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Laser scanner helps cyclists win a gold medal at Athens

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ACQUISITIONS

Rofin buys into the US marketplace

Rofin-Sinar, the German maker of industrial laser systems, has been on a spending spree in past few weeks, acquiring three laser firms that specialize in diode, solid-state and CO2 sources respectively.

 Shortly before OLE went to press, Rofin purchased two laser firms in the US for an undisclosed sum in order to expand its presence in North America. The two firms are PRC Laser, a New Jersey-based maker of CO2 lasers, and LeeLaser, a Florida-based supplier of solid-state lasers. Both were owned by Dover Industries, a US conglomerate with an annual turnover of around $4bn (€3.26bn).

 “We are proud to report that we have found two leading laser producers that fit perfectly within the Rofin group of companies,” said Peter Wirth, Rofin’s CEO. “It’s our goal for next year, with these acquisitions, to deliver more than 3000 laser units, and that the new companies will add around 10% of sales to our existing business.”

Peter Wirth, Rofin’s CEO, says that the purchase of Lee Laser and PRC Laser will add 10% to Rofin’s annual revenue.

The news came just one week after Rofin gained ownership of Dilas DiodeLaser by upping its stake in the German maker of high-power diodes from 15% to 95%. The remaining 5% of the shares are held by one of the co-founders of Dilas.

 The Mainz-based firm has 130 employees and an annual turnover of about $26m. It has just received a $4.4m order for its products in North America, via its distributor Osram Opto Semiconductor.

 In total, the three acquisitions will add about 250 employees to the Rofin group and boost its revenues to above the $300m mark.

 PRC Laser and Lee Laser were both founded in the mid-1980s. Each has around 60 employees and between them the two firms have installed an array of 1000 laser units. Their combined sales figure is approximately $30m, of which 35% comes from North America. By comparison, Rofin claims to have 16,000 laser units installed worldwide and in fiscal 2003 reported an annual revenue of $257m.

 PRC specializes in fast-axial-flow CO2 lasers (with output powers ranging from 1 to 7 kW) for applications in the machine-tool industry. It makes around 150 units a year in its Florida factory, and has a European sales subsidiary based in Belgium.

Lee Laser makes lower-power solid-state lasers for cutting and marking applications in the electronics and semiconductor sectors. It makes around 400 units a year from its facility in Landing, New Jersey.

 Rofin says that PRC and Lee have little customer overlap with its existing business and it plans to run the firms as separate entities from its micro and macro groups. Perhaps most significantly, the new acquisitions will help Rofin to penetrate the US market. Currently, just 20% of Rofin’s revenue comes from North America, with Europe and Asia playing a far more important role.

 “These acquisitions reduce our dependence on foreign currencies within our financial figures by about 10%,” Gunther Braun, Rofin’s chief financial officer, told analysts during a conference call. “We want to increase our US presence and have a higher proportion of US-dollar business.”

CONSOLIDATION

Newport unveils Spectra-Physics integration plan

Newport has announced its plans for integrating Spectra-Physics, the company it acquired in July, into its business. The US supplier of test-and-measurement and photonics equipment says that over the next nine months it will be streamlining its operations, bringing annual savings of $12m (€9.77m).

 The company reconfirmed that it expects sales to be in the range of $95–100m in the third quarter of 2004, rising to $105–110m by the end of the year.

 The savings will come from consolidating duplicate product lines, operations and administrative activities in the US and Europe. A Spectra-Physics manufacturing plant in Oroville, California and a Newport facility in Chandler, Arizona are set to close, with their activities moving to other facilities.

 The plans will result in a net reduction of between 75 and 100 jobs across a wide range of functions, representing a 4–5% reduction in the firm’s total workforce.

 “Newport and Spectra-Physics already operated with relatively lean and efficient workforces and have relatively minimal product and operational overlap,” said chairman and CEO Robert Deuster. “The total reduction in headcount is lower than might be expected from an integration of two companies of this size. When completed, we believe these actions will make Newport a more profitable and efficient company.”

 R&D spending of $12.7–13.7m for the third quarter of 2004 will include a charge of $3.2m to write off in-process R&D relating to Spectra Physics. The fourth-quarter spend is likely to be around $10m. Newport expects these factors to generate a net loss in the third quarter of 2004 of between $22 and $25m, rising to around break-even for the fourth quarter.
Kodak shifts focus to the consumer market

August and September have been busy months for Eastman Kodak as the company continues to reshape its business. First, it sold its Remote Sensing Systems (RSS) operations for $725 m (€592.9 m) in cash. Then, less than two weeks later, it agreed to purchase the CMOS imaging business of National Semiconductor, US.

The RSS business, a developer of high-resolution satellite imaging systems and information services that saw sales of $425 m last year, has been sold to US firm ITT Industries. All 2000 RSS employees will be transferred to ITT’s facility in Rochester, which becomes ITT’s Space Systems division.

“The sale of RSS is consistent with Kodak’s digitally-orientated strategy to focus on the consumer, commercial and health imaging markets,” said Kodak’s chief executive officer Daniel Carp. “By selling RSS, we have sharpened our focus on our key growth markets.”

This shift was in evidence again as Kodak splashed out on National Semiconductor’s CMOS imaging business for an undisclosed sum. Kodak says the deal will see it placed as one of the premier developers of both CCD and CMOS devices.

As part of the agreement, Kodak will acquire intellectual property and equipment, and plans to hire 50 employees from National Semiconductor’s Santa Clara site. The assets will become part of Kodak’s Imaging Sensor Solutions (ISS) division, which designs and makes image sensors for professional and industrial imaging markets. Kodak plans to open a new ISS office in Sunnyvale, California, which will be staffed by the former National Semiconductor employees.

“This acquisition accelerates our longer-term goal of providing CMOS devices that offer the image-quality of CCDs while taking advantage of the power, integration and cost benefits associated with CMOS technology,” said Chris McNiffe of Kodak’s ISS division.

INVESTMENT

Japanese firms increase LCD activity

Three well known Japanese firms have forged a joint venture to take advantage of burgeoning worldwide demand for LCD television sets. The collaboration between Hitachi, Matsushita and Toshiba will invest ¥110 bn (€0.817 bn) in building amorphous TFT-LCD panels measuring 23 inches and above.

The venture will commence operation in January 2005 and will build its production line at Hitachi’s Mobara facility in Japan’s Chiba prefecture. Mass production is set to begin in the second quarter of the year ending 31 March 2007 (fiscal 2006). Production capacity will then be expanded, with the collaboration hoping to produce 2.5 million 32 inch TV LCD panels by the second half of fiscal 2008.

The displays will be based on Hitachi’s in-plane switching (IPS) technology. According to Hitachi, IPS results in a wide 170° viewing angle both horizontally and vertically. There is minimal greyscale inversion because the liquid-crystal molecules can rotate while remaining parallel to the substrate.

While Hitachi, Toshiba and Matsushita own the majority of the shares, the companies plan to solicit investment from other firms involved in LCDs, such as device makers and material suppliers.

“Proving further that Japan is getting serious about LCDs, Sanyo Epson Imaging Devices of Japan, a merger between Seiko Epson and Sanyo Electric’s LCD businesses, is to begin operations on 1 October. The new business will make small and medium-sized LCDs for use in mobile phones, digital cameras and automotive applications.

The company will employ 2500 people and anticipates seeing second-half revenues for the fiscal year ending 31 March 2005 of approximately ¥200 000 m.
**IN BRIEF**

**IMAGING**
CEDIP Infrared Systems, the French thermal infrared camera specialist, has opened a subsidiary in Munich, Germany. CEDIP Infrared Systems GmbH will be responsible for promoting, marketing and supporting CEDIP products in German-speaking countries. The new offices will also house a temperature-calibration laboratory and a camera-testing facility.

**FIBRE LASERS**
IPG Laser of Germany has installed a 10 kW, 1 µm fibre laser system at German firm LTZ/SLV Mecklenburg-Vorpommern, based in Rostock. IPG says this is the first commercial shipment of its 10 kW system. SLV says the laser will be used by other German firms and institutions for applications such as pipeline welding, shipbuilding and tailored blank welding.

**FUNDING**
Intense Photonics, the UK maker of integrated optical components, has secured £7.3 m (£18.2 m) in its latest funding round. All of the company’s existing investors are taking part in the new round. The firm plans to use the cash to purchase additional semiconductor fabrication equipment for module packaging.

**LIDAR**
Textron Systems, the US developer of military hardware, has received a $49.9 m contract from the US Air Force Research Laboratory under its Lidar Applications for Vehicles with Analysis (LAVA) program. The five-year program will develop and test high-power laser radar systems for long-range tracking and identification of airborne objects. Textron’s Hawaii Operations will act as centre of the LAVA activities.

**LITHOGRAPHY**
Northrop Grumman has donated in excess of €22 m (€18.2 m) of EUV lithography intellectual property and equipment to the University of Central Florida’s College of Optics.

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**SOLAR CELLS**

**Konarka grabs Siemens’ organic research team**

Konarka Technologies, the US-based developer of polymer solar cell technology (see OLE September 2004 p25), has acquired Siemens’ organic photovoltaic research activities for an undisclosed sum.

The deal unites two of the leading initiatives to create solar cells based on flexible polymer materials. It also gives Konarka a presence in Germany, an important developer and adopter of renewable energy sources.

“The Siemens team showed the first polymer cells with efficiencies above 5%,” said Andreas Brinkroff, CEO of Siemens Technology Accelerator, the firm responsible for commercializing the technology. “Now we look to Konarka, with its strong management team and solid technology base, to secure and leverage the value we’ve created.”

A swell as ownership of Siemens’ intellectual property (IP) in the field, Konarka gains its research team, headed by Christoph Brabec. Brabec will become Konarka’s director of polymer photovoltaic research, while Thomas Grandke, head of materials and systems at Siemens, joins Konarka’s scientific advisory council.

“This [acquisition] puts three of the most recognized pioneers in conductive polymers on the same team, along with our new scientists who have already shown what they can do, achieving some of the highest efficiency levels for plastic photovoltaics yet,” said Konarka’s founding scientist, Alan Heeger. He added: “Konarka has the knowledge, personnel and manufacturing process in place to be the first to apply photovoltaic nanotechnology to viable commercial products that change the way we use electricity.”

