

► BY BROOKE C. STODDARD

# Making a Mark

Marking systems have new software and hardware for easier use and improved performance.

**N**eed a low-stress marking system for critical components? A dot-peen machine may be the best option. Prefer the electrochemical method but worried about possible corrosion? Many electrolytes now have a nearly neutral pH, so there's less chance of corrosion. Need a method that marks in a variety of fonts and sizes? Then laser marking may be the way to go.

There are numerous ways to mark parts and tools, each with advantages and limitations, depending on the application. In recent years, marking systems have been improved with new software and hardware, making them easier to use, for example, or requiring less operator intervention.

#### Dot Peen

Dot peening is still reliable, according to Rick Pentz, vice president of business development for Dapra Marking Systems, Bloomfield, Conn. In dot peening, an electrically controlled

carbide stylus strikes a workpiece surface, making a cold-formed indentation, or dot. The dots can be formed into letters, numbers or codes.

According to Pentz, dot peening is low stress if applied properly. That means dots are formed without cutting or removing material; the process creates a compressive stress in the dot's root that isn't detrimental to the product. Pentz added that the dots can be made in a range of light or heavy strokes by changing software settings, that dot peen is especially useful for critical components and that, for example, the aerospace industry likes it for many of its parts.

Dot peening's principal advantages are that it makes a permanent mark and the cost is low. Entry-level machines cost \$6,000 to \$7,300. "These are good for job shops," Pentz said.

**Dot peening can be faster overall than laser marking at creating a serial number. The reason is not that dot peen's marking speed is faster, but that the safety parameters with laser marking increase its cycle time.**

"There has not been a good deal of [hardware] innovation with the basic dot-peen machine over the last several years," he continued. "There are better stepping motors and linear guides, but where we have really seen improvements is in the software and in new capabilities."

He noted in particular the effort to make the machines more user-friendly. There are customized graphical user interfaces (GUIs) to make operation more intuitive. And it is easier now to transfer data from a file or a file server. Transferring data means an operator would not have to re-enter it, which could lead to mistakes.

Manufacturers can buy dot-peen machines with a PC or, to save money,

without. Also, some companies hook their PCs through an Ethernet connection directly into their industrial database. The dot-peen machine then works almost like a printer, Pentz said.

Pentz added that the machines are more suitable than those of several years ago at marking nonflat surfaces. "This is especially helpful for forged pieces, draft angles and uneven or round surfaces," he said. Today's ma-

chines are more capable of detecting changing surfaces and adjusting the impact force to achieve a consistent mark depth. Adjusting the force may not be necessary in some industries, but it can be in others. "For example, the aerospace industry has minimum/maximum tolerances," Pentz said. He added that those depth-of-mark tolerances are typically 0.0025" to 0.004" for many aerospace parts.

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His company offers a dot-peen machine that is more portable than earlier models and can be moved on a cart. Dapra is also working toward greater integration of the marking tools so marking can be done in machining centers.

Tom Mackey, president of Monode Marking Products Inc., Mentor, Ohio,

also manufactures dot-peen machines. He noted that not only have the prices dropped, the marking speeds have increased. Dot peening can be faster overall than laser marking at creating a serial number, Mackey said. The reason is not that dot peen's marking speed is faster, but that the safety parameters with laser marking increase its cycle time.

According to Mackey, marking la-

sers use a wavelength that can harm human vision, so operators often use an interlock laser light enclosure for marking. A dot-peen marker might take about a second to make a 1/32"-high, five-digit number and a laser only about a tenth of a second. But fixing the part within a light-tight laser safety enclosure will take twice as long as the 1 or 2 seconds needed to fixture the dot-peen marker, Mackey said.

But echoing Pentz, Mackey said the main improvement has been in software. New software features include database and Ethernet connectivity to send data to the marker and additional features in offline programming. "By working with IP addresses and networking," Mackey said, "an engineer can design a mark at his desk and then send it to the machine."

### Electrochemical

As with dot peening, a noteworthy recent improvement to electrochemical marking is the software used to control it. This allows for easier usage and data input. Dapra also builds machines for electrochemical marking.

