Quick off the mark

Steed Webzell discovers that the latest innovations in laser marking are making a big impression in a world where 'small' is an essential parameter

Part marking systems are deployed so that the life of a component can be traced from initial process through to delivery to the customer. En route, information is recorded in the form of a discreet mark on the part.

Thanks to the development of coding techniques in recent years, the amount of information that can be stored in a mark has increased dramatically and most of the recent advances in marking technology are, thanks to the advent of Data Matrix, a two-dimensional machine-readable 'checkerboard' code, capable of far higher data capacity than a standard single-dimensional linear barcode.

Applying data matrix codes or any other marks can be undertaken using many different methods. However, laser marking is emerging as the process of choice. The advantage of laser systems is the small beam width, allowing manufacturers to mark extremely small parts. Laser marking is also clean, reliable, simple to maintain and has greater durability than many other systems.

Nd:YAG laser marking systems are suitable for use on metals, including hardened steel, as well as plastics,

Protecting brand integrity

Of course not all laser marking systems use a laser to produce the mark, some use coatings that are laser reactive, such as those manufactured by Datalase (formerly Sherwood Technology). The company's latest high speed coding and marking system uses a laser reactive coating that undergoes a colour change reaction when imaged with a CO_2 laser.

Packmark is a patent-pending, coding and marking solution designed for applying high speed, on-demand variable information. Due to the stability of the image produced, this novel solution, which has a wide range of applications relating to coding, marking and tracking and tracing, provides extreme protection for brand integrity.

DataLase Packmark is available via a number of licensed partners and is currently being adopted by a number of companies in the pharmaceutical and manufacturing industries. It works by applying the DataLase additive or coating on to the specific label area of the outer case as the packaging is being produced. On the final production line, a computer controlled CO_2 marking laser 'writes' the required label data on to the mark area causing a reaction that changes the coating from white to black.

Electrox controls the total design of its laser markers. Its Raptor uses its latest development, Enhanced Fibre Technology

producing a high quality mark in a quiet manner. These lasers are optically pumped using a flashlamp or laser diodes, and have become the most common type of laser used for marking purposes.

The Nd:YVO4 laser (Vanadate laser) emits in the same wavelengths as YAG laser, but it has different pulse characteristics that allow it to interact with materials differently. In general, Nd:Vanadate lasers maintain greater power at higher pulse frequencies, which can be very useful in marking materials such as plastics.

More recently, fibre laser technology, a safe, low cost alternative to Nd:YAG, has emerged with notable success. The fibre laser is made of a long fibre optic cable that has a core doped with a rare element that creates a laser beam when it is excited. Fibre lasers typically use a diode laser (the same as used in YAG lasers) to excite the cable by firing the diode laser into one end of it.

The use of a solid state fibre laser source can provide round the clock, maintenance-free operation. Whereas conventional lamp or diode-based laser markers require periodical replacement of non-serviceable parts such as diode bars, there are no such costs associated with fibre laser technology which offers far higher life expectancy.

So what is next? Well, according to Electrox, EFT (Enhanced Fibre Technology) is set to become the new most highly sought platform for progressive manufacturers. The reason? Not only can EFT mark metals and plastics, it also comes with a price tag some 33 per cent less than conventional systems and its diode technology with a four-year warranty, such is the confidence that Electrox has in its new introduction. The diode offers 360,000 hours mean time to failure (approximately 40 years' use), compared with around 600 hours offered by traditional lamp-based systems.

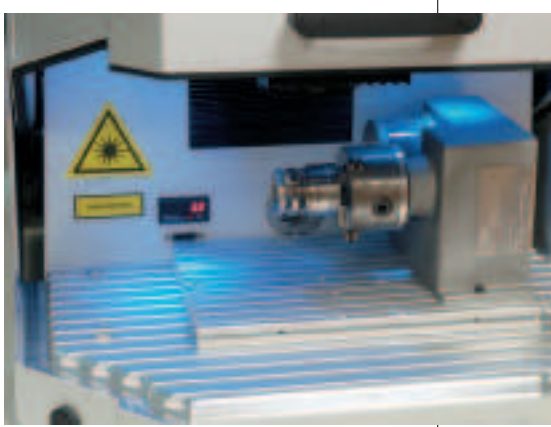
Essentially EFT features fibre optic delivery to the laser head. Here fibre optic energy is converted into laser light using 'secret' new technology to 'handle' the light.

Howard Moore, general manager says: "By applying cutting edge laser principles and an innovative light management system, Electrox has created EF Technology which unites the very best of existing technologies with the very best of the new. With EFT we have initiated an entirely new laser marking configuration to provide a total price-performance package. The first system to use EFT is our new Raptor laser marker that is now available in the UK."