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**MATERIALS PROCESSING**

**Indian centre promotes use of lasers**

A new laser centre in India that aims to make the technology more accessible has been opened in the province of Chennai in the south of the country. The centre, known as Laserline Fabrication, will offer materials processing services to customers from the automotive and electronics industries.

The project is the brainchild of Mr Sabarikanth, managing director of Optilase, an Indian distributor of lasers which is also located in Chennai and has been in business since 1994. Optilase currently represents several foreign laser manufacturers, including Canadian firm GSI Lumonics, LS Laser Systems of Germany and Nuvonyx, a US developer of high-power diodes.

“Chennai’s new laser processing centre.

This is the first laser processing centre in India which has a facility to do cutting, welding, drilling and surface treatment on a commercial scale,” said Sabarikanth, who will also manage the centre. “Other commercial centres cater to cutting with a CO₂ laser, but we are the only one to do all types of laser processing under one roof.”

According to Sabarikanth, the centre will initially be equipped with a 500 W Nd:YAG laser (a continuous-wave) model from GSI, with plans to install another one or two before the end of the year.

“I’ve been in the laser business for about 18 years and have been thinking that it needs to be done,” Sabarikanth told OLE. “There are a lot of customers who can’t afford to buy a laser.”

Unlike China, which already has some large laser firms, India’s laser industry is still in its infancy. “There are no laser manufacturers in India,” noted Sabarikanth. “Growth is only starting now.”
Dear Editor,

I read with interest the article by Paul Maclennan in the July/August issue of OLE (p27) on optics and materials used in CO2 lasers. Unfortunately, it did not discuss diamond optics made by chemical vapour deposition (CVD), an important new material in this area. Optics made from CVD diamond, such as output couplers, exit windows or beamsplitters, enable enhanced CO2 laser performance, especially at higher power levels. These benefits include improved beam-quality and increased reliability of the optic in the laser system. Diamond optics for CO2 lasers are typically 1 inch in diameter and 0.5–1.2 mm thick, but sizes up to 4 inches in diameter can be manufactured.

Output couplers For output couplers, diamond is an attractive alternative to ZnSe and GaAs for higher laser powers, as it ensures a high beam quality without thermal lensing or aberrations. Diamond is also an extremely reliable and durable material in this application, so it is very well suited to laser applications where up-time of the system is critical and maintenance should be kept to a minimum.

Beamsplitters Diamond is superior to ZnSe, especially for high-power lasers or high power densities when it is necessary to maintain a high beam quality outside the cavity for both reflected and transmitted beams.

Exit windows These are used in special CO2 laser designs such as SLAB lasers, just outside the cavity where a window is used to transmit the laser beam with a high beam quality and high power density out of the gas chamber. Diamond converts these components from a consumable to an integral part of the investment, which you can forget about for the lifetime of the laser system.

The attractive properties of CVD diamond include:

- Very high thermal conductivity
- Thermal lensing reduced by 200× compared to ZnSe
- High damage threshold
- Used typically ≥5 kW or with high power density from 2 kW onwards
- Same refractive index as ZnSe
- Same AR/PR coatings as on ZnSe
- No maintenance/no replacement required
- High initial cost, low cost of ownership
- Useful wavelength range: >5 µm
- Transmits visible and IR
- Low expansion coefficient.

Thomas Schaich
Area sales manager optics, Element Six BV (www.e6.com)

Paul Maclennan replies:

I should apologize for not mentioning CVD Diamond in my article. It is something we hardly ever encounter in our day-to-day dealings with the laser end-user community and most of the enquiries we receive relate to straightforward component replacement. We perceive the main restricting factor regarding diamond to be cost, although not being able to polish curves onto a diamond substrate adds some practical limitations. In cases where it is possible to use flat substrates, we have taken the view that the main restricting factor to component lifetime is the coating rather than the base material.

Having said that, we are constantly seeking ways to increase component lifetime and would be happy to work with Element Six to the benefit of the laser community at large.

Paul Maclennan
Umicore Laser Optics (laseroptics.umicore.com)

If you have an opinion on any of the stories in this month’s issue of OLE, please e-mail the editor, Oliver Graydon (oliver.graydon@iop.org).
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IR cameras improve train braking

State-of-the-art infrared imaging is optimizing the performance of braking systems on France’s famous Train à Grande Vitesse (TGV) express trains. The French study, commissioned by national rail operator SNCF, involves the infrared camera specialist CEDIP, the brake-pad manufacturer Fler-tex and the National Centre for Scientific Research (CNRS).

As CEDIP spokesman Pierre Bremond explains, for a TGV train travelling at 300 km/h (186 mph) to make an emergency stop within the mandatory 3.5 km each brake disc has to dissipate a staggering 14 MJ of energy within just 80 s.

In order for the train to decelerate safely and effectively, the brake disc needs to manage this heat load efficiently. The generation of excessive “hot spots” could cause parts to deform or fail with potentially disastrous consequences.

“The aim of the study is to better classify and to explain the thermal gradients on the surface of the [brake] disc,” explained Bremond. “Hot spots count among the most dangerous phenomena in frictional parts leading to damage and early failure. These high local temperatures may also lead to unacceptable braking performance such as brake fade or undesirable low-frequency vibrations called hot judder.”

To take a closer look at the performance of different brake-pad materials and brake designs, the team is employing CEDIP’s latest high-speed infrared camera (called JADE). The camera takes an infrared image of a steel brake disc (640 mm diameter, 45 mm thick) in action, effectively capturing a thermal snapshot of the disc showing its temperature distribution and ability to dissipate heat.

Using an experimental rig to simulate TGV rolling stock, temperature measurements were made while the brake disc was spinning and during its braking phase. The team was able to freeze-frame the disc’s motion by reducing the camera’s integration time down to 10 µs.

Operating in the 3–5 µm wavelength at a 200 Hz frame rate, the camera could measure hotspots ranging from 300 up to 1200 °C on the disc’s braking surface.

“Thanks to the high frequency and high resolution of JADE cameras, our observations give new information on the conditions of hot-spot appearance,” concluded Bremond. “Thermal low cycle fatigue may be occurring, and our first results show a relation with the development of cracks on the disc surface.”

SPORT SCIENCE
Scanner helps UK cyclists win medals

Sports engineers in the UK have used a 3D laser scanner to help the country’s Olympic track-cycling team bring home two gold, one silver and one bronze medal from last month’s Olympics in Athens.

Partly funded by a Department of Trade and Industry grant, Sheffield University’s Sports Engineering Research Group (SERG) set up the facility back in 2003 as part of a national programme to give the UK elite sports industry access to advanced R&D facilities.

The group uses a 3D scanning system, ModelMaker, to digitize sports equipment and athletes into a high-resolution surface map. Based around a 5 mW class-IIIa laser, the system supplied by 3D Scanners UK uses a 70 mm scan line to generate more than 23 000 points per second 50 µm apart.

The operator moves the scanner head over the target in a manner similar to spray-painting. “The system can render the surface in real time,” David Curtis of SERG told OLE. “You can see where you’ve missed points and quickly go back and rescan.”

Working on the principle of laser-stripe triangulation, a camera set at an angle to the target surface logs variations in height by detecting changes in the shape of the scan line. From a cycling perspective, the scanner provides an elegant way of integrating the rider and the bike into an aerodynamic model.

With gold medals riding on a fraction-of-a-second’s advantage, it is essential to optimize the aerodynamic performance of the bike and rider. “The split is around 66% rider, 34% bike,” added Curtis. “Because it is very hard to alter a rider’s physical shape, the team’s focus is on getting a rider into a position that optimizes biomechanical performance as well as being aerodynamic.”
Researchers are now able to take a much deeper look inside living organisms, thanks to a state-of-the-art fluorescence microscope that has been developed by scientists at the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany (Science 305 1007).

Using a method known as selective plane illumination microscopy (SPIM), the team has managed to image living fish and insect embryos to depths of up to 0.5 mm and with a resolution of better than 6 µm. The set-up is compatible with conventional microscope objectives.

Thick biological specimens present a challenge to researchers using existing optical imaging techniques, owing to the absorptive and scattering properties of such organisms. “Over the years we’ve seen current microscopes falling short of what scientists need,” EMBL scientist Ernst Stelzer commented. "This new microscope is easy to build, is about one-third the cost of current technologies, and gives scientists improved resolution by a factor of about five."

Importantly, unlike rival techniques such as confocal laser scanning microscopy, using this method means that only the focal plane under observation is illuminated and therefore exposed to photo damage. As a result, SPIM is able to generate a sharp image by eliminating out-of-focus fluorescence.

A thin light sheet from either an argon-ion or HeNe laser illuminates the sample, which is embedded in a cylinder of agarose gel immersed in an aqueous chamber. The microscope’s objective lens, with its optical axis at right-angles to the light sheet, dips into the chamber and collects fluorescence from the sample.

"We use a high-precision four-axis (xyzθ) motor to move the sample through the fixed optical system,” Stelzer told OLE. “Power is below 4 mW per light sheet — that is, about 4 µW per line or pixel.” The team reports no detrimental effects on the living organisms when imaged over three-day periods.

EMBL scientists have used SPIM to examine the heart of a Medaka fish embryo, a structure that is hard to image because of a surrounding yolk sphere. Using a fast-frame technique, they recorded moving images of the heartbeat. The team claims that previously this could only have been demonstrated at stages when the heart was exposed, or by cooling the embryo to reduce the heart rate.

Stelzer hinted to OLE that there had been some interest in commercializing the set-up, but refused to reveal any more details.

Taking a closer look: EMBL's selective plane illumination microscopy (SPIM) set-up (left) can image to depths of up to 0.5 mm with a resolution of 6 µm. Scientists have used the technique to study Medaka fish embryos without detrimental effects (right).
Tiny dye laser suits lab-on-a-chip

Scientists in Japan have used a femtosecond laser to fabricate a tiny dye laser that is embedded in a block of glass (Optics Letters 29 2007). The development could represent a step towards cost-effective "lab-on-a-chip" devices that use miniature optical circuits to analyze liquid samples.

