

## Laser Science is the Gold Sponsor of the Laser World of Photonics 2013

### Newly Launched Products:

- *Coherent's Fidelity 1055 - 2, a High Power Femtosecond Fiber Laser*
- *Hinds Instruments announces Birefringence Imaging Microscope*
- *PCO's new PCO.Edge gold 5.5 sCMOS camera*
- *Fianium introduce the world Brightest Supercontinuum Laser*

Laser Science Services (I) Pvt. Ltd, has chosen to become the gold sponsor of this year's Laser World of Photonics 2013, which is to be held in Mumbai from the 12th to the 14th of November. This 3 day exhibition is one of the biggest in India and is organized by the Messe München International (MMI India), which holds these exhibitions in various countries on a grand scale.

Laser Science is presenting 13 of its principals, each one, a global leader in their respective businesses, and their most advanced systems at the exhibition this year. These include the Sting Ray and the Laser Lift Off Model from Coherent Inc. (Santa Clara, USA), 1KW OEM System and the high power and standard G4 systems from SPI Lasers (UK), the MOKE system and PEM kit from Hinds Instruments (USA), the PicoEmerald & wavescan by APE (Germany), a Beam Delivery Unit by Optec (Belgium), a streak camera & Optoanalyze s/w from Optronis (Germany), a DFB Laser by NanoPlus (Germany), optics and optomechanical components by Sigma Koki (Japan), the laser head - LPY707G from Litron Lasers (UK), the LDC-

400 cleaver from Vytran (USA) and the PCO.Edge 5.5 camera from PCO. (Germany). Other principals include Cyber-Laser (Japan), Rainbow Photonics (Switzerland).



Team Laser Science at their booth during the Laser World of Photonics 2012.

In addition to the demo systems, Laser Science has also organized special talks and seminars by some of its principals on the 2nd and 3rd days of the event, which focus on very interesting and engaging topics.

Last year, the Laser World of Photonics played host to 128 exhibitors and 2,688 trade visitors. However, this year, with two other concurrent exhibitions "Intersolar India" and "Analytica Anacon India" during the same period, at the same venue, Laser Science expects the participation of visitors and exhibitors to double this November.

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## Bringing Tomorrow's Technology to Indian Labs

In the last 3 months, Laser Science has installed a number of new systems across various labs in India. The most recent of these is Excimer Laser ComPex Pro 102F from Coherent GmbH at National Center for Nano-Science and Technology, Mumbai on February 2014.

In January 2014, Laser Science installed ComPex Pro 205F from Coherent GmbH at TIFR Mumbai .

In November 2013, Laser Science installed Excimer Laser ComPex Pro 201F from Coherent GmbH at DIAT Pune and also Neocera Pioneer 180 PED System at University of Mumbai.



Neocera Chamber at University of Mumbai

## Laser Science Bags SE-2B NSIC-CRISIL Rating

CRISIL in association with NSIC ( National Small Industries Corporation) has awarded Laser Science Services (I) Pvt. Ltd. a rating of **SE-2B**, which stands for 'High Performance Capability and Moderate Financial Strength.'

The CRISIL SME Rating in association with NSIC indicates the SME's performance capability and financial strength. This rating reflects the level of creditworthiness of the SME, adjudged in relation to other SMEs.

## Enlitech Officially Enters the Indian Market Through Laser Science

After several years working in the photovoltaics field, Enlitech, in the second quarter of 2013, won the tender held by Indian Institute of Technology - IIT Kharagpur, for the purchase of a Spectral Response/Quantum Efficiency measurement system. With this sale, Enlitech officially entered the Indian market through its Indian partner, Laser Science.

## Hinds Instruments Wins R&D 100 Award for 150 XT Mueller Polarimeter

Hillsboro, Oregon, September 5, 2013 – Hinds Instruments, the leading global supplier of photoelastic modulators (PEMs), was awarded 2013 R&D 100 award from the R&D Magazine for its 150 XT Mueller Polarimeter.

## Research Article: Three-dimensional Patterning of Metal Nanostructures Using a Femtosecond Laser

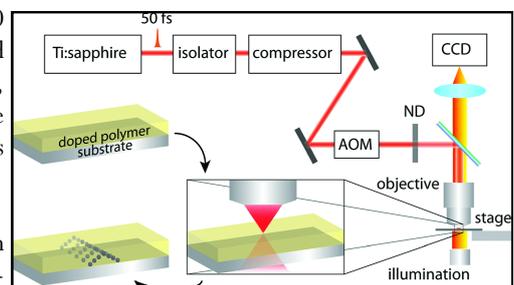
Patterning metals in three dimensions at the submicrometer scale is a necessity for a number of state of the art devices used in microelectronics, optics and bio-sensing applications. One emerging technique that can be leveraged to produce such structures while maintaining a high resolution is femtosecond laser direct-writing.

