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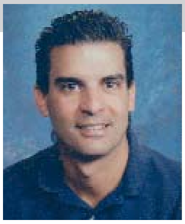
BY MIKE PRINCIPATO



Knock off the knockoffs

Consider these two scenarios.While strolling near Times Square in New York City, a woman spies a street vendor with a table full of handbags that look like the Louis Vuitton models she's lusted after for months, right down to the distinctive logo. For 30 bucks—a fraction of the real thing's price—she buys a look-alike handbag and continues on her way.

Meanwhile, back in your shop, a coordinate measuring machine is tracing the complex profiles of another company's precision-manufactured part, silently digitizing the dimensional data. This information will allow you to produce that part, perhaps at a lower cost than the current manufacturer.

If you're OK with scenario one, you'd better get your moral compass readjusted. And if you're a little uneasy with scenario two, welcome to the Conundrum Club.

The handbag is counterfeit, plain and simple. Made in China, it literally exploits the investment of the original manufacturer in everything from design costs to brand-building expenses. It is, in effect, stolen merchandise.

The precision part being reverse-engineered, well, that falls into a grayer area, doesn't it? If you procured the sample part by honest means and are scanning it for the express purpose of improving upon its design, I humbly submit that you are trying to create a better mousetrap, and, thus, following in the footsteps of ingenious Yankees like Henry Ford and Bill Gates.

The distinction between "counterfeit" and "knockoff" is often blurry, but deserving of your full attention. Here's why.

The vast majority of counterfeit goods sold in the U.S. originate in China. The problem has become so bad that even Chinese government authorities worry that intellectual property originating in China will be counterfeited—by Chinese companies. *Business Week* recently speculated that 5 to 7 percent of all world trade involves counterfeit goods, and that profit margins may be in serious peril.

Why should you care about what seems to be an abstract, global economic issue? Because the plague of counterfeiting is already hurting your shop. And if you hope to one day make the leap from contract manufacturer to proprietary producer of your own trademarked goods, counterfeiting is slowly but inexorably draining away much of the financial incentive to do so.

Think of it this way: If you're one of the thousands of shops whose very existence depends on the economic well being of a relative handful of companies or industries, what's in their best interest is certainly what is also in yours. So if you happen to be making a good living producing motorcycle engine components, say, for Honda, you should be alarmed to know that Chinese counterfeiters sell a "Honda" CG125 for half the cost of the real bike.

Counterfeit goods threaten your livelihood by illegally undercutting the market and profitability of the original products. At best, counterfeits endanger your business; at worst, they endanger unsuspecting buyers who believe the product they've purchased is backed by the engineering, testing, manufacturing quality and warranty of the company that truly built the brand name's reputation.

There's no easy out here, especially for those who produce a brand of manufactured goods or plan to do so. What incentive do you have to sweat the design, engineering, prototyping and marketing of a new product if the odds are strong that it will be counterfeited in months, if not weeks? Answer: About the same incentive a U.S. machine tool builder has right now to conceive, build and risk millions on the next Big Thing. The irony is twisted to the point of being nauseating: The very industry that helped drive America to unprecedented levels of productivity per employee over the past decade is stalled because of fears that the financial rewards of launching a new product will be stolen by a cheap-knockoff specialist.

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Political outrage without a solution is about as common as blue suits in Washington, D.C. So the following are a few concrete ideas for those of you who are as worried about this as I am:

- E-mail your U.S. government representatives. No, I'm not being trite. Members of Congress have e-mail and use it regularly, and it's opened up a whole new world of communication for people like us who've got hectic schedules. A simple message broadcast to every representative from thousands of us, stating "As owner of ABC Manufacturing, I am extremely concerned about the negative impact of the proliferation of counterfeit goods in America …" will get a lot of attention.
- Write a letter of support to your customers who produce branded products, noting your concern over the impact of counterfeits on their business and, by extension, yours. Enclose a copy of the e-mail you sent to your representatives, and copy the letter to the CEO of the company you serve.
- Last—but not least—don't buy counterfeit goods. Every fake Rolex, Burberry and Big Bertha you purchase hurts somebody somewhere in America—including you.