"The laser could be used as an optical source for analysis like absorption or fluorescence spectroscopy," said team member Koji Sugioka from the RIKEN research institute in Saitama, Japan. "We have already succeeded in fabricating some 3D micro-reactor structures in the same glass, and we can easily integrate them and the laser into a single glass chip."

At the heart of the laser is a miniature rectangular dye chamber (200 µm deep and about 600 µm wide/long) that lies 400 µm beneath the surface of the glass. This chamber is surrounded by four 45° hollow micromirrors. A central hollow bore channel is used to inject laser dye into the chamber. The hollow structures are made by illuminating photo-etchable glass (Foturan from Schott Glass) with 145 fs pulses from a 775 nm laser operating at a repetition rate of 1 kHz. The glass is then baked before the laser-exposed regions of it are selectively removed by etching with an acid solution. Finally, the etched sample is baked again. The dye laser viewed from above and a schematic of its operation. The tiny (less than 1 mm wide) square dye chamber and four micromirrors can clearly be seen.

Sugioka and his colleagues Yajun Yu and Ken-Ichi Fujii from the RIKEN laboratory in Tokyo have already succeeded in fabricating a micro 3D micro-reactor structure of about 1 mm wide/long that lies 400 µm beneath the surface of the glass. Four different laser dye solutions Rh6G, Rh640, Rh660 and Rh670 were pumped into the chambers, each micro cell was filled with the different laser dye solutions Rh6G and Rh640.

"The passive mirror was a carbon-fibre composite (CFC) mirror weighing 10 times less than their glass ceramic counterparts are being developed in the UK. It is hoped that the technology will ease the transportation of telescope mirrors to remote mountain-tops, and save valuable weight on satellites."

The project team expects to receive its first active CFC mirror this month. With some doubts being aired regarding the long-term stability of composite materials, the group is on a mission to win over industry sceptics.

Managed under the Smart Optics Faraday partnership, the two-year £185 000 (€270 000) programme is a collaboration between University College London's (UCL's) Optical Science Laboratory, QinetiQ and Cobham Composites.

The group already has a 30 cm-diameter CFC passive mirror that was manufactured at Cobham's site in Leicestershire, UK, at the end of last year. Weighing just 497 g, it has only 10% of the mass of an equivalent Zerodur mirror. The mirror's 150 µm-thick Ni layer was ground and polished back at UCL to give a smooth surface with a roughness of just 4 nm.

The moulded passive mirror design features alternate layers of composite and aluminium honeycomb. The honeycomb geometry, common in space technology, helps to stiffen the mirror and protect it against launch forces of up to 5 g.

With its strong interest in satellite systems, project partner QinetiQ is eager to exploit CFC's payload advantage. But as UCL researcher Sarah Kendrew told OLE: "It's not just about space." The mirrors could also benefit unmanned airborne vehicles, helping to lighten their surveillance environment-monitoring payload.

Being lightweight and robust, CFC mirrors have clear advantages over more established materials such as print-through, the team was in a position to kick-start stability testing and roll out an active or "adaptive" design.

A adaptive optics, which corrects for optical aberrations induced by the atmosphere, is set to play a vital role in upcoming extremely large telescopes such as the Anglo Australian Telescope and the Overwhelmingly Large Telescope.

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OLE • October 2004 • optics.org
Researchers look inside a laser pulse

By Belle Dumé

The oscillation of the electric field in a laser pulse has been measured for the first time by physicists in Austria and Germany. The technique could be used to study ultrafast dynamics in atoms and molecules (Science 305, 1267).

Ferenc Krausz and co-workers sent a 250 attosecond EUV pulse into a gas of neon atoms, along with the longer femtosecond pulse that they wanted to measure. This second pulse contains only a few cycles of the electromagnetic field.

The attosecond pulse ionizes the neon atoms, and the electrons that are released are accelerated by the electric field of the longer pulse. The duration of the electron bunch is much shorter than the timescale over which the electric field of the femtosecond pulse changes.

The energy of the accelerated electrons depends on the strength of the electric field in the femtosecond pulse. By varying the relative timing of the two pulses and measuring how the electron energy changes, it is possible to build up a picture of the electric field in the longer pulse. The method reveals that the light pulse is 4.3 fs long.

Belle Dumé is a science writer at physicsweb.org.

Nanotechnology

Nanowire waveguides supply the missing link

By Liz Kalaugher

While nanowire devices that can emit light and detect photons are already available, nanowire waveguides have so far proved elusive. Now, scientists in the US have used nanoribbons of crystalline oxide to channel light between devices.

“In the past couple of years we have demonstrated nanoscale lasers and detectors: what is missing is an element that could link these individual components together,” Peidong Yang of the University of California, Berkeley, and Lawrence Berkeley National Laboratory said. “A sub-wavelength optical waveguide is exactly what’s needed for this purpose. So we tested these ultralong nanowires as a possible candidate – it turns out that they can serve as a very good optical waveguide with low optical loss.”

Yang and his colleagues used nanoribbons of crystalline oxide (SnO2) as waveguides. Thenanoribbons were up to 1 500 µm long and rectangular in cross-section, with sizes from 1 5 × 5 nm to 2 × 1 µm. According to the scientists, many of the ribbons were 100–400 nm wide and thick, which is an optimal size range for the efficient steering of visible and ultraviolet light within a subwavelength cavity.

As well as being capable of channeling visible and ultraviolet light with little optical loss, the nanoribbons were highly flexible, despite the brittleness of bulk SnO2. That enabled relatively easy manipulation, optical linking and assembly.

The researchers injected light into a nanoribbon cavity from an optically pumped zinc oxidennanowire, and used another one to detect photoluminescence electrically from a nanoribbon.

“We are mostly interested in integrating these waveguide components into a fully functional photonic circuit to carry out on-chip optical computing or in applications such as chip-based chemical/biological detection,” explained Yang.

The team now plans to work on integrating nanowire components. “We are now pretty good at making such nanostructures to perform individual optical or electrical functionality,” explained Yang. “But we are at an early stage in terms of a fully functional system using nanowire building blocks. This is the direction that requires much more effort.”

Liz Kalaugher is editor of nanotechweb.org.

Sources

Polymer holey fibre can lase in the red

Scientists from Australia have made a pulsedred laser by doping a microstructured polymer fibre with the dye Rhodamine 6G. The prototype, developed by the University of Sydney and Macquarie University, emits up to 16 µJ/pulse at 631.9 nm and has a lifetime of 130 000 shots at a 10 Hz pulse rate (Optics Letters 29, 1882).

Rather than adding the laser dye to the initial monomer, the team uses a simple way of doping the fibre pioneered by colleagues at the National Chemical Laboratory, India, and the University of Sydney. “The breakthrough came with the solution-doping technique which allowed us to dope the polymer very easily at the preform stage, simply by passing a solution of the dye through the holes,” Sydney University researcher Alex Argyros told OLE. “It only adds about 5 min to the usual fibre fabrication time.”

By exposing the microstructured fibre to a saturated solution of Rhodamine 6G dye in acetone for 30 s, the larger dye molecules were able to move into the polymer (PMMA) matrix. Heating the fibre at 90°C for 16 h helped the dye diffuse evenly throughout the core region, giving a final dye concentration of around 1 mmol/l in the core.

When pumped by 532 nm, 10 ns pulses from a frequency-doubled Nd:YAG laser, the fibre started to lase. The raw cleaved ends of the fibre act as cavity mirrors. The team says that the laser’s linewidth of about 0.5 nm is much narrower than the values reported for other PMMA-R6G systems.

Analysing a 1.5 m length of fibre, the group reports a threshold of 20 µJ and a slope efficiency of 18%. The maximum output of 16 µJ/pulse, corresponding to a peak power of 2 kW, is limited by the estimated 13 GW/cm² damage threshold of the polymer. The researchers are now keen to produce a tunable version of the laser by adding gratings to the fibre.
A quantum cryptography system is the last thing you would expect to find in a sewage system. But under the streets of Vienna in Austria, a group of scientists has installed optical fibre and performed a quantum secure bank wire transfer (Optics Express 12, 3865).

"The exposure of the fibres to realistic environmental conditions, such as stress and strain during installation as well as temperature changes, were important features of this experiment," Andreas Poppe and his colleagues report in their paper. "The successful operation of the system shows that it works in a realistic quantum cryptography scenario."

The system consisted of a transmitter (known as Alice) at Vienna’s City Hall and a receiver (Bob) at the headquarters of an Austrian bank. The sites were linked by 1.45 km of singlemode optical fibre. The team used an entangled-state quantum cryptography system. Entangled photons are unpolarized while they travel and only assume a polarization state when measured.

At Alice, a 405 nm laser diode pumps a nonlinear BBO crystal which produces entangled photon pairs at 810 nm using type II down-conversion. One of the photons is locally analysed in Alice’s detection module (four silicon avalanche photodiodes), while the other is sent over the 1.45 km link to the remote site (Bob). "There was also a synchronization signal indicating every sent photon," Poppetold OLE. "The exchange of needed photons lasted about 30 s and then the key was ready."

Poppe and colleagues are now working on a 1550 nm system. "We used a lossy wavelength of 810 nm where we had 6 dB overall loss from the transmission and the connectors," Poppe said. "We also want to put the overall system in a 19-inch rack."

According to the authors, one advantage of their system is that the key, which allows both parties to decode information, comes into existence at both Alice and Bob, so it does not have to be transferred.

This work was carried out by scientists from the University of Vienna, ARC Seibersdorf Research in Austria and Ludwig-Maximilians University, Germany. The fibres were installed by WKA. 
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CRDS makes the leap out of the laboratory

Picarro plans to launch a portable CRDS gas sensor in 2005. James Tyrrell talks to the US-Canadian firm about the field testing of its robust, suitcase-sized technology.

Field-deployable cavity ring-down spectroscopy (CRDS), providing parts-per-billion sensitivity in a unit the size of a suitcase – a far-fetched scenario? Not according to US-Canadian company Picarro, which is busy commercializing the technology (for an explanation of CRDS see box p20).