What really makes this process possible is the non-linear optical interaction between highly compressed, ultrashort femtosecond laser pulses and the material of interest. Such interactions allow for multi-photon absorption thus breaking the diffraction limit that typically restricts the smallest feature that can be patterned into a target material. In fact, recent studies have shown that this technique can lead to material change that is confined to as small as attoliter volumes within a tightly focused region.

In their paper, Vora et.al demonstrate the fabrication of disconnected 3D silver nanostructures by supplementing the femtosecond laser direct-writing of a polymer matrix with a photoreduction reaction. The laser used in the study was a 795 nm center wavelength Ti:sapphire laser with a 11 MHz repetition rate and a 50 fs pulse duration. With this, they were able to achieve an impressive 300 nm pattern resolution to-

gether with a 100 micron per second writing speed, demonstrating the versatility of this technique.

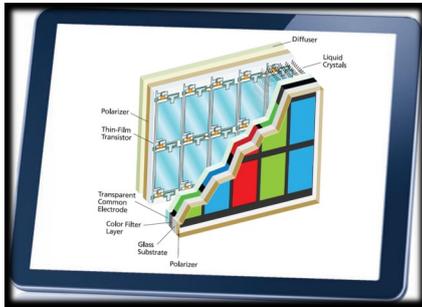
Such an approach may also be extended to the patterning of metamaterial stacks and other sophisticated photonic structures, which is presently difficult to do with sufficiently high resolutions. An additional advantage of this technique is its cost-effective nature and simple setup that can be easily modified to pattern a vast number of materials for a host of applications.



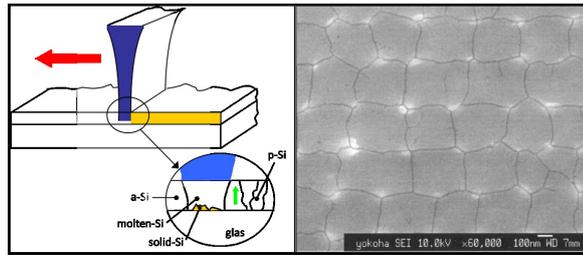
Schematic of the fabrication process (Taken from Ref.). A microscope objective focuses laser pulses from an 11-MHz ultrafast Ti:sapphire laser system inside a doped polymer sample. The microscope objective also provides in-situ imaging. A high-precision and long-travel three-axis translation stage scans the sample in the x-, y- and z-directions while an acousto-optic modulator shutters laser pulses to control exposure. The result is a direct-written dielectric-embedded silver structure in 3D.

*Ref: Kevin Vora, SeungYeon Kang, Shobha Shukla and Eric Mazur, Appl. Phys. Lett. 100, 063120 (2012)*

## Excimer Laser's Trail-Blazing Role in Smartphone and Tablet Manufacturing



Anatomy of an active matrix LCD color display.



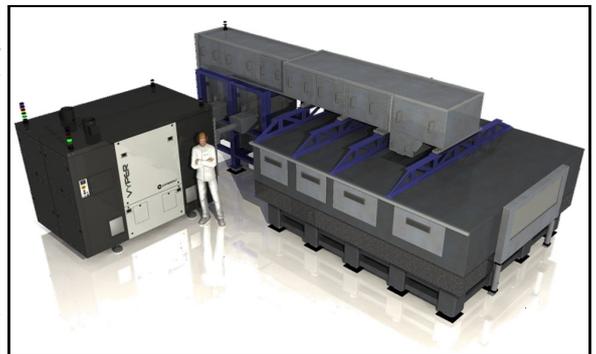
Stochastic vertical crystal growth mechanism (left) and typical crystal grain pattern with ELA (right).

Over the past decade, flat panel display technology has advanced to a point where cell phone and tablet screens having resolutions greater than 250 pixels per inch are now commonplace. In order to reach such high resolutions, it is essential that the backplane of the thin film transistor (TFT) array controlling individual pixels in the display be made out of high electron mobility materials. This however, is difficult to realize with amorphous silicon since its inherently low mobility makes it impossible to draw sufficient power from the system while also meeting miniaturization requirements.