HIGH POWER WITH LOW PULSES

EF Technology provides very short energy pulses – 25 ns compared with anything from 70 to 200 ns in other systems. This enables high peak powers (up to 10 kW) to be combined with low pulse energies that facilitate high contrast, low damage marking on metals and plastics (see also "Last Word", page 56). The highly controllable beam virtually eliminates surface damage around the mark and to

Technifor's new, compact LaserTop 410 measures just 590 by 827 by 806 mm



Trumpf's VectorMark Workstation is compact, flexible and mobile

delicate substrates, enabling EFT to be used for marking components where surface finish and retention of material integrity are paramount, especially in demanding telecommunications and automotive applications.

Near perfect beam quality and exceptional energy stability over the entire operational range mean EFT delivers very small spots, typically 70 µm from a 254mm lens, although smaller spots are possible (down to 25 µm) with high speed, self-tuning digital signal galvanometers. This creates high energy intensities to give a substantially improved performance compared with more traditional systems. The high beam quality facilitates large depths of focus, so laser markers based on EFT are better able to mark complex, curved or awkwardly shaped components. There is no ramping in or out of power and pulse frequencies range from 0.1 to 100 kHz.

The Raptor from Electrox is a compact laser marking system with a very small laser enclosure, incorporating an optical unit sealed to IP67. It is entirely air cooled, eliminating the need for water or refrigerant circuits and takes power direct from a single phase outlet.

Compact, bench-top laser machines certainly appear to be an emerging trend. For instance, with a footprint some 60 per cent less than previous generation models (80 per cent less volumetric footprint), the BenchMark laser marker from HK Technologies can be sited easily on any convenient workbench.

BenchMark uses a solid state fibre laser source providing life expectancy in the region of 100,000 hours. This new technology also presents far lower running costs to the customer thanks to its highly efficient performance. As a result, BenchMark is powered by a standard single phase 240 V supply (drawing approximately 6 A) and is air cooled using integral fans.

The Trumpf VectorMark Workstation 150 has been designed as a compact, mobile and flexible laser marking system while, with workshop space at a premium, Technifor has responded to market demands by introducing a new compact laser marking workstation, the LaserTop 410.

Measuring just 590 by 827 by 806 mm, the other chief benefit of this space-saving equipment is ease of use. The operator selects features with a single click or by scrolling though simple menus. Operator access is also greatly enhanced via the unit's large counter-balanced door which ensures parts to be marked are loaded quickly and easily. Components are aligned using a red pointer and motorised height adjustment with position display.

KEYWORDS FOR DESIGNERS

Simplicity, reliability and accuracy were key words for Technifor design engineers when developing the LaserTop 410. Achieving these objectives, the company says the machine is sure to reach a far wider potential customer base than its predecessors.

Based on the successful TD410, the LaserTop 410 can be used to mark metals, plastics or ceramics. The unit's high efficiency air cooling system gives a diode life of more than 10,000 hours.

Weighing in at 35 kg and having one of the smallest footprints (150 by 25 mm) in industry, the LMS6000 laser marking system from Tyco Electronics offers portability and can be easily relocated for sharing or on-site work.

The new LMS6000 laser marking system is a fully functional and closed loop, ytterbium-doped fibre laser system and capable of marking a variety of flat label materials and direct marking on specific metallic and plastic substrates. In addition, the LMS6000 laser marking system offers true closed-loop functionality by including an in-line mark grading system with error detection capability. The system also features reel-to-reel transportation with integral fume extraction and vacuum hold-down of the workpiece.

An efficient and precise ytterbium laser provides marking resolution up to 1,000 dpi at a marking speed of 2,000 mm/s. Tiny labelling details including compact barcodes and 2D data matrices are common applications for the LMS6000 on materials such as: Al-AN anodised aluminium tags, acrylic coated polyester, polyester, TTVF polyvinyl fluoride, stainless steel, copper, titanium and carbide.

Elsewhere, the latest turnkey laser labeller, Label Marker E from Rofin-Baasel, is designed with the high uptime needs of automotive assembly lines in mind. The key advantages of the special laser etched labels are their ability to withstand weathering and their tamper-evident characteristics.

The labels can resist under-bonnet solvents and temperatures and so are used increasingly to label a variety of assemblies, including engine blocks.

Many people will have noticed the grey or black labels on the inside of their car's petrol filler opening and car door frames – these are normally permanent as they are laser marked on to label stock.

Information such VIN data, fuel type or car tyre pressures is entrusted to such permanent, non-transferable labels for the lifetime of the car. These labels are generally designed with multiple layers and the laser is used to vaporise the top (often black) layer, revealing the lower (often white) layer.

The Rofin laser marker can mark characters on to these labels at a rate of up to 1,000 characters per second, so label production can be incredibly quick.

The new system design is an evolution of the D-line version already in use at many car manufacturers around the world, though it is more compact and is based on Rofin's successful end-pumped 30W E-line solid state laser.□

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