Named after the type of sword carried by the Duke of Alba, a 16th-century Spanish maverick with a keen eye for technology and a sense of daring on the battlefield, Picarro plans to bring its cutting-edge technology to the marketplace next year.

Formed by leading Stanford scientists in 2002, the company has an R&D base in Sunnyvale, California, and a manufacturing facility in Ottawa, Ontario. Its first product, a cyan laser, went into full production in January.

The company’s chief technology officer, Barbara Paldus, is confident that CRDS has the power to take on its well established optical rivals: Fourier transform infrared (FTIR) spectroscopy, non-dispersive infrared (NDIR) spectroscopy and tunable diode-laser absorption (TDLA) spectroscopy.

“The primary advantage of CRDS is that it measures the absolute optical loss or absorption inside the cavity,” explained Paldus. “FTIR, NDIR and TDLA all require calibration because they’re a relative measurement of the absorption.”

She continued: “Because CRDS uses a coherent, narrow-linewidth light source, you can identify spectral lines that FTIR and NDIR can’t resolve. Therefore you can distinguish the fingerprints of different molecular species with much higher precision.”

Capitalizing on this, Picarro has built CRDS instruments to monitor the absolute concentration of carbon dioxide in the atmosphere to better than 1 part in 3000 in less than 1 min. “That’s really important,” emphasized Paldus. “Because the way they measure CO₂ right now is a relative measurement, they have to use calibration bottles.”

The company feels that such a “calibration-free” device, which begins field trials next summer, could have an impact on a global scale. “It would be a significant step towards being able to practically implement the Kyoto protocol, for environmental monitoring and carbon-cycle research, as well as the credits and debits of emission for each country,” said Paldus.

**Real-time measurement**

Working with Dave Bowling and his team at the University of Utah, Picarro is testing a field-deployable CRDS instrument that measures, in real time, the carbon-13:carbon-12 isotope ratio of CO₂ in ambient air with a precision of better than 0.2 parts per thousand.

“The ratio of the stable carbon isotopes in carbon dioxide [13CO₂:12CO₂] is an accessible variable that allows scientists to draw inferences about the carbon cycle on local and global scales,” Eric Crosson, Picarro’s CRDS makes the leap out of the laboratory

Flying high: the team at Picarro’s research lab in California has produced a CRDS module for atmospheric sensing that has been flown in an aeroplane. The firm will launch its first CRDS products next year.

Schematic view of the company’s cavity ring-down spectrometer set-up, as explained on p20.
Laser beam shaping with only one element

For many modern laser applications the beam profile is very important and a Gaussian beam is often not the best solution. Often, better results can be achieved by transforming a Gaussian beam into a profile “flat top”. A flat top consists of a plane intensity profile with relatively steep edges, and is very helpful in material processing or even data storage applications. In the case of data storage it is important that the polarisation states of the laser beam do not change. As the intensity peak of a Gaussian beam mostly contains twisted polarisation states, a flat top would be much more suitable for this application.

Until recently, beam shaping was performed by either diffractive or refractive optics. It is known that diffractive optics almost lead to intensity losses while refractive optics can be costly as they tend to consist of several single components, such as micro lenses. The Vision Crystal Technology AG (VCT AG) from Germany recently realized beam shaping with a small monoclinic double tungstate (MDT) element, which is specially oriented and cut for the effect of conical refraction. The MDT element converts an incoming unpolared or circular polarized Gaussian beam into a flat top or other beam profile. The resulting profile depends on the diameter of the incoming beam and the crystal length, so that for a given wavelength the desired beam profile will be achieved by either adapting the diameter of the input beam or the crystal length. Thus different beam profiles - from flat tops up to hollow light cylinders - can be generated. The required MDT material is directly grown, oriented, cut and polished by the VCT AG. As MDT is transparent from the UV to the near infrared region this kind of beam shaper could be interesting for many laser applications.

For more information on this cost-effective alternative to conventional beam shapers please contact www.vct-ag.com
vice-president of R&D, told OLE. “The specificity of cavity ring-down is very good, so we can separate the isotopes of CO₂.”

According to Crosson, most of those measurements are currently being made with mass spectrometry, which is difficult to deploy in the field. Scientists have to use bags to collect the samples, then hike them back to the laboratory for analysis.

The big benefit of Picarro’s device is that it is robust enough to be stationed in a monitoring hut. “There has to be [electrical] power in the field,” he explained, “although the enclosure doesn’t have to be very well environmentally monitored or controlled.”

The firm is also field testing its units across a variety of other applications ranging from monitoring ethylene at parts-per-billion levels (for fruit-ripening applications) through to moisture detection in semiconductor fabs (to protect the growth rates of oxides).

In order to service so many applications Picarro’s focus is on developing an “optical engine” for analytical-instrument OEMs. “It’s basically the heart and the brain of an analytical instrument,” explained Paldus. “The optical engine contains the cavity, the optical components such as the laser and the detector, CRDS-specific control and processing electronics, plus a minimum of gas-handling equipment.”

This modular design philosophy has helped the firm overcome challenges such as mirror alignment and cleaning. “It’s very difficult from a service and training point of view to let the user replace the mirrors,” said Paldus. “It’s much easier to have a monolithic cavity that you can pop in and pop out.” Making the cavity as a single unit also has operational advantages, simplifying beam alignment and vibration isolation.

To boost their chances of success in the field, Picarro has been working hard on transforming what began as a highly sensitive, lab-based, optical-bench set-up into a rugged product. “The team at Sunnyvale has actually produced an instrument that’s been flown in a plane and used in trials,” Bill Gignac, Picarro’s vice-president of operations, told OLE. “So you’re not talking about something that can’t be made robust.”

However, does the firm have a business model to match the strength of its product? By taking the OEM route Picarro believes it can penetrate applications faster and more effectively. “Our OEM customers have very

“We’ve shrunk the size [of the CRDS unit] so it fits into a standard 19 inch rack mount.”

Bill Gignac, Picarro

Boxed and ready to go: customers are already using Picarro’s prototype CRDS unit.

The Pan-European collaboration between BFi OPTILAS and Ophir has led to the implementation of a central calibration lab based in its German facility (Puchheim / Munich).

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specific market-domain knowledge and excellent channels into those markets,” said Paldus. “They can provide a level of service and technical support to customers that is more on a 24–7 global scale than we as a small company could afford to do.”

Picarro says that its CRDS development cycle is about 85% complete. “We’ve shrunk the size so it fits into a standard 19 inch rack mount and we’ve fabricated prototypes that customers are using in their facilities,” explained Gignac.

“We see cavity ring-down coming into its own as a commercial product in volume in the 2006 timeframe,” added Paldus. “I’d say the official product release will be in the early part of 2005, leading to full production release sometime late in that year.” The pricing of the instruments is likely to range from $20 000 up to $70 000 (€16 500 to €58 000), depending on specific product configurations and performance requirements.

“The other thing we will be launching sometime in the next year is a laboratory instrument for research, and that’s very exciting to us,” enthused Paldus. Targeting key labs and staff, Picarro wants to put its lab product in the hands of creative researchers focused on developing revolutionary CRDS applications – medical diagnosis, for example. “We believe that there are applications for isotope detection as an enabling tool for medical diagnostics.”

At the moment Picarro uses telecommunications DFB lasers which tune over a fairly limited range and limit detection to one or at most two species per laser. However, Paldus reveals that the new research instrument will be more broadly tunable.

Researchers have recently thrown open the laboratory doors to a wider range of CRDS applications. Working with Richard Zare and Kate Bechtel of Stanford University, Picarro has just demonstrated what it claims is world-record sensitivity for the detection of liquids (6.7 × 10⁻⁸ absorbance units). “The technique will eventually be extended to thin films and solids,” said Paldus. “It will be very interesting to see what the high sensitivity of cavity ring-down can bring to those other materials and applications.”

What is CRDS?

Cavity ring-down spectroscopy (CRDS) uses a high-finesse optical cavity, or resonator, constructed from two or three mirrors (Picarro has a patented triangular design). The first step is to inject light into the cavity, which has gas ports to manage sample handling.

Once enough light has built up in the optical cavity, you extinguish the source and measure the energy decay using a detector placed behind one of the cavity mirrors. The time constant of this exponentially decaying signal is known as the decay constant or ring-down time, and characterizes the sample gas. Its value is inversely proportional to the concentration of molecular species in the cavity.

With a 20 cm-long cavity having an effective path length of 20 km, CRDS offers a tremendous enhancement in sensitivity over tunable diode laser adsorption (TDLA) spectroscopy. Additionally, the small resonator volume (25 ml) of CRDS units compared with TDLA (1 l) and FTIR/NDIR (0.2–1.0 l) is said to give the technique a shorter response time (also known as “dry-down time”).

Mirror reflectivity is a key performance parameter of CRDS – the higher the reflectivity, the longer the decay constant and the greater the instrument sensitivity. However, higher reflectivity makes the decaying signal harder to detect as there is less and less light falling on the photodetector.
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CIP gives research centre

The Centre for Integrated Photonics describes itself as an open-style development facility for industry and academia alike. Jacqueline Hewett spoke to the UK firm’s management team about its plans to become a self-sustaining business.

There was little Christmas cheer for photonics researchers in Ipswich in the south-east of England at the end of 2002. With the industry still in a steep downward spiral, Corning announced the closure of its research facilities in the area, marking the end of an era.

But salvation came in a rather unexpected form in the new year. The East of England Development Agency (EEDA) stepped in with a bold plan which would see it buy Corning’s assets and allow the prestigious Martlesham Heath Photonics research group to remain open. Now owned by EEDA, the facility has become a business called the Centre for Integrated Photonics (CIP).

Housing in excess of £40 m ($75.9 m) of high-tech equipment, CIP offers services ranging from precision optical coatings and glass machining through to III-V device fabrication and data transmission testing to greater than 100 Gbit/s. CIP opens its doors to both academic and industrial customers.

The centre’s heritage is long and prestigious. Photonics activity started in the 1970s when the centre was part of British Telecom’s (BT’s) research labs. It was recognized as one of the principal telecoms research labs alongside Bell Labs in the US and NTT in Japan. But then things started to change.