The use of polycrystalline silicon is a viable solution to this problem owing to the fact that electron mobilities in excess of  $200 \text{ cm}^2/\text{V}\cdot\text{s}$  can be comfortably reached with polysilicon TFTs. The difficulty with doing so is that the annealing process for transforming amorphous silicon into polysilicon must be carried out at very high temperatures. As a result, traditional glass substrates that cannot withstand such high temperatures must be replaced with quartz, which turns out to be cost-prohibitive for large-scale manufacturing.

Thankfully, over the last decade researchers have developed a highly efficient low temperature polysilicon process known as excimer laser annealing (ELA) that circumvents the disadvantages associated with traditional annealing techniques and has therefore become the processing technique of choice. As it turns out, the use of an excimer laser with a wavelength of 308 nm allows one to anneal amorphous silicon on glass substrates without melting or damaging the glass in any way. The primary reasons for this are the low penetration depth and short pulse width associated with this process that keep the glass from undergoing thermal damage.

In addition, the productivity of ELA based systems has improved drastically in recent years with the latest addition being Coherent's 750 mm line beam annealing system called the 'VYPER'. These systems are now being used to successfully crystallize thousands of Gen 5.5 substrates that are employed in the mass-production of large-area, high efficiency AMOLED displays and OLED TV panels.



Complete annealing system including VYPER laser, 750 mm line beam module and annealing chamber.

*Article Courtesy: Ralph Delmdahl, Burkhard Fechner, Coherent LaserSystems GmbH & Co. KG, Göttingen*

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Incepted in 1988 by Dr. Lalit Kumar, Laser Science is India's premier distributor of lasers and spectroscopy instruments. Our range of products covers scientific and industrial laser systems, spectroscopy, microscopy & imaging systems. We distribute over 36 major brands that are reputable global market leaders in their respective fields. Our extensive customer coverage includes R&D institutions and commercial & industrial organizations all over India.

Our strategic focus is on continuously exceeding customer expectations, a commitment to quality, proactive market development and providing the most superior quality customer service.

Headquartered in Navi Mumbai, Laser Science has regional sales offices in Chennai, Delhi & Kolkata.

**BRINGING TOMORROW'S TECHNOLOGY TODAY**

*CELEBRATING 25 YEARS OF EXCELLENCE!*

**Newly Launched Products**

**Coherent Inc, USA announces its new product Fidelity 1055 - 2, a High Power Femto-second Fiber Laser**

Fidelity is a revolutionary ultrafast fiber laser that offers a unique combination of high average power and extremely short pulses in a simple to operate and maintenance - free and compact package. This product carry various features as shortest specified pulse length from a commercial fiber laser, High average power >2W, Compact foot print, Air cooled, R - 232 interface and many more. It can be used for different applications as Time Resolved, Non-Linear Spectroscopy, Multiphoton Excitation (MPE) Microscopy, Optogenetic Microscopy, Terahertz Generation, Super continuum Generation, Amplifier Seeding and others.

**PCO launches the new PCO.Edge gold 5.5**

The new pco.edge gold 5.5 is a another breakthrough in scientific imaging cameras, due to its distinctive ability to simultaneously deliver extremely low noise, good frame rates, wide dynamic range, high quantum efficiency, high resolution and large field of view - all in one image. It carry various features as quantum efficiency of image sensor <60% , spectral range of camera : 370nm - 1100nm, camera pixel scan rate : 86.0 MHz, Camera non linearity <0.6%. This camera can be used for different applications as astronomy, live cell

microscopy, localization microscopy, photovoltaic inspection, high content screening, biological & chemical luminescence, flow cytometry and many more.

**Fianium introduce the world Brightest Super-continuum Laser**

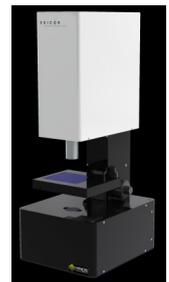
Fianium have introduced the White Laser SC480-20, the world's highest brightness supercontinuum laser with an unprecedented 20W of total power. This new system has over 3W of visible (350-750nm), 4.5W of extended visible (350-850nm) power and a continuous output spectrum from 480nm to 2400nm.

**Hinds Instruments announces Birefringence Imaging Microscope**

Hinds Instruments has applied the power & versatility of the Photo Elastic Modulators (PEM) to produce a birefringence imaging microscope. With the digital resolution of 0.01nm a detection limit (noise floor) of 0.1nm and a measurement range of beyond 300nm (using red light), this new instrument offers quick and reliable measurement in an integrated system package that includes camera, optics, electronics, sample stage hardware & software. This product is ideal for measuring birefringence in biological structures, glass, crystals, and many other organic and inorganic samples.



**Fidelity 1055-2**



**Exicor-Micro-Imager**



**PCO.edge Gold 5.5**