About the Author

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A mirror image

BY SUSAN WOODS,
FEATURES EDITOR

During the sinker electric discharge machining process, an electrode is used to form a mirror image of itself into a metal workpiece, usually to make a mold cavity. As the electrical current passes through the electrode, the energy creates a channel through the dielectric fluid to the workpiece. Each spark melts a tiny part of the workpiece, which is ejected during the discharge cycle, creating the mirror image. Obviously, the electrode must be made from material that resists erosion. Good electrode materials are electrically conductive as well.

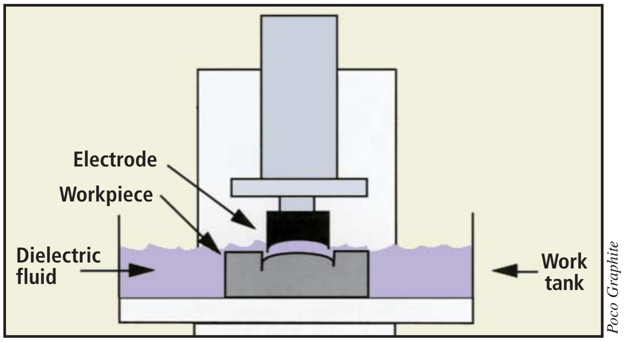
Electrode materials perform differently, depending on the application and workpiece material. Some materials remove metal efficiently, but have low resistance to wear. Others used in the same application may have high wear resistance, but a low metal-removal capability.

Graphite is the most common electrode material. It is easy to machine, conducts electricity and has a higher melting point than metallics. Graphite materials are classified into grades by their average particle size.

Metallics, including copper, copper tungsten, tellurium copper, brass, tungsten carbide and pure tungsten, also work well as electrodes under certain conditions.

When choosing between graphite and metal, specifically copper, for an electrode there are some key characteristics to consider, such as metal-removal rate, wear resistance, ease of machining and cost. For example, a large cavity with little detail requires an electrode that provides a high mrr and good wear resistance. A small cavity with intricate detail requires an electrode with good wear resistance and that is easy to machine.

The ability of an electrode to produce and retain detail (this is resistance to wear) is related to its physical properties and microstructure. Compared to copper, a graphite electrode can be run at a higher mrr in relation to wear rate. Copper's low melting point, approximately 1,083° C, often causes too high of a wear rate in relation to its mrr.



The EDM process.

Therefore, because of the low wear resistance of copper, the number of electrodes needed to complete a mold could be more than the number needed when using graphite.

A graphite's mrr varies according to its grade and operating parameters. Generally, graphite grades that have a small grain size, uniform microstructure and high strength are ideal for producing fine detail and a good finish. Graphite grades with a large grain size are ideal for large mold cavities with less critical detail.

Copper is relatively soft, which makes it somewhat difficult to machine. It tends to tear during machining and can gum up the wheel during grinding. And, edge burrs usually need to be removed by hand, especially when copper is ground. However, the addition of an alloy can make copper more machinable. For instance, adding tellurium to copper enhances its machinability without changing its EDMing capabilities to a great extent.

Graphite is easier to machine than copper and so higher cutting speeds can be used. And graphite requires no manual deburring.

However, graphite is dirty. When cut, its chips take the form of a black abrasive dust, which must be controlled. This dust can enter the machine tool, causing it to wear prematurely.

Also, because of their hardness, some grades of graphite are prone to chipping. To prevent chipping on graphite with extreme hardness or inconsistent microstructure, machinists need to use suitable cutting tools and the correct speeds and feeds. Because of its abrasive characteristics, high-grade carbide cutting tools with a titanium-nitride or diamond coating should be applied when cutting graphite.

Specialized machining centers are available for machining graphite electrodes. These machines often come equipped with a high-speed spindle and dust-evacuation system. An existing machining center can be converted to machine graphite by adding a high-speed spindle, either permanently or one that can be installed and removed when needed.

Generally, when considering the cost of an electrode, there is more to it than just looking at the cost of the basic material itself. In fact, that is usually only a minor part of it. The cost to actually make and use an electrode in a specific application is what is important. The cost per cubic inch of the electrode material is often insignificant when compared to the number of electrodes needed and the machining, EDMing and finishing/polishing time.