“In 2000, BT started to pull back from hardware development and that resulted in them looking for a buyer for the photonics group,” explains Neil Weston, CIP’s vice-president of sales and marketing. “Corning was chosen from a number of suitors to own the centre and they acquired it in 2000.”

During the telecoms boom, Weston reckons Corning invested around £20 m to replace equipment and hire staff. Then came the industry’s dramatic U-turn. “Over the course of 2001 and 2002, Corning was retrenching from its telecoms activities. They had put a lot of value into the centre and kept it open right up till the end of 2002 when they decided they couldn’t hold onto it anymore,” he says.

Broad knowledge

It was then that EEDA entered the equation. The agency’s remit is to spend government money on what it believes is important to the region. Determined not to let the facility slip through its fingers, EEDA started talking to Corning about how the centre could be kept open for industry and universities in the UK and Europe.

“EEDA bought the assets from Corning for a nominal value,” says Stephen Holton, the CEO of CIP. “It was a very amicable transfer. There were certain elements of IP that were transferred. Corning gave us as much as they reasonably could in the circumstances.”

CIP was launched commercially on 1 January 2004 and acts as a service provider for both universities and industry. Its funds come from three sources: EEDA, involvement in European Union and UK Research Council projects, and commercial contracts.

But as Holton explains, CIP’s goal is to become a self-sustaining business. “Over the next three to four years, we want to become a sustainable enterprise with income coming from university research and industry. EEDA funding will go to zero,” he says.

CIP also finds itself in the strange position of operating as a not-for-profit organization. “Any income is reinvested into the centre. EEDA is the sole owner of CIP and we have no shareholders that we have to give a dividend to,” explains Holton. “We can offer very good value to industry and to universities for the work that we do.”

With £40 m of kit under one roof (see box), what exactly have the 32 staff of CIP got to offer? First and foremost, the centre houses an eight-wafer Aixtron MOVPE reactor, so it can see the fabrication of III-V devices through from the initial material design and growth to pilot-scale packaging.

“We could act as a foundry for InP devices for III-V companies,” says Weston. “We can do development on our equipment and know that it is reproducible at full scale. That is the advantage of the research and pilot-scale production that we have got.”

The same is true for CIP’s plasma-assisted deposition coatings kit. “It is production-quality equipment being used in a research mode,” Weston says. “We have a number of contracts to produce high-quality coatings.”

As well as compound-semiconductor expertise, CIP has a significant amount of
experience in silica-on-silicon waveguides—the technology behind planar lightwave circuits (PLCs). PLC technology was initially developed at the centre before it was transferred to Kymata (now GemFire based in Livingston, Scotland) in the 1990s.

One offshoot of the PLC research is glass processing and etching. For example, CIP can chemically etch 30–50 µm-deep channels in glass slides to make biomedical components such as microfluidic channel plates. These are used to react small amounts of substances for drug discovery.

CIP is also benefiting from BT and Cornwall’s investment in testing kit. “We can test to a maximum speed of 160 Gbit/s,” says Holton. “It’s an enormous strength and nobody else really has this sort of capability ready to be used by industry.”

Making money
CIP is also a specialist in the hybrid integration of photonic devices. These skills are being put to good use as part of a European Commission Framework Six project called MUFINS which started last month. The aim is to develop photonic integrated arrays of components, such as microfluidic channel plates. These skills are going to be used by industry in the future.

CIP is working with the RACT Institute of Athens, Telecom Italia, Siemens, Essex and Bristol universities in the UK, Eindhoven University in the Netherlands and the Fraunhofer Institute in Germany on the project.

Since opening in January, CIP has also become involved in a £1.65 m project funded by the UK’s Engineering and Physical Sciences Research Council (EPSRC). The Photonic Component Research for Integrated Nanotechnology and Communications Environment (PRINCE) project involves groups at University College London (UCL), Imperial College London and the universities of Cambridge and Essex.

The project runs for 15 months and £1.24 m is being sub-contracted to CIP by UCL. The partners plan to develop a range of optical-communication components including ultrafast electro-absorption modulators (EAMs), semiconductor optical amplifiers (SOAs) for regeneration and switching, and passive waveguide devices as well as hybrid and monolithic integrated components.

Crucially for CIP, the university partners have approached them to help manufacture the devices. “We are not allowed to apply for EPSRC grants,” explains Weston. “The universities apply for the grant and factor in the cost of using our facilities. We act as a subcontractor as part of the grant. We also offer our facilities as part of PhD programmes.”

On the industrial side of things, CIP has teamed up with BT to develop photonic technology to reduce the cost of fibre-to-the-home. At the 30th European Conference on Optical Communication (ECOC), which was held in Stockholm last month, both parties reported prototype optical transmitter components, based on CIP’s EAMs, capable of 10 Gbit/s transmission over 100 km.

CIP also used ECOC to launch a small range of research products. The initial selection of 1.55 µm devices includes EAMs, capable of 10 Gbit/s transmission over 100 km.

“These are high-spec devices and are not going to be used in mass production,” Holton told OLE. “The big players will need these to continue their in-house R&D. I don’t see us as a volume manufacturer of standard products. We are concentrating on high-value-low numbers for specific R&D purposes rather than mass markets.”

Having attracted around 40 industrial customers through their doors during their first year, Holton and Weston are both optimistic about the future. With a cost base of around £2.5 m, CIP is confident it can break even in 2005. But onething is certain – CIP is in a “use it or lose it” situation.
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Photonics unlocks chip bandwidth bottleneck

The continuing rise in the speed of computer chips means that copper tracks on printed circuit boards could soon be unable to keep up. Oliver Graydon spoke to Intel about its plans for making the transition to high-speed optical interconnects.

Intel, the well known integrated circuit (IC) specialist, has made a prototype optical interconnect that can transfer data at 1 Gbit/s per channel between two silicon chips separated by 20 cm. The 12-channel demonstrator suggests that the world’s IT industry is moving a step closer towards incorporating photonics into PCs with the aim of overcoming bandwidth bottlenecks.

In fact, if Moore’s law holds true and processing speed continues to double every 18 months, it is almost certain that a PC built in 2015 will require some form of internal optical data-bus to wire up its different chipsets. Over the next decade the bandwidth of interconnects inside a computer is expected to increase by an order of magnitude – from around 1 GHz to 10 GHz – thanks to developments such as the PCI Express bus. However, this increase will require a shift in technologies from the electrical to the optical domain.

**“It’s a technology that we are not going to leave untapped.”**

Ian Young, Intel

one is to change the channel, using an optical interconnect to replace the limitations of an electrical one."

The fundamental problem facing computer manufacturers is that as bandwidth rises, the attenuation of copper tracks in printed circuit boards (PCBs) made from conventional dielectric material (known as FR4) starts to soar. For example, calculations suggest that at 10 GHz a typical 20 inch-long electrical interconnect may have an effective insertion loss as great as 50 dB.

Although FR4 can be replaced with a new dielectric laminate called Rogers 4000 that potentially doubles the bandwidth of an electrical interconnect, the material is about five times more expensive and is only practical as a short-term fix.

With these issues in mind, Intel and others are busy exploring the option of using photons and optical waveguides to transfer data around a computer’s motherboard. “We’ve got to go to a new medium that doesn’t have the distance limitations of copper, and that means photons in a waveguide,” said Young. “It’s a technology that we are not going to leave untapped.”

The big attraction of this approach is that an optical link supports much higher data rates than its electrical counterpart – potentially many tens or even hundreds of gigabits per second – over far greater distances. This is good news for circuit designers, as it means that chips can be spread further apart, making it much easier to avoid very high thermal loads that plague modern PCBs packed with powerful chips. Today’s short connections may maximize speed, but because the chips are so close together there is a risk of overheating.

“Maybe an electrical solution will stretch to 13–15 Gbit/s, but other factors will start to come into play, such as the cost and ease of manufacturing,” said Young. “We’re not targeting an optical solution for 10 Gbit/chip-to-chip – we’re resetting goals at the 20 Gbit/s rate and upwards.”

Intel is not the only company keen to develop the necessary technology to make the transition to optics. IBM has just...
Optical Interconnects

Optical Interconnects have a new type of germanium-on-insulator photodetector which can be made by CMOS technology and is ideal for integrating into chips. And at the end of last year, IBM and Agilent embarked on a three-year $30 m (€24.6 m) project funded by the US Defense Advanced Research Projects Agency on the topic of optical interconnects for connecting multi-chip modules.

Intel believes that optics could be playing a role in board-to-board links in as little as two years' time, but that it will be at least seven years before it is deployed for chip-to-chip communication. “The transformation from electrical to optical interconnects will gradually occur over time in the future,” Young told OLE. “Box-to-box is here today, board-to-board for backplane connections up to 30 inches will happen sometime in the next 2–7 years and after that it will be chip-to-chip.”

Two-pronged approach

The IC giant is now busy building and testing prototype designs in a drive to find a cost-effective approach that will suit deployment on a commercial scale. In the May issue of Intel Technology Journal, the firm described its progress to date and unveiled two designs of chip-to-chip optical interconnects: a hybrid integration approach that relies on traditional packaging of separate optoelectronic and electronics (see figures 1 and 2); and a silicon optical bench that brings the two technologies together within a single housing (see figure 3).

“One group is trying to see what we can do with our silicon know-how, using etching for example, to help solve optical alignment problems; the other is trying something that is more compatible with conventional microprocessor packaging,” said Young. “It’s good that we’re doing both because we may find that one or the other has a lower cost, a better performance or is easier to align.”

Using the hybrid integration approach, Intel has demonstrated a 12-channel parallel optical interconnect that uses an array of vertical-cavity surface-emitting lasers (VCSELs) and polymer waveguides to transfer 1 Gbit/s per channel between two chips separated by 20 cm. The firm also says that this distance could be significantly extended using standard multimode fibre.

The prototype link consists of two transceiver chips, each of which is wired by high-speed microstrip lines to discrete optical transmitter and receiver sections. The transmitter consists of a 1 × 12 array of 850 nm VCSELs and the receiver a 1 × 12 array of photodiodes. The hybrid approach is compatible with microprocessor flip-chip pin-grid arrays (FCPGAs). Using this scheme Intel has constructed a 1 × 12 optical chip-to-chip link that operates at a channel speed of 1 Gbit/s over 20 cm. The firm says that longer distances should easily be achievable.

