GETTING THE MOST OUT OF MARKING

Andrew May, director of ES Precision, shares five tips to get the best laser marking results

ES Precision is only two years old, however the three staff that program our eight laser marking workstations have been working with industrial lasers much longer than that – around 75 years – which is certainly enough time to have developed a few 'tricks of the trade'.

Our firm's business is a job shop – we undertake the subcontract laser marking of components or finished goods on behalf of our customers. We are able to mark tiny ID matrices and alphanumerics barely visible to the eye, cut and mark tamper-evident labels, and produce scales or other functional marks on medical devices and automotive parts. We've done this on hundreds of materials, such as metals, plastics, coated products, ceramics, wood, leather.

Laser marks are permanent, high resolution, can have excellent contrast, and can be produced in a variety of ways, depending on the material. Metals such as stainless steel, for example, can either be engraved with depth, which provides little contrast, or instead annealed to generate a smooth, black oxidised surface, providing high contrast. But plastics can either be carbonised, producing a dark mark, or foamed, producing a white mark. For coated materials – such as back-illuminated car dash switchgear or laminated labels – the underlying layer can be seen even after the top layer has been cleanly ablated.

The action of the laser, delivered at high speed by galvo mirrors, depends not only on the material but also on the parameters of the laser selected. Lasers commonly used in laser marking and engraving applications can be solid state (Nd:YAG, fibre; Vanadate) or gas (CO_2). Most operate in the invisible infrared part of the spectrum, but some can be frequency-doubled or even tripled to generate laser pulses in the green or UV part of the spectrum. While certain parameters are intrinsic to the type of laser source being used – the wavelength and maximum power available, for example – others will be programmable during testing – such as the peak power, Q-switch frequency and galvo speed.

Whether you want to get the most out of a laser you already have, or are considering buying a new laser for a particular task, the following tips might help you to improve the results you get:

1. Focus is key. The laser will usually give the crispest, cleanest results only when perfectly in focus, and the tolerance to getting this wrong ('depth of focus') can be as little as 1mm. Double-check the laser is properly in focus if you are unhappy with your results.

"If you want to get the most out of your current laser, or are considering a new laser, these tips might help improve your results"

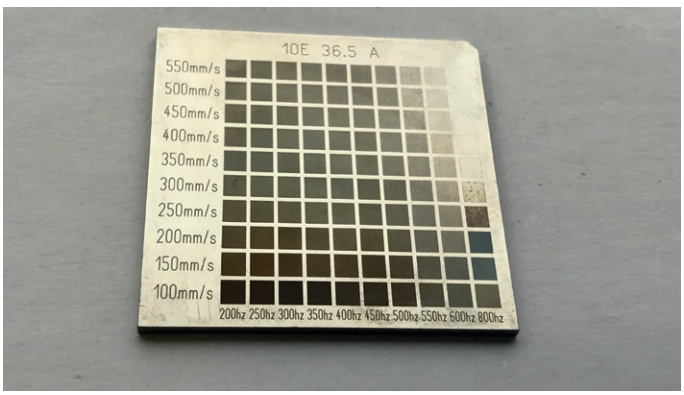

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Figure 1: A test matrix showing the range of possible marks on stainless steel by varying Q-switch frequency (x-axis) against galvo speed (y-axis)

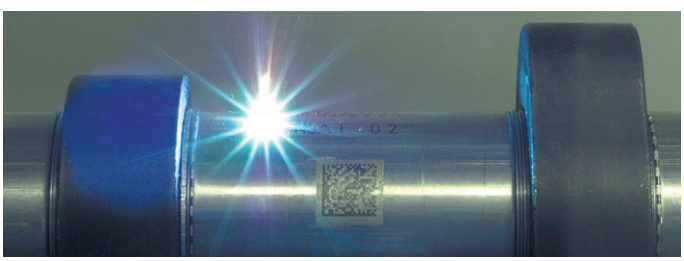

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Figure 2: ID Matrix contrast on metals can be improved by using two passes; one to create a light background and the second to mark the dark code

2. Select the right lens for the task. It is tempting to use a large marking field – why not take a lens so that you can mark anywhere over a larger area? In addition, a larger lens gives the user a bigger depth of focus (see tip 1) – what's not to like? The reason is down to basic optics: doubling the focal length of the lens not only doubles the field dimension, but also doubles the focus diameter of the spot. For a pulsed laser, that will mean that each pulse only has one quarter of the peak power density. That can easily make the difference between an acceptable result and an unacceptable one.

3. Mark a matrix to vary one parameter against another to efficiently test a material's response to the chosen laser. Several different test matrices can be created, but one that is particularly useful is to vary pulse- or Q-switch frequency against galvo speed – see figure 1 for an example on stainless steel.

4. Faster marking can be better – two or more passes, sometimes each with different parameters, can yield better results than a single slower pass in the same total mark time. Deeper marks can be produced with many repeated rapid passes – erosion engraving – rather than one slow, thermally-damaging pass. Another trick that is useful when good contrast is essential, for example when marking a barcode onto bare metal, is to etch the whole region of the code with a mark to lighten up the metal, and then mark the dark bars on top. See figure 2.