40 Years of success

INTERVIEWED BY SUSAN WOODS, FEATURES EDITOR

Thinbit/Kaiser Tool Co. Inc. celebrated 40 years in business last June. Lenore E. Perry, president of Thinbit/Kaiser, Fort Wayne, Ind., discussed how her parents started the company and what she sees in the company's future.

CUTTING TOOL ENGINEERING: How did Thinbit/Kaiser get its start?

Lenore E. Perry: My dad, William H. Kaiser, had a job shop and over the years he found he was always making his own grooving tools. At that time in the late 1950s and early 1960s, no one sold the grooving tools off the shelf in the exact sizes he needed. For a particular size tool, he would have to wait while the supplier made it as a special, and he would have to pay a lot of money for it. This kind of negated what he was attempting to do, which was provide work in a timely manner for not a lot of money. Over time, he decided if he could come up with a way to produce these small grooving tools in 0.001" increments, and have them in stock to where he could ship them in 24 hours, maybe he would have something. That was the birth of Thinbit. My parents started the business in the garage and attic at our house in Fort Wayne. My mom took care of the shipping and office work. It was not a very big house and we had carbide under the beds, in the living room—all over the place.

CTE: When your dad started, was his goal to turn it into a company this size, manufacturing more than 11,000 items?

Perry: My dad is 94 and my mom was 89 when she passed away in 2001. I don't think they ever in their wildest imaginations thought it would turn into this.

CTE: What do you remember about those early days?

Perry: I helped from the time I was little. My first jobs, when I was about 5 or 6, were sweeping the shop and oiling the machines. Then when I could count really well, I counted the bits. Initially, my dad sold HSS inserts only. He would gets sheets of steel, shear them into strips and cut them up by hand. Then he would put them into coffee cans with oil. And because they had just been rough cut, they had slivers on them. It was my job to spread them out newspaper, dump out the cans with the oil and count the bits. I didn't like it because I got splinters in my fingers. I would go to school and I'd have cuts and dirt around my cuticles. Not only was it embarrassing, it hurt!

CTE: How did you come to take over the business?

Perry: I came into the business in 1980. I had graduated from college and was designing computer systems for the medical industry. My parents approached me to see if I was interested in taking over. They were 53 when they started the business so they were getting ready to retire. I am an only child and so if I wasn't interested, they were going to sell it. But it took me almost 2 years to decide. I knew if I decided to do it, I couldn't come in, work for a year or so, and then say 'I'm sorry, but I don't like this.' I knew it was a long-term commitment. My dad retired in 1982 and my mom did the books until about 1986. Doug, my husband, started in 1987.

CTE: What is the key to the success of the company?

Perry: From the very beginning, my parents said 'we always want to produce the highest quality product we can, ship it in the fastest time possible, which was 24 hours, and provide excellent customer service.' And that mission statement has followed through to this day. We still strive to produce the highest quality product. We are always evaluating our manufacturing methods to make sure we are doing things in the best possible way. We have customer service people, and if the level of questions gets beyond what they can handle, the customer can talk to an application engineer. But when the customer calls, they talk to a live person. We also still strive to have 24-hour shipment. Some of our products now take 48 hours, but we work hard to have the items on the shelf so we can ship them out as quickly as possible. And we do ship a lot of products by next-day air delivery.


Lenore E. Perry

CTE: What was one of your biggest challenges and how did you overcome it?

Perry: The recession after 2000 was a difficult time for everyone, particularly manufacturing. But my thought has always been that no matter what happens, you try to make yourself better from it. During the recession, we had to cut some people and change a number of methods to become more productive. We honed our costs to where they are manageable. I believe that we are better at what we do now. We can handle a lot more orders and volume without adding a lot of people because our methods are better. And not that we wouldn't have changed our methods, but maybe not in the manner that we did if not for the recession.

CTE: What is your opinion on the state of manufacturing?

Perry: There is a lot going overseas, no question, but I think we need to take a look at what we do and make it as efficiently as possible. This country will never be able to compete with people who make 50 cents an hour, or day, and have no benefits. That makes it difficult to compete one on one, so you have to get better at what you do and build a name for yourself. I am proud to be an American manufacturer. I would not want to take our business overseas.