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Light signals from the VCSEL array are coupled via a 45° mirror into a 1 × 12 array of polymer waveguides which terminates with an MT [multi-terminal] connector. The photodiode array is connected in an identical fashion to a separate waveguide array. To create a functional link, the MT connectors from two separate transceiver chips were simply connected via a separate length of polymer waveguide. Intel says that of the 20 prototype assemblies that it made, 90% of them were fully functional.

The transceiver chip was fabricated by a 0.18 µm CMOS fabrication process and contains all the necessary circuitry for driving the VCSEL array and processing the received signals from the photodetector array. This includes a clock unit, amplifiers, and bit error rate testing. The chip, along with the optoelectronics, was mounted on a standard microprocessor substrate (flip-chip pin grid array) using passive alignment.

Intel says that it used acrylate waveguides made by photobleach processing because they have the potential for high-volume, low-cost manufacture. The waveguides have a core dimension of 35 × 35 µm and an optical loss of just 0.1 dB/cm.

The loss of an entire link varied between 7 dB (best case) and 12 dB (worst case) per channel. The largest contributor to the loss is the coupling between the VCSELs or photodiodes and the waveguides. This loss is very sensitive to any misalignment (1 dB half-width of ±10 µm) and varied between 1.5 and 3 dB in the prototype.

The other approach that Intel is exploring is to use a silicon optical bench which is mounted on a PCB. This exploits Intel’s expertise in etching and processing silicon to create a platform for housing and passively aligning all the parts needed for a complete transceiver module (optical fibre, integrated circuits and laser, plus photodetector). Connections called “thru vias” run vertically through the base of the silicon package and connect the circuitry to the PCB beneath.

Either wet or dry etching can be used to create a trench and alignment stops for the optical fibre, a 45° mirror for coupling light from/to the fibre and a VCSEL or photodiode. This technique is as yet untested and represents a radical departure from conventional electronic packaging. However, it potentially offers a more integrated solution that could be cheap to produce.

Whichever approach proves the most successful in the lab, to make it to market it must be cost-effective and easy to manufacture in volume, with a supply chain already in place. “I believe that we can build an optical link today, but if you want to dislodge an electrical 5–10 Gbit/s solution then cost would be your problem,” said Young. “In particular, the laser [VCSEL] is a concern. We’ve got to get a very low-cost device and the volumes that we need are two orders of magnitude higher than the industry is capable of supporting. We would probably ship in a single month the entire number of VCSELs that have been made to date.”

3. Intel’s silicon optical bench could provide a convenient way to integrate optoelectronics and electronics with a single module on a PCB. Trenches and marks on the bench passively align the optical fibre to ensure a low-loss connection.

Either wet or dry etching can be used to create a trench and alignment stops for the optical fibre, a 45° mirror for coupling light from/to the fibre and a VCSEL or photodiode. This technique is as yet untested and represents a radical departure from conventional electronic packaging. However, it potentially offers a more integrated solution that could be cheap to produce.

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Optical adhesives offer a clear answer

Want to bond a lens or a fibre-optic component? Detlef Heindl describes the differences between various optical adhesives so that you don’t end up in a sticky mess.

Optical adhesives are a vital, but often hidden, ingredient of photonic systems. Today a wide range of commercial products are available to fix optical fibres, bond and coat lenses, and encapsulate LEDs, among other applications. However, it is important to choose carefully to optimize the adhesion as well as the optical and physical properties for your specific use.

The big difference between the two main categories of optical adhesives, epoxy resins and ultraviolet (UV) curable compositions, is how they are prepared and cured. Epoxies are often supplied as two separate components which harden when they are mixed together, thanks to a chemical reaction. There are also single-component epoxies which are cured by exposure to heat, such as 121–148 ºC for 1 h or even longer. In contrast, light-curable adhesives harden when illuminated by short-wavelength (usually blue or UV A) light.

The choice of which to use depends on the volume and time requirements of the application and the desired properties. For small, infrequent jobs in a laboratory environment where the curing time is not an important consideration, an epoxy might be the adhesive of choice.

However, in circumstances where it is a critical factor, a large number of parts need to be bonded on a regular basis, or processes are automated, an acrylic UV-curable adhesive is the better choice. Unlike epoxies, which can take 24 h or longer to cure at room temperature, acrylic UV curables harden in just a few seconds when exposed to light of an appropriate wavelength.

The other advantage of UV adhesives is that there is no need to mix multiple components and no limitation on pot life (the length of time before the adhesive goes off after it has been mixed). For example, a fast-acting two-part epoxy may have a pot life as short as 10 min. The remainder of this article will focus on the technology, application and properties of UV-curable adhesives.

Two main types of light-curable adhesive are available: acrylate-based materials and epoxy (cationic) systems. Acrylates have a wider range of physical properties (viscosity, appearance and adhesion) than epoxies.

UV-curable acrylates are comprised of oligomers, monomers, additives and photoinitiators. These formulations can be tailored to provide optically clear resins with specific refractive indexes, adhesion and resistance to UV. Oligomers are medium-length polymer chains that contribute to the adhesive’s tensile strength, modulus and elongation. Monomers provide adhesion to different substrates. Additives can provide a wider range of viscosities to allow for easier dispensing, or can be incorporated as fillers for extremely low shrinkage.

An acrylate does sometimes suffer from surface tack (stickiness) due to a reaction with atmospheric oxygen. In most cases, however, surface tack can be eliminated by adjusting the light intensity, wavelength or duration of the curing process.

Where tackiness is an issue, cationic epoxies offer an advantage (no oxygen inhibition) but often have a longer curing process that can be impeded by moisture and humidity.

Adhesives designed for use in the optical path typically offer a very high clarity – in excess of 90% across the visible and near-infrared wavebands – and come with a wide refractive index range (1.40–1.60). They also have a low linear shrinkage of 0.1% or less and are often compatible with glass, plastic, metals and ceramics. Outgassing, the release of gas from the adhesive during the curing process, can now be as low as 10^-6 g per gram of adhesive.

Aid from additives

High cross-linked densities, normally required for low-outgassing epoxies, typically produce overly rigid polymers that are not suitable for durable bonding. Now, however, additives in acrylic UV optical adhesives can increase cross-linking substantially, which effectively “traps” volatile components within the adhesive matrix and lowers thermal outgassing. This is important where the engineers are looking for low outgassing, such as in the assembly of sealed lasers.

All light-curable adhesives rely on using the energy provided by light to trigger a curing reaction. The formulations include a range of photoinitiators that are sensitive to light of different wavelength ranges. While many are designed for UVA light (340–380 nm), some also respond to visible light. This can help accelerate the curing time as more light energy is absorbed, and it can help increase the cure depth. Typical cure speed for acrylic adhesives is 1–15 s. Heat is sometimes used to speed up the curing or assist it in areas that are hard to illuminate.

Specialized light-curing equipment is available for the curing process and ultimately the selection depends on the area and speed of the cure. Users have a choice between spot lamps, flood lamps and focused beam systems to create an illumination area ranging from a 5 mm-diameter spot to a large 20 × 20 cm footprint. In order to achieve complete and high-quality curing
it is important that the system’s spectral output and intensity are carefully matched to the adhesive’s absorption maxima.

Although a lamp may boast a large light intensity it is necessary to check how much of that lies in the required wavelength band. Today, spot intensities ranging from 4000 to 20 000 mW/cm² across the UVA waveband are available. By contrast, a focused beam system may typically deliver a 2.5 x 15 cm beam with an intensity of between 250 and 2500 mW/cm². For the illumination of larger areas, flood systems that offer a 20 x 20 cm footprint with an intensity of 30–70 mW/cm² are available.

As for the application of the adhesives, the options include dispensing, spraying, brushing and roll coating. The best method is often determined by the viscosity of the adhesive and the size and type of the part to be treated. Adhesives are commonly available in a wide range of package sizes – everything from a syringe or cartridge containing 10 g to a 1 kg bottle or a 200 kg drum.

To ensure consistent, high-performance bonding the temperature and humidity of the curing environment and stored materials must be kept from reaching unacceptable levels. Increases in temperature can cause a significant drop in the viscosity of the adhesive, changing its dose and flow. As is the case with all coatings and adhesives, it is crucial to ensure that the parts to be bonded are not contaminated by dirt, dust, oil or chemicals since this can cause poor adhesion. Ideally, variations in the size, chemistry or surface quality of the part to be bonded should be kept to a minimum.

To ensure continuous and repeatable process quality, users should be aware that the bulbs (lamps) in curing systems gradually degrade. As a result, the light intensity of a system decreases as the bulb gets older. The amount of degradation depends on the age of the bulb, the number of times that the bulb is switched on and off, and the operation temperature. Even though the bulbs have a high lifetime expectancy it is essential that the intensity of a curing system is checked at regular intervals by a radiometer to ensure that it is sufficient. To help prolong the life of the bulb do not switch the system on and off repeatedly – if the equipment is to be used within 2 h of finishing a process it is better to leave the lamp on.

Our advice is to choose a curing system that delivers a maximum intensity level that is three to five times higher than the lower limit needed for your application. We also suggest that you check the curing bulbs regularly and change them when the measured intensity is 50% above the lower limit. For example, if you require 20 mW/cm² for 10 s to give a satisfactory cure then choose a system providing 100 mW/cm² and change it when it reaches 30 mW/cm².

Detlef Heindl is managing director at Dymax Europe, a leading supplier of optical adhesives based in Frankfurt, Germany. For more information visit www.dymax.de.
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**Nanopositioner**

Piezosystem Jena

The Tritor 200/20 three-axis nanopositioner from Piezosystem Jena provides a linear travel range of $235 \times 235 \times 30 \, \mu m$. Designed for microscopy applications, the central $50 \times 50 \, mm$ aperture can hold a variety of microscope stages, while samples can be mounted using the M4 thread holes in the top plate.

