

Seeing the light

Photonics technology opens the door to a multitude of applications, so how can designers tap its full potential? By **Chris Shaw**.

This October sees Coventry's Photonex exhibition showcasing the latest photonics and optical innovations, demonstrating the latest technology and potential applications for the future. But with products ranging from lasers, spectrometers, detectors, optics, fibre optics and contact image sensors, how exactly do you define photonics?

As Mike Biddle, the Technology Strategy Board's (TSB) lead technologist for Electronics, Photonics and Electrical Systems, points out, there is no single magic market either. Photonics covers light generation by lasers or LEDs, transmission and manipulation by fibre or bulk optics, through to the detection in medical sensors or even photovoltaic cells where it achieves the added benefit of electricity generation. So it's no surprise that, according to the TSB, the global photonics market exceeds \$600billion.

Biddle observed: "Our definition covers the highest power industrial laser for cutting thick metal, down to the small semiconductor laser that has revolutionised the way we communicate. It also covers lighting – arguably one of the oldest and most frequent ways that users interact with photonics without realising it – along with the display in your living room or on your mobile phone."

And photonics isn't limited to the visible spectrum – being found in applications from X-rays in hospitals and passive infrared sensors in security lights, to lights in supermarket checkouts. So it's easy to take photonics for granted. Biddle stated: "It is a common misconception that photonics is one of industries that has disappeared from the UK following the dot.com bubble. This is not the case – it has just evolved."

Stuart Sendall, director at Pacer, defines photonics quite simply as the emission, manipulation and detection of light. He



explained: "There may be electronics behind and thermal management galore, but the light is always undergoing one of these three processes." And, he observes, with so many applications, future growth could come from almost any sector. Sendall suggested: "I guess I would see organic LED [oled] for commercial lighting – I believe Thorn Lighting and CDT are working in this area – and plastics based flexible oled displays that cover your wall at home as two of the funky developments coming our way."

Sendall also believes that phototherapeutics will become more mainstream and a less toxic form of healing for degenerative diseases such

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as Parkinsons and Alzheimer's. He explained: "The use of cellular biomedical research also now relies entirely on highly sophisticated photonics based technology to enable early indicators of potential drug and genetic treatment pre-trials on animals." According to Sendall, this process enables the most encouraging cell based results to go forward reducing the risk, time and cost of medical trials.

It appears that photonics needs to play to its strengths. Industrial lasers, for example, are already gaining a foothold in markets where their precision and quality of cutting, etching or marking is deemed superior than traditional technologies.

Products, such as Photonic Products' variable focus industrial laser diode modules, not only demonstrate the strength of photonics technology, but its versatility. The company claims its modules' performance and boresight accuracy is less than 0.25° of the existing range of standard industrial laser modules and designed to be a complete laser solution for

heavy duty manufacturing processes such as micromachining, marking, cutting, drilling, welding, forming, soldering and other industrial laser uses.

Transversely, the company's range of fibre pigtailed and receptacle packaged laser diodes has been designed for scientific equipment and optical instruments requiring a high laser diode light source. Applications range from communications networks, telecoms systems and free space optical communications.

As the company's director of sales David McGuinness confirmed, photonics technology gives designers the freedom to build modules across the board and provide end users with ease of use. "Their compact size allows for easy and efficient integration into existing production systems," he noted. "As laser source, beam delivery, variable focus optical system – OEMs get a complete laser system with Photonic Products' industrial laser modules which can be individually tailored to their application."

Biddle concurred: "By demonstrating this value add, we will improve the adoption of the technology – not because people want photonics – but because it's the solution to their problem or need. We want the industry to recognise this and engage across all of our interventions and not just apply when a competition says photonics on the tin, for example optical sensors for healthcare or emissions monitoring."

Recognising the potential

According to Biddle, it is up to UK businesses to recognise their appropriate part in this global value chain and exploit their photonics innovations to the full commercial potential.

"Consumer applications will grow," he predicted. "Displays are an integral part of more and more devices these days and this trend will only continue, with further integration and more features – smartphones are one example where users expect a new intuitive interaction. It is integration like this that will further open up photonics to the mass commercial market so we should think about how photonics works with electronics, not just about the two individual disciplines."

So as photonics continues to move closer to the consumer, will this also increase the pressure on price? Biddle observed: "We've

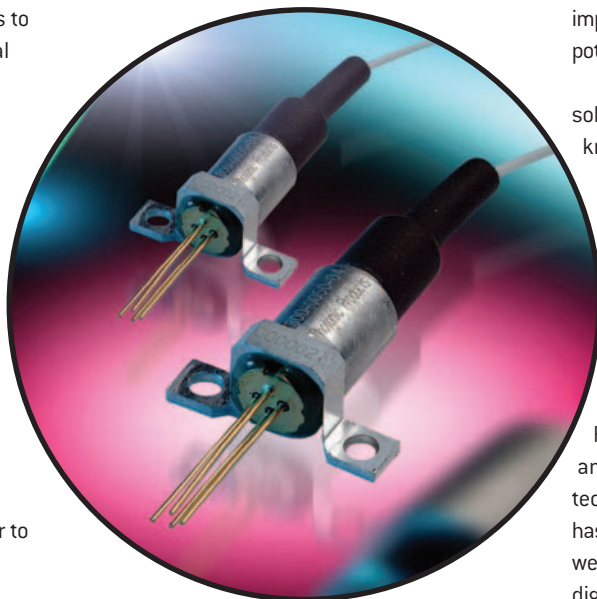


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already seen this trend in the telecoms market and the lcd/plasma display market, to name just two, and this will spread. The industry needs to meet this cost issue head on."

While cheaper components will be part of this, Biddle says that we also need to recognise where to deliver value in other ways: "If we continue with the example of lcd and plasma displays, these typically consume more power than the CRT sets they replaced on our desks and in our living rooms, which does not fit well with the carbon aware era we now live in. Some newer technologies such as oled displays and plastic electronics in general, will have a role to play here and of course they have other benefits



to in terms of flexibility, lower temperature processing and the exciting new opportunities that the technology enables."

Sendall added: "If you look at the UK, it has several leading startup companies working on sensors for very harsh environments such as down hole drilling or turbine system gas monitoring where temperatures are so extreme that passive optical systems have had to be used to sense gases, pressures and strains.

"The temperatures involved require completely new architectures and processes for assembly of the manufacture of parts about to experience 700°C heat at the sensing element, but have conventional technology tucked way back in a more benign environment."

Opening doors

As globalisation, digital communications and the growth of emerging economies present profound challenges to UK business sectors, this opens the door for a number of challenges – or opportunities – to promote UK photonics innovation. Open access to global supply networks and emerging markets is easier than ever, the UK boasts a highly skilled workforce, world class science base and open market philosophy also puts the UK in a strong position. And because technology such as photonics underpins products and services across the economy, presumably this must surely put the UK in a strong global position? Biddle thinks so but warns that more needs to be done – particularly in areas such as reducing energy consumption, enabling intelligent environments, improving communications and exploiting the potential of plastic electronics.

He asserted: "Photonics has a wide range of solutions to problems that people don't even know they have. If we take the energy agenda as an example, the deployment of photovoltaics might be better considered in terms of building integrated systems that reduce some of our daily needs from the grid rather than fields of solar cells connected directly to the grid, which might not be the best use of land in the UK."

Between October 14 and 15, Coventry's Photonex exhibition will allow us to evaluate and speculate the potential for this pervasive technology. And as Biddle affirms: "Photonics has many of the answers to the big questions we all face, especially in this low carbon and digital age."