BY DR. JEFFREY BADGER

Show your aggressiveness

Dear Doc,

I use diamond wheels to grind carbide drills with a variety of diameters and geometries. When I get a new tool design, I never really know which grinding parameters to use. On top of that, I'm trying to reduce the number of passes. Is there any way to know beforehand which parameters to use so I don't have to waste time finding the optimal ones during setup?

The Doc replies:

A fast and easy way exists to determine fairly accurately which parameters to use. But first, let's start with some fundamentals. In all grinding operations there's a "sweet spot" of speeds and feeds that a given wheel grinds at most effectively. It's based on how aggressive the grinding wheel is attacking the workpiece.

As you grind more aggressively, the wheel wears more and self-sharpens better. When grinding HSS, which is usually performed with conventional abrasives, if you are too aggressive and experience too much wheel wear, it's not a big problem. You just dress your wheel to form and keep grinding. It's not optimal, but it works.

When grinding carbide with diamond, however, grinding too aggressively causes financial trouble. Diamond wheels aren't cheap, and dressing away too much diamond reduces profitability. In addition, dressing a diamond wheel is a more time-consuming process than dressing a conventional wheel.

On the other hand, grinding less aggressively generates less wheel wear. The wheel becomes blunt, which increases forces and heat generation. This, in turn, increases the risk of burn and chatter. When grinding HSS with conventional abrasives, if the wheel becomes blunt you can just dress it sharp. When grinding carbide, however, if you keep dressing a blunt wheel, you'll just waste time and money. Therefore, it is important to set your parameters for carbide just right—at the sweet spot.

Over time, machine operators usually become pretty good at finding the sweet spot. But to grind a new geometry, they have to go through the whole trial-and-error process to find it. To avoid this, you need a rough-and-ready equation to calculate the sweet spot for your parameters. You need to calculate what's called the "aggressiveness number."

This number indicates how aggressively you're grinding, and is calculated using the equation:

$$\text{Aggressiveness number} = \frac{\text{Workpiece speed}}{\text{Wheel surface speed}} \times \sqrt{\frac{\text{DOC}}{\text{Wheel diameter}}}$$

Unlike most equations, the aggressiveness number is practical—and simple. It doesn't matter which units you use—meters per second, feet per minute, fathoms per year—as long as you're consistent. I suggest you take 10 minutes to enter the equation into a spreadsheet. Also, you may want to multiply the result by some constant to generate a number that's not unreasonably large or small.

Archives MNATP, Collection Meillassoux

Let's say you're flute grinding in two passes with a 100mm-dia. wheel running at 20 m/sec. and a workpiece speed of 150 mm/min. for the first pass and 200 mm/min. for the second. The DOC is 2mm for the first pass and 1mm for the second pass. That gives aggressiveness numbers of 1.06 and 1.00, respectively.

Now, let's say you have to grind a drill that has half the diameter and half the total DOC of a drill you know the aggressiveness numbers for. If you just divide the DOCs on each pass by two and double the workpiece speed, you would be in trouble. Using the previous example, your aggressiveness numbers would be 1.50 and 1.41. Grinding that aggressively will quickly wear your wheel away.

But you feel you should be able to go faster because you're not grinding as deep. Then increase the wheel speed. Increasing it to 28 m/sec. will generate the same aggressiveness numbers as before, the ones that were working in the wheel's sweet spot.

Now, let's say you want to combine those two passes into a single pass. If you go with the original wheel speed of 20 m/sec., you will need a workpiece speed of 170 mm/min. to get an aggressiveness number of 1.04. Try it and see what happens. If all works well and you want to cut cycle times even further, increase the workpiece speed again. But to keep the same aggressiveness number, increase the wheel speed accordingly. Just be aware that you're now generating more heat and have an increased risk of chatter.

By taking a few minutes to play around with these numbers on a simple spreadsheet, you'll be able to save a lot of time determining parameters. And you'll be able to make serious inroads into reducing cycle times. What's more, the aggressiveness number works for any grinding operation, not just fluting.

If he's using equations, the grinder who wants to improve things has got to keep it simple. The aggressiveness number is as simple as it is useful. △

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