**Electrochemical marking is a good choice for thin-walled products because there is no impact and no engraving that might distort the wall.**

Pentz said the chemicals, called electrolytes, have been improved, especially for marking stainless steels and nickel-base alloys. Moreover, the electrolytes can be fine-tuned through the power unit's settings. "If you want a black mark," Pentz said, "you can make it black rather than brown."

Electrochemical marking consists of two processes: etching and oxidizing. Manufacturers can do either to make a mark or can do the two in combination to increase contrast.

Mackey added that many electrolytes have been improved by bringing them closer to neutral pH, reducing the opportunity for corrosion. However,

Mackey said the best recent improvement in the electrochemical industry has been the introduction of inexpensive 2-D data matrix marking. "You purchase the marking kit for under \$700," he said. That includes the power unit, hand-marking supplies and electrolyte but not the 2-D data matrix stencil cutting system or the software.



Columbia Marking Tools

Programmable UID/2D pulsed-laser marking machine from Columbia Marking Tools has a pulsed fiber-laser marking head and Cognex camera mounted in a Class I laser surround enclosure.

In addition to marking up to 1,000 parts per hour, automated systems—machines with digital power units—shift control of etch power and etch time from the operator to a programmable unit. According to Mackey, older analog units allowed operators to vary the power (AC or DC wattage) and the cycle time of contact—that is, how long power was applied to the marking process.

Mackey added that etching surrenders nothing to lasers when it comes to marking speed. "I can mark three or four lines of legend in 1 or 2 seconds, as fast as or faster than a laser can," he said, adding that lasers have not been approved for marking some aerospace, automobile and medical instrument parts.

Pentz said he prefers electrochemical marking for titanium, though laser marking the material is satisfactory so long as it creates an acceptable contrast. He added that electrochemical marking is a good choice for thin-walled products, because there is no impact and no engraving that might distort the wall, and for many titanium aerospace parts, because lasers would

apply more stress than the manufacturers would find acceptable.

### Lasers

Lasers are considerably more expensive than electrochemical or dot-peen marking systems. And Pentz said they are not particularly good on a workpiece that will suffer lots of wear and tear. He cited drilling equipment's "down-hole" parts as an example of

surfaces on which dot peen would be preferable to laser marking, explaining that many down-hole parts specify low stress marking of a kind that dot peen can achieve by applying a stylus with the proper geometry.

But lasers have distinct advantages. For one, they are highly versatile. Lasers can make deep marks—that is, they can engrave—or can make surface marks, annealing the surface metal.

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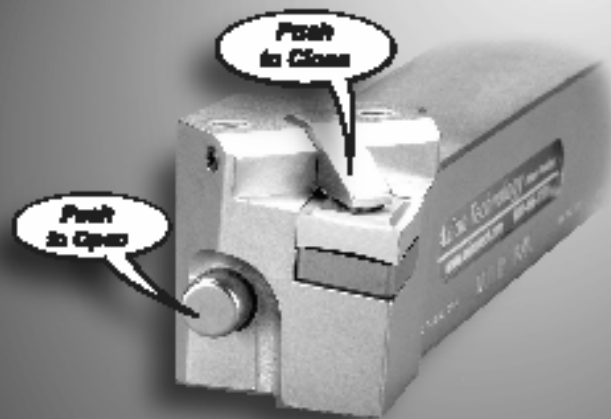
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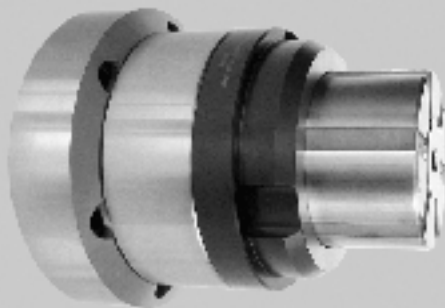
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The deeper the mark, the more time the laser requires. "You can get good depth," said Pentz, "but it takes time. Using lasers can be fast if you merely want a surface annealing for your mark."