According to the company, the stage’s high resonant frequency leads to high stability and accuracy. The stage’s z-axis drive also features active tilt-error compensation. The company can supply the Tritor for vacuum and low-temperature environments as well as applications in optics and laser tuning, fibre positioning, imaging and cell tracking.

**LED light line**

StockerYale

The Cobra 500 LED light line from StockerYale is designed for inspecting the quality of large LCDs and FPDs. The company claims that the Cobra 500’s extremely high working intensity outperforms both fluorescence and fibre-delivered halogen illumination.

The firm also says that the Cobra 500 is the first in a series of products based on its chip-on-board reflective array technology. The product comes in stackable 50 cm units, various wavelengths and a range of mounting options. Options include active intensity control and a backlight configuration.

**Diode laser**

Oseir

Oseir of Finland has launched a high-power diode laser as part of its HiWatch family. Two different geometries are available: the HiWatch Sheet, which emits a $30 \times 1 \, mm$ beam, and the HiWatch Solid, which produces a $30 \times 25 \, mm$ beam. The company says that these products are ideal for imaging and measuring small, rapidly moving targets.

The HiWatch laser emits at 795 or 808 nm and both versions have a peak power of 200 W. Oseir says the lasers generate $0.1–20 \, \mu s$ pulses and can operate at repetition rates of 10 MHz. The company adds that the laser weighs less than 1 kg and can be easily integrated into any system environment.

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**Polarization controller**

ThorLabs

Thorlabs is now offering an ultrafast inline polarimeter and a polarization controller for the 1450 to 1650 nm wavelength range. Specifications include sample speeds of up to 1 MS/s; accuracies of $\pm 0.25^\circ$ for the state of polarization (SOP) on the Poincaré sphere; and an insertion loss of less than 0.6 dB.

According to Thorlabs, the DPC5500 polarization controller offers true control of the output SOP instead of a limited polarization-transformation function, and does not suffer from drift and hysteresis effects.

The IPM5300 polarimeter is said to be an ideal solution for polarization monitoring, polarization-controller testing, polarization-mode dispersion and loss measurements.

**Galvanometer scanner**

Scanlab

Scanlab of Germany has added the dynAxis L to its dynAxis range of galvanometers. The firm says it can now supply galvanometers for use with apertures ranging from 5 to 30 mm. Scanlab says that the dynAxis L has been tailored to handle the requirements of materials-processing applications such as welding and soldering as well as marking applications requiring maximum focus quality. The rotor’s 5.1 gcm$^2$ moment of inertia is said to make the dynAxis L ideal for 20–30 mm mirror apertures. It includes features such as a high-accuracy position detector and integrated temperature stabilization.
Motion-analysis software

Photron

Photron USA has released Motion Tools, an automated slow-motion-analysis camera-control software package. The basic software comes free with Photron’s PC-based high-speed video cameras and features automated single-point tracking or manual tracking that captures between one and four points per frame. Optional modules can be purchased as add-ons to the basic software. For example, the data-acquisition module can record up to 16 channels of external ASCII data. Up to eight time-synchronized Photron PCI cameras can simultaneously capture 200,000 data samples per second. Photron adds that the enhanced analysis feature can track up to 18 trajectory points simultaneously.

www.photron.com

Bavarian Photonics

Bavarian Photonics of Germany, a member of the TuiLaser Group, has added the Aion Industrial 355-5-V to its family of laser systems. Based on an Nd:YVO₄ crystal, the Aion Industrial 355-5-V offers 5 W of power at 355 nm. The energy per pulse is said to reach up to 250 µJ with repetition rates of up to 100 kHz. The frequency-tripled laser has a pulse width of around 25 ns at 50 kHz with a peak power that exceeds 15 kW. The firm claims that the laser has an M² of less than 1.5 and a pulse-to-pulse stability of less than 3% RMS.

Typical applications of the source are solar-cell structuring, resistor trimming, wafer machining, ultraviolet stereolithography and precise micromachining.

www.bavarian-photonics.com

Nanopositioning system

Mad City Labs

The Nano-LP200 nanopositioning system from Mad City Labs, US, is now available with a standard travel range of 200 × 200 × 200 µm and sub-nanometre positioning accuracy. The system’s 20 mm profile permits integration into existing instrumentation, such as optical microscopes and atomic-force microscopy systems. It also features a centre aperture which is compatible with probes or objective lenses, without compromising the range of motion.
Mad City Labs adds that the Nano-LP has minimal coupling between axes thanks to the use of a true parallel design. The system also uses fully integrated piezoresistive sensors for absolute position measurement and sub-nanometre accuracy when operated under closed-loop control.

www.madcitylabs.com

Stencil-cutting system
Synova

Synova of Switzerland has developed a stencil-cutting system based on laser-microjet technology. According to the firm, the LSS cuts up to 20 holes per second without neat damage, burrs or oxidation. Large working areas of up to 800 × 1000 mm are available and a second laser head may be added to double the throughput. Synova lists other benefits and specifications as a high mechanical precision (±5 µm); low running costs; a 2.5 tonne granite structure; a fast and precise fixation of a stencil with or without a frame; and a reliable laser source.

Initial beneficiaries of the LSS are the semiconductor (for packaging solder masks) and flat-panel display industries.

www.synova.ch

Optical parametric oscillator
Pro-Lite Technology

Pro-Lite Technology, a UK-based distributor, has released the VisIR2-ULD optical parametric oscillator (OPO) from German firm GWU. The OPO is tunable between 400 and 2500 nm or 210 and 2500 nm using optional second harmonic generation. The OPO is said to emit a circularly symmetric beam with a divergence of 0.5 mrad, making it suitable for applications such as multipass absorption and atmospheric LIDAR. The signal and idler from the ULD are orthogonally polarized, which Pro-Lite says eliminates the characteristic degeneracy gap in an OPO’s tuning range at 710 nm. Tuning is via a manual micrometer as standard, although an optional stepper motor driver with LabView drivers is available at extra cost.

www.pro-lite.uk.com

X-ray fluorescence spectrometer
Jobin Yvon

Spectrometer specialist Jobin Yvon is now distributing the XGT-1000WR energy-dispersive X-ray fluorescence spectrometer from Horiba. The instrument has been designed to address forthcoming environmental legislation restricting
the use of toxic materials in the manufacture of electrical and electronic equipment (RoHS directive). A primary filter enhances the detection limit of the five main elements involved (mercury, lead, cadmium, chromium and bromine). A CCD camera displays a real-time image of the sample compartment to ensure proper sample placement. The XGT-1000WR is designed for simple and fast quality control of samples as big as 46 × 36 × 15 cm. Two high-intensity narrow X-ray beams are available, with beam diameters of 1.2 and 0.1 mm, to perform fast and accurate analysis even on small portions of larger samples.

www.jobinyvon.co.uk

Laser-diode driver

iC-Haus

iC-Haus of Germany has added the iC-WKM to its series of diode drivers. Featuring a high current capacity of up to 350 mA and a supply voltage range of up to 15 V, the iC-WKM is optimized for M-type common cathode laser diodes, particularly blue lasers that have a grounded case.

The firm says that all the protective circuitry has been integrated into the device, such as reverse polarity and transients in the power supply. Its also protects against damage caused by ESD, excessive temperature and overcurrent. The laser power is preset via a resistor, while the monitor current acts as a reference and is controlled with an accuracy of better than 3%.

www.ichaus.com

Imaging microscope

Thermo Electron

Thermo Electron has unveiled the Nicolet Continuum XL imaging FT-IR microscope and a new version of its Omnic Atlus7 imaging software package.

The Nicolet microscope features an optical design that enables users to perform single-point collection and imaging on the same system. In single-point mode, Thermo says that dual remote sample masking provides optimum spatial resolution, enabling pure spectra to be obtained from small samples. The company adds that in imaging mode, high-fidelity optics allow the rapid collection of sharp images.

The Nicolet is supported by a new version of the Omnic Atlus7 software which is said to integrate data acquisition, spectral processing and image visualization. Thermo adds that users can link spectra, video images and chemical images into a single window.

www.thermo.com

Diode-laser controller

Newport

Newport has developed a diode-laser current driver circuit that it claims has noise characteristics 10 times lower than anything else on the market. Additionally, the new instrument is said to deliver greater stability, expanded dynamic range and improved electrical efficiency. According to the company, these improvements will benefit any noise-sensitive diode-laser-based application such as telecoms research and spectroscopy.

The compact design uses two heat sinks, placed face-to-face and cooled by a single fan, to dissipate power from voltage and current regulators. Splitting the heat load lowers the thermal mass of each individual heat sink and is said to allow a faster response to changes in diode resistance and user adjustments. Newport has applied to patent the design.

www.newport.com

Vacuum optical mounts

SORL

Space Optics Research Lab (SORL) of the US is now supplying optical mounts for large mirrors for use in vacuum environments. The mounts are said to be suitable for vacuum to 10⁻⁶ Torr. The vacuum mounts can be provided with SORL’s aspheric mirrors or as stand-alone components. SORL says that optics up to 40 inches in diameter and convex or concave masters can be produced.

The large optic mounts for reflective components feature adjustment of orthogonal tip-tilt and height of optical axis. Coarse and fine adjustments can be made and locking screws are provided. An alignment flat can be mounted to accelerate and ease the interferometric alignment of aspheric optics.

www.sorl.com

Laser-power meter

Coherent

Coherent has released FieldMate, a laser-power meter featuring an analogue needle display. The US firm claims that by using fast electronics and a digital-processing algorithm, the analogue needle can respond more quickly and with less overshoot than other meters on the market.
Fieldmate can measure laser output from 150 nm to 11 µm, with power levels from a few nanowatts to 10 kW and with beam diameters as large as 200 mm. The compact unit can be either battery- or mains-powered, making it suitable for field and laboratory use. It also features an output for connecting to a strip chart recorder or other data-acquisition instruments.

www.coherent.com

OLED display

One Stop Displays

US firm One Stop Displays has launched a 1.5 inch colour OLED device. The 1.65 mm-thick display would suit next-generation identity, security and programmable card applications. Featuring an SSD1338 driver IC, which supports 262k colour depth, the display is said by the firm to provide a high level of both clarity and colour, outperforming similar passive-matrix and active-matrix LCD devices.

www.onestopdisplays.net

Planar waveguide splitter

Chromux Technologies

Chromux Technologies, the US manufacturer of optics and MEMS-based products for telecoms and military/aerospace applications, has introduced 1 × N planar waveguide splitters. The firm says that the components are ideal for managing video, voice and data signals in optical access networks using passive-optical networking technology.