3D-MICROMAC FEATURED PRODUCT

Laser contract manufacturing for the production of components for small and large series

3D-Micromac expands its existing product and service portfolio and adds laser contract manufacturing to its portfolio in the field of industrial laser micro machining.

With this strategic step, 3D-Micromac intends to deepen the connectivity with existing and new customers in the development of new laser processing technologies for industrial manufacturing.

'We want to respond to the increasing number of enquiries from customers who do not need their own laser equipment, for example in the field of small-batch production. This gives us the great opportunity to work together with our customers on new solutions. In addition, we can greatly expand our know-how and deepen our expertise,' says Uwe Wagner, CTO at 3D-Micromac.

Contract manufacturing is carried out exclusively on the laser machines of 3D-Micromac. Depending on the requirements, industrial laser systems, as well as versatile development systems, are available in 3D-Micromac's application and service centre.

More information, including some impressions on the processing results, are available at:
www.lasermicroprocessing.com

5. Try out as many different laser types as possible! At ES we have five laser types – Nd:YAG, Vanadate, fibre, CO_2 and frequency-tripled Vanadate. We can therefore choose from a wavelength range of 355 to 10,600nm, and from outputs which are either continuous wave, pulsed or Q-switched. We regularly surprise customers with what we can achieve after they advised that they had tried laser marking and 'it didn't work' – not all lasers are equal!

Laser marking is ubiquitous – even the keys I'm hitting to type this are laser marked (NB – if your keyboard graphics wear off, they'll be screen-printed, not laser foamed). At its best it is an elegant and even beautiful way to finish products and it is unmatched for resolution and permanence. However, we do see sub-optimal laser marking – results that could have been improved with a little extra care and attention, or by choosing a better suited laser for the job.

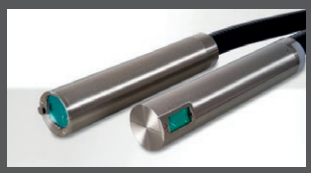
It's not easy to select from the burgeoning range of laser marking technologies out there; today's engineers can even use picosecond and femtosecond laser marking to eliminate thermal damage, if budgets permit.

Anyone considering using lasers on their production line or via a subcontract service, such as ES provides, should pay particular attention to tip 5.

Choosing the best laser is critical, and best quality and throughput are likely to be worth paying a bit more for.

COMMERCIAL PRODUCTS

Among the latest laser marking products is Foba's new Titus vector scan laser marking head, which offers exceptional flexibility in terms of line integration, usability and speed. The head is available with straight-out (0 degrees) or turned (90 degrees) beam exit, and will be part of Foba's new 20W or 30W fibre laser marking systems: Y.0200-xs and Y.0300-xs.



The Titus is just over 20cm long, has a tubular shape, and weighs around 630g. This makes it easy to mount with a clamping bracket, enabling it to be integrated into a wide range of production lines with ease, and while saving up to 90 per cent of the standard installation time required. The system includes an integrated focus finder and pilot laser, which significantly accelerates adjustment of the marking field size.

Also new to the market is Markem-Imaje's ultrafast fibre laser marker, The SmartLase F500, intended to cut the cost and increase the uptime of high-volume beverage can production lines. The SmartLase F500 enhances traceability and anti-counterfeiting efforts by making it easier and more cost effective for manufacturers to put permanent codes on products, even in high speed production environments. It enables manufacturers to print up to 2,400 characters per second on lines running up to 640m per minute.

Through the use of proprietary algorithms, the SmartLase F500 laser can mark surfaces including aluminium and steel beverage cans, as well as many plastics, flexible films, extrusion polymers and bare metals. The precise number of characters and speed depends on the underlying material and message complexity.

Laserax also unveiled three new marking machines this year: the Open-Air Machine (OAM), the Rotary Table Workstation (RTW), and the Rotary Table Machine (RTM).

The OAM is an inline marking machine designed to apply direct part marking in a fabrication process. It is a set-and-forget laser system perfect for adding traceability on parts held by a robot. The robot brings the part to be laser-etched in front of the laser aperture, where safety presence sensors ensure a 100 per cent safe laser marking process. When the marking and quality control is complete, the robot moves the part to the next operation in the production cycle.

The RTW is a semi-automatic marking machine in which parts are manually laid down on fixtures. The operator positions a part on the RTW fixture and launches the machine, the table rotates 180° and the laser marking proceeds. As the first part is being marked, the operator can load a second

part on the rotary table. The operator manually triggers the next rotation, removes the marked part and the cycle starts again. The RTM machine works in a similar way, however rather than an operator loading and unloading parts, this inline system can be serviced by a robot handling the part.

Coherent's latest marking offering is the PowerLine E 8 QT, a sub-system that uses an 8W UV laser to enable high-speed marking of polycarbonates, plexiglass, PMMA and other plastics. It combines modular, high-performance scan optics and a sophisticated software interface to deliver significant operational flexibility. This allows straightforward implementation of complex tasks, such as 3D marking on curved surfaces, on-the-fly marking, engraving and serialisation.