Lasers have sophisticated software, the better for making patterns, codes and fonts. But, over the last few years, the software has become more intuitive and user-friendly. For example, Dapra makes special interfaces for graphics and overlays the normal laser software with screens a user would find more friendly.



In the application shown, the UID/2D pulsed-laser marking machine uses a new 20w Sun Matrix high-speed fiber laser marking head to permanently mark 2-D matrix codes and part numbers on rough machined surfaces of cast iron automotive differential cases.



Columbia Marking Tools

Said Bill Bittner, sales manager of Ultra-Dex Tooling Systems, Flushing, Mich.: "The software is now all Windows-based. There is no more coding as for CNC machines, no G and A codes. The interfaces are icon-based; if you want a bar code, you click on the bar-code icon; or if text, then on the text icon. You can train operators on the machines in just a few hours."

The lasers themselves have also evolved. CO<sub>2</sub> lasers for a time were marking workhorses. Then came neodymium-doped yttrium aluminum garnet (Nd:YAG) lasers, which were lamp-pumped. These were followed by diode-pumped YAG lasers, which used less power and whose diodes last longer than the lamps. YAG lasers are still marking well and advancing in technology, but fiber lasers—ones whose light is delivered along an optic fiber—have been capturing market share because, for one, they are less expensive than other lasers.

### YAG Lasers

One end user pleased with its YAG lasers is Muskegon (Mich.) Tool Industries Inc. Until 2 years ago, the toolmaker used an electrochemical marking system, then bought a YAG laser from Ultra-Dex. "We are very pleased with its flexibility,"

## making a mark

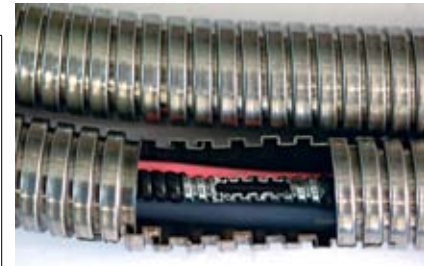
said Gretchen Wheeler, Muskegon Tool's sales and quality manager. "With electrochemical marking, we only had two fonts to choose from. Now we have a wide range of type fonts and sizes we can pick. And we are very pleased with the appearance of the mark; we believe it has made our tools look more

professional."

Wheeler said that with the YAG laser, Muskegon Tool is better able to satisfy customer requirements for text. She added that for Muskegon Tool, the laser is faster than the company's old electrochemical method.

Muskegon Tool is able to clone marks for multiple batches using the machine. The laser is set up in the ship-

ping department; it is not part of the tooling line. "It is very user-friendly and required only an hour's training," Wheeler said. Muskegon Tool can mark on rounded surfaces. "Short text on a radius works fine, but if you have long text, you'll see some fade out," she added. "We mark both axially and radially."



A fiber cable carrier used in a Lasit USA laser marking machine. The carrier features two stainless barriers to prevent damage and breakage of fiber cable.

**Lasers have sophisticated software, the better for making patterns, codes and fonts. But, over the last few years, the software has become more intuitive and user-friendly.**

### Fiber Lasers

Fiber lasers have different configurations than YAGs and several advantages, according to one supplier. There are no mechanical parts inside, thus no mirrors to align or cavities to keep sealed, said Robin Barbero, vice president of Lasit USA in Branford, Conn., a division of Lasit, Naples, Italy, and El En Group, Florence, Italy.

Fiber lasers also consume less power and offer a smaller spot size—Barbero said they can write on the head of an eyeglass screw. For example, a fiber laser with a 4"x4" or 6"x6" field lens can mark on a 0.025"-dia. spot. With advanced software, fiber lasers are capable of marking bar codes, 2-D data matrix codes, serial numbers or graphics. They can anneal at the surface or engrave up to 0.005" deep.

Afzaal Mir, president of FSC Cutting

Tools Technologies LLC, Greenville, S.C., sells YAG lamp-pump, diode and fiber lasers. "Fiber marking is as good as the old marking technology," he said, "but the new generation of laser technology is faster, better, requires less maintenance and offers more control because of improved software and better motors."