The waveguide splitters are available as chips or packaged modules in 1 × 8, 1 × 16 and 1 × 32 configurations. The 1 × 32 configuration features an insertion loss of 16.8 dB, a polarization loss of 0.3 dB and 1.7 dB uniformity over a 390 nm-wide transmission window (1230–1620 nm).

www.chromux.com

Infrared camera

Cedip Infrared Systems

Based on a thermo-electrically cooled MCT detector array, the JADE SWIR camera from Cedip Infrared Systems of France is said to provide an excellent thermal response from 0.8 to 2.5 µm. The camera operates at up to 100 fps at a full image size of 320 × 256 pixels over a 14-bit dynamic range. It is also fully compatible with Cedip’s PC-based analysis and reporting software.

According to the company, the JADE SWIR
Find the difference!

Fewer and fewer industries are camera-shy. Whatever task they perform, electronic eyes in machine vision systems miss absolutely nothing. They unerringly inspect everything that comes in front of the camera. This means that even complex, highly automated production lines are now monitored and controlled by cameras. The results: optimum process speeds, maximum quality, fewer stoppages and increased safety. Vision 2004, the world’s leading trade fair for machine vision, will show you how to use intelligent machine vision systems to make your production even more economical and also provide information on their almost unlimited application areas.

The “appetisers”

Industrial VISION Days
12th Vision Award
Complete programme and online registration: www.vision-messe.de

BFi OPTILAS now offers LIMITS training software for laser safety. Developed by laser-protection firm LaserVision, the interactive software details laser classes, primary and secondary hazards, and the respective protective measures required by current legal standards.

According to the firm, its training software suits users of all laser applications in the medical, industrial, metrology, telecommunications and
research sectors. Laser-safety officers looking to brush up their knowledge or prepare training for their colleagues may also benefit from the software. Users can decide on the way and order in which to approach each subject, with animated presentations and video clips helping to clarify the complex nature of laser safety. A final test is included in the package along with a comprehensive electronic glossary.

www.bfiopitlas.com

Piezo inverter

GDS

Global Display Solutions (GDS) has launched a piezo inverter for multi-lamp backlight systems such as LCD televisions and headrest displays. Compared with wire-wound components, GDS’s piezo inverter is said to offer improved reliability, safety and EMI performance. The inverter uses optical feedback to provide uniform lamp output and can compensate for variations in brightness caused by temperature variations in the display. Multiple lamp systems using the piezo inverter work independently in the event of single or multiple lamp failure, so the display will continue to operate.

www.gds.com

Green DPSS laser

Laser-compact

Russian firm Laser-compact has introduced a compact LCM-S-111 high-quality, low-noise, green-laser module designed for metrology, holography, interferometry, photo printing and display applications. The company claims that the unit’s small size and ease of installation would suit OEM applications. The green (532 nm) laser modules are available with output powers of up to 50 mW. A low-noise version yields up to 20 mW of 532 nm TEM00 single longitudinal-mode radiation. Typical M2 is less than 1.2, coherence length is more than 10 m and optical noise is less than 0.5% RMS for a frequency range up to 20 MHz.

www.laser-compact.ru

Video microscope

Moritex

Moritex Europe introduces the MS-804 into its family of video microscope systems. The unit features proprietary honeycomb CCD camera technology, multi-exposure, and high-intensity LED lighting, and comes with software to acquire high-resolution (1280 x 960 pixel) images. A digital zoom facility rapidly magnifies features of interest. The firm claims the ability to change shutter speed and combine bright and dark images helps boost the MS-804’s dynamic range. Device functions such as area, linear and angle measurement, colour extraction and counting would suit industrial micro-inspection and quality-assurance tasks.

www.moritex.com

Alignment system

PI

Nanopositioning firm PI is offering a new and improved F-206.S Micro-Hexapod alignment system with 33 nm resolution. The system suits alignment tasks requiring independent, precise motion in six degrees of freedom. Owing to its reduced moving mass (one common platform for all six actuators), the system is said by the firm to respond and settle faster than conventional multi-axis motion systems.

A single software command allows free selection of the unit’s position, determined in real time by six space-control algorithms. The Hexapod comes with its own alignment software, LabView drivers and DLLs. Typical applications listed by the company include micromachining, MEMS alignment, semiconductor handling, microsurgery, photonics alignment and packaging, optical-device testing and collimator/array alignment.

www.physikinstrumente.de

Fusion splicer

Fujikura Europe

The FSM-17S fusion splicer from Fujikura Europe offers a splicing time of 11 s and splice-protector shrink time of 35 s. The FSM-17S is capable of splicing various fibre types, and uses a fixed v-groove alignment system to ensure fast and simple operation. The unit features a dual-position monitor and PC communication via USB. Fujikura claims to have harnessed the technology of its high-spec FSM-50S splicer to deliver a compact, competitively priced product for small-scale installations and networks. At just 2.6 kg, the FSM-17S splicer is said to be one of the lightest models currently available.

www.fujikura.co.uk

Crystals & OPOs

www.gwu-group.de/laser
Photodiode
Opto Diode
Opto Diode is offering its US-manufactured silicon PIN ODD-1 photodiodes at $1.20 (€0.98) each for 1000 units. The photodetector has an active area of 1.35 × 0.76 mm, low dark current and responsivity of 400–1100 nm. The device comes in a TO-18 package and has a lead-soldering temperature of 240 °C. Suitable for industrial photo controls and other applications, the photodiode has a maximum junction temperature of 100 °C and can be stored and operated over a –55 to 100 °C range.

Thermal imager
Land Instruments
Infrared temperature measurement specialist Land Instruments has announced the Cyclops TI 814. Featuring a 320 × 240 detector, the thermal camera captures high-resolution images over a –20 to 500 °C temperature range. An extended range of –20 to 1500 °C can be specified as an option. The ergonomically designed unit includes a built-in laser pointer and can transmit live video through a wireless interface.

OLED display
Osram
Osram Opto Semiconductors, a subsidiary of the German lighting specialist Osram, has added an 80 × 48 pixel display to its Pictiva range of products. Using self-luminous OLEDs, the displays are said to provide excellent contrast and a wide viewing angle of 160°. Short response times allow information graphics and video clips to be shown in real time.

Precision rotary stage
Aerotech
Aerotech’s ASR1100 precision rotary stage provides a bolt-on solution for the high-throughput precision machining of small-diameter components. Featuring a pneumatically operated collect, chuck and clear aperture for product feed-through, the stage has a direct-drive servomotor which has a high-resolution encoder to position tubular components.

The stage has a footprint of approximately 115 × 255 mm and an overall height of 95 mm. The company says that the stage’s weight of 5 kg is significantly less than competing designs and offers the performance advantage of reduced load and inertia when mounted on multi-axis systems.

LED measurement software
Optronics Laboratories
Optronics Laboratories, the US manufacturer of light-measurement systems, has released a software-development kit for its OL770-LED high-speed LED measurement tool. The OL770-420 software is aimed at users looking to develop their own applications or to integrate the OL770 tool with other automated test and measurement systems.

By eliminating mass loading and local stiffening effects, the firm claims that its unit also delivers improved measurement accuracy. The PSV-400-3D would be suitable for applications requiring experimental modal and structural analysis.

Scanning laser vibrometer
Polytec
Polytec, a provider of laser-based measurement solutions, is now offering its PSV-400-3D scanning vibrometer. The device uses the Doppler shift of back-scattered laser light to determine the instantaneous velocity and displacement of more than 250 000 points on a vibrating structure. An alternative to accelerometer-based devices, the PSV-400-3D is said to decrease set-up time and simplify data acquisition.

By eliminating mass loading and local stiffening effects, the firm claims that its unit also delivers improved measurement accuracy. The PSV-400-3D would be suitable for applications requiring experimental modal and structural analysis.
SWITZERLAND

Stolyarevskaya to lead ACOL’s Russian lab

ACOL Technologies, the Swiss designer of high-brightness LEDs, has appointed Raisa Stolyarevskaya as head of its LED and chip-diagnostic laboratory in Russia. Stolyarevskaya represents Russia at the International Commission on Illumination (CIE) and has almost 30 years of experience in optical and physical measurements and research.

At ACOL, Stolyarevskaya will ensure that products comply with international lighting metrology standards. Previously, she led the Photometric Group at the All-Russian Research Institute for Optical and Physical Measurement. “Having a member of the CIE committee in the ACOL team is a great advantage for the company and its customers,” said CEO Jean-Charles Herpeux.

US

Avanex appoints Major as president and chief exec

Avanex, the US provider of photonic solutions for fibre networks, has announced Jo Major as its new president and CEO. Major is a 15-year optical communications veteran, having previously held positions at JDS Uniphase and SDL. He succeeds Walter Alessandrini, who came out of retirement in November 2002 to resume his role as president and CEO. Alessandrini remains as chairman of the board of directors. “I am very excited about the opportunity to lead Avanex at this time,” said Major.

UK

New head of product development joins ZBD

David Dix has been appointed head of product development at ZBD, a UK supplier of “zero-power” bistable LCD displays. Dix will be responsible for driving the commercialization of ZBD’s technology, which allows a static image to remain on a display when the power is switched off. His appointment follows the launch of ZBD’s electronic label for the retail sector. Most recently Dix was product manager at Red-M, a wireless networking solutions provider, and he has previously held positions in the IT industry at Perle Systems and 3D Labs.

US

ORA expands its team of software developers

Ron Gordon has joined the US optical software developer Optical Research Associates (ORA) as senior systems engineer. Gordon received his PhD in optics from the University of Rochester, and his experience includes engineering positions at IBM Microelectronics and Motorola. Gordon will be focusing on developing software for the lithography industry, a key market for ORA.
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