</tr>
<tr>
<td>Mitsubishi Electric Automation Inc.</td>
<td>22</td>
</tr>
<tr>
<td>Morse Cutting Tools</td>
<td>62</td>
</tr>
<tr>
<td>Nachi America (Cutting Tools)</td>
<td>17</td>
</tr>
<tr>
<td>NT USA Corporation</td>
<td>72</td>
</tr>
<tr>
<td>NTK Cutting Tools</td>
<td>59</td>
</tr>
<tr>
<td>Okuma America Corporation</td>
<td>9</td>
</tr>
<tr>
<td>OMAX Corporation</td>
<td>44</td>
</tr>
<tr>
<td>OMG North America LLC</td>
<td>54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADVERTISER NAME</th>
<th>PAGE #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platinum Tooling Technologies Inc.</td>
<td>76</td>
</tr>
<tr>
<td>Pratt Burnerd America</td>
<td>64</td>
</tr>
<tr>
<td>Precision Cutting Tools</td>
<td>15</td>
</tr>
<tr>
<td>PTS GROUP</td>
<td>28</td>
</tr>
<tr>
<td>Quaker Houghton</td>
<td>7</td>
</tr>
<tr>
<td>RoTec Tools Ltd.</td>
<td>16</td>
</tr>
<tr>
<td>Royal Products</td>
<td>78</td>
</tr>
<tr>
<td>Sandvik Coromant Co.</td>
<td>39</td>
</tr>
<tr>
<td>Scientific Cutting Tools</td>
<td>70</td>
</tr>
<tr>
<td>Seco Tools LLC</td>
<td>61, 63, 65</td>
</tr>
<tr>
<td>Star SU LLC</td>
<td>43, 50</td>
</tr>
<tr>
<td>Tapmatic Corporation</td>
<td>67</td>
</tr>
<tr>
<td>TechMet Carbides Inc.</td>
<td>10, 11</td>
</tr>
<tr>
<td>Tool-Flo Manufacturing Inc.</td>
<td>1</td>
</tr>
<tr>
<td>Tungaloy America Inc.</td>
<td>57, Cover 4</td>
</tr>
<tr>
<td>Unist Inc.</td>
<td>51</td>
</tr>
<tr>
<td>Up! LLC</td>
<td>31</td>
</tr>
<tr>
<td>Walter USA LLC</td>
<td>53</td>
</tr>
<tr>
<td>YG-1 Tool Co. Ltd.</td>
<td>2</td>
</tr>
<tr>
<td>Zebra Skimmers Corporation</td>
<td>73</td>
</tr>
</tbody>
</table>

The Advertisers Index is provided as a courtesy to advertisers. Every effort is made to avoid errors, but should one occur, CTE is not responsible.
So-called metallic wood with the strength of an alloy has potential uses in machining, as well as other applications, said James Pikul, whose research team recently published a study on the subject. The researchers built a sheet of nickel with nanoscale pores that make it as strong as titanium but four to five times lighter.

“It can be quite brittle, so on its own it might be difficult to shape,” said Pikul, assistant professor of mechanical engineering and applied mechanics at the University of Pennsylvania. “We are, however, looking at making composites from it that will increase its ductility, in which case it could prove to be a nice workpiece material as the composite should be more ductile.”

Sezer Özerinç of Middle East Technical University in Turkey; Paul V. Braun and William P. King of the University of Illinois at Urbana-Champaign; and Vikram S. Deshpande and Burigede Liu at the University of Cambridge in the U.K. were the main co-contributors to the study. They have researched metallic wood since 2012 but primarily used the material for battery applications.

Pikul said his initial work showed that if used as a current collector in batteries, the material could enable them to have 100 to 1,000 times the power of typical commercial batteries. After that research, he realized that the geometry and chemistry of the material might provide promising mechanical properties. The researchers started studying those properties in 2015, and the report about metallic wood was the result.

“I imagine it can be used as the reinforcing material in a composite,” he said. “It is possible it could be used for machining as it is light and strong and hard, but I think it has more applications as a structural material where the weight matters more.”

The strength of metallic wood can be controlled between 100 MPa and 1,000 MPa, with density between 1,000 kg/m³ and 10,000 kg/m³. The specific strength is comparable to high-strength alloys, Pikul said. The empty space of the pores and the self-assembly process in which they’re created make the porous metal akin to a natural material, such as wood.

The material is a metal foam with very small struts on the order of 10nm to 100nm. The researchers believed that the tiny struts would possess enhanced mechanical properties due to an effect observed in nanopillars. The team was correct, and the strengthening of the metal that occurs when the struts are small is the principal reason the highly porous nickel is able to have such high strength.

The second thing that interested the researchers was the self-assembly fabrication. To make a material with tiny features requires precise engineering, but making a large material with nanometer-level features is really difficult because it requires control over billions of components per cubic centimeter of material, Pikul said. The only practical way to accomplish that is to do what nature does and guide the material to self-assemble, which is how metallic wood is made.

He said it could be available for use in five to 10 years.

“The challenge is there are not contract manufacturers for making nanomaterials,” Pikul said. “So there are additional technologies we need to invent to make a material like this commercially available.”

For more information about the department of mechanical engineering and applied mechanics at the University of Pennsylvania’s School of Engineering and Applied Science, call 215-746-1818 or visit www.me.upenn.edu.

about the author
Ken Schnepf is a freelance writer based in the Chicago area. He can be reached at kjsgdp1@aol.com.

A microscopic sample of the metallic wood.
HIGH STRENGTH FOR HIGHER PRODUCTIVITY

The excellent wear resistant CCX turning grade is built for long tool life when high-speed finishing in soft steel, general steel, and cast iron. The unique design of the CCX cermet grade with a thick CVD coating is difficult to accomplish using conventional technology and provides greater wear resistance at higher cutting speeds.

Check it out: kyoceraprecisiontools.com/CCX
ACCELERATED TURNING

More Robust than Ever

Unparallel Performance in Interrupted Hard Turning Applications

CBN Tip Size: 200% larger for improved wear control in the cutting zone
Brazing Area: 160% larger for enhanced brazing strength

Tungaloy America | info@tungaloyamerica.com | 888.554.8394
www.tungaloy.com/us