Color marking is possible on titanium and stainless steels using a special YAG system with CorelDraw, CorelPaint or AutoCad software to assign color levels.

Bittner said a fiber laser's life is twice that of a YAG's, owing to the pumping source. But the fiber lasers do not have the frequency range of the YAGs. For this reason, some medical and aerospace parts makers still use YAGs for certain applications. "With some medi-

cal applications, you can't have any raised surface at all, so you'd use a very high frequency and a high pulse rate per second," Bittner said. "Doing so anneals the surface rather than engraves it, thus making a permanent noncontact mark that has not affected the part's integrity. A lower frequency and lower pulse rate would be applied for a deeper mark. But for tooling it is a very good

laser. With carbide, you often want a lower frequency because carbide is a hard material. In any event, the mark is permanent, and you could not remove it except by grinding."

Fiber lasers use less power than YAGs; fiber lasers draw energy from 120v wall receptacles. Also, fiber laser prices continue to drop. Pentz said some are in the mid-\$30,000 range for



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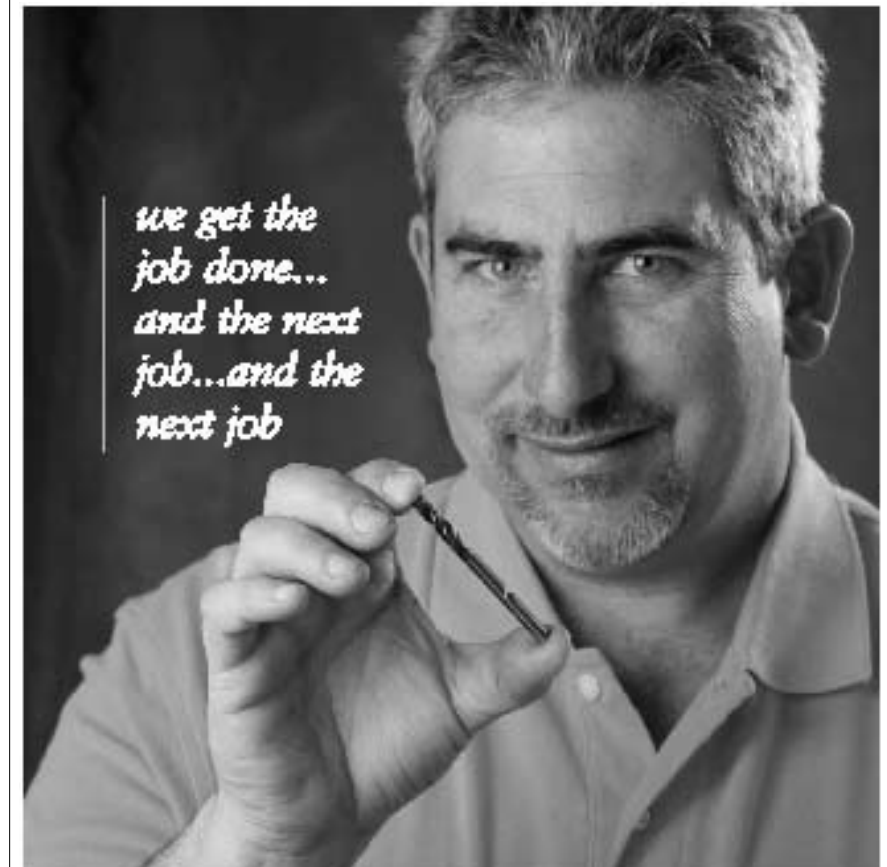
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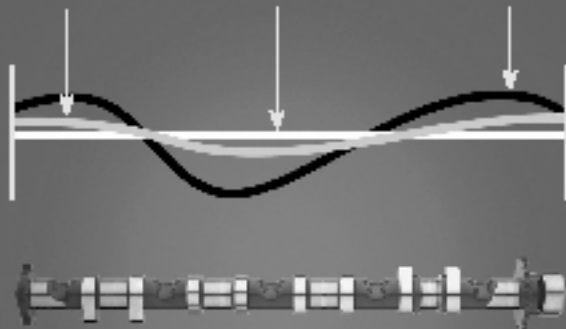
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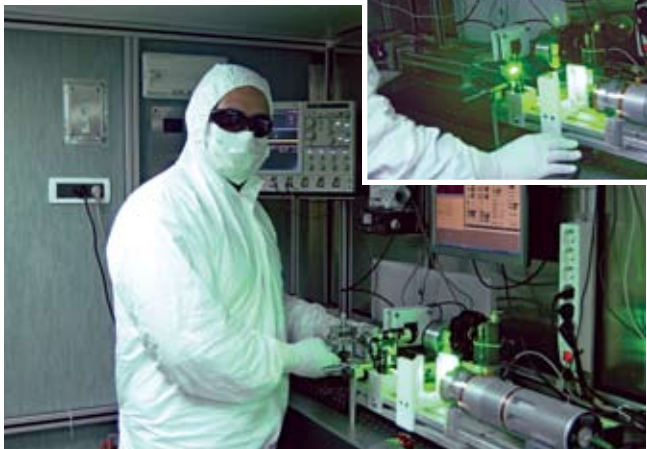
a Class I (user protected) application, about half the cost of 3 to 4 years ago. The reliance on the fiber rather than a diode makes them more reliable. Lasit USA offers a fiber laser machine with a 2-year unconditional warranty. Barbero said the machine is modular and easy to service.

Lasit USA sells a 20w fiber laser that can mark 600 characters per second and that connects to a company's network or a client's PC through a 100MB/sec. TPC/IP connection.

Barbero said one of Lasit's fiber lasers has a 3-axis head capable of marking on areas larger than the common 11.5"×11.5" field. The machine features a scan head that rotates 360°. "This is useful when marking the curved surface of a cylindrical part. The scan head can mark tools in V blocks with 180° coverage without rotating the part. And rotary indexers with W axes are available to completely rotate one or several parts to mark around the circumference."

Jon Burkholder, president of Eagle Bay Distribution Inc., Columbus, Ga., is pleased with his fiber laser. "We couldn't have afforded a YAG, but we could buy the fiber laser.

"Now, instead of outsourcing our marking, we do it in-house and much faster. I mark our pieces—knives for military and law enforcement—



Lasers used in Lasit parts marking machines are manufactured in a clean room.

## Keywords

### dot peen:

Marking system that applies a stylus to a surface, making a low-stress, cold-formed indentation, or dot. Series of dots can be formed into letters, numbers or codes.

### electrochemical marking:

Marking system in which a stencil and chemicals are applied to etch or oxidize a mark into a surface.

### Nd:YAG laser:

Lamp- or diode-pumped neodymium-doped yttrium aluminum garnet laser that can be applied for marking surfaces by annealing or engraving.

## making a mark

almost like using a computer-connected printer. The quality is excellent. I get a preview on the computer screen before the mark is made. There is no problem with fumes, and the machine is small."

Ben Parker, Monode's laser product manager, said laser marking machines are dependable. "We've had a 10w fiber laser working for years in a drill and tap manufacturer and never had any trouble with the laser, though we've replaced the computer several times owing to contamination with cutting oil."

The lasers can be worked into production lines with varying degrees of automation. Fiber lasers are smaller than earlier lasers, Parker said, and their delivery system allows them to operate in areas of vibration, heat (up to 105° F) and high humidity (up to 92 percent), whereas earlier lasers using precise rail alignment seldom held up under such conditions. "The superior fiber laser beam quality is complemented with new software that controls laser pulsing, allowing a 10w pulsed laser to do the work, surface effect, of a 20w or greater lamp-pumped YAG," he said.

"There used to be a lot of skepticism about production marking with lasers," Parker added. "But because lasers are now more robust, they have become more accepted. With more units sold, the price has dropped, allowing non-contact, computer-controlled marking to become mainstream. This has been a huge change." △

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