

IPG Photonics Extends Laser Welding Solutions with the Acquisition of Cosytronic

System Tools in Welding and Automation Technology Allow IPG to Target Applications in Automotive, Sheet Metal Production and other Material Processing Applications

IPG Photonics is proud to announce the acquisition of privately-held, Germany-based Cosytronic KG (COSY), a specialist in the joining technology with an emphasis on engineering know-how in automated welding turnkey solutions. The acquisition allows IPG to extend its product offerings to include a welding tool that integrates seamlessly with IPG's fiber laser.

COSY's core capabilities include the development, engineering and application of new, modern joining techniques and innovative welding tools for many material processing end-markets. The acquisition is expected to have no material effect on IPG's financial results in 2010. Financial terms were not disclosed.

"With the acquisition of Cosytronic, we plan to enhance IPG's product portfolio of laser welding tools with fiber lasers – a promising complementary market for us," said Dr. Valentin Gapontsev, IPG Photonics Chairman and CEO. "Combining our state-of-the-art fiber laser technology with COSY's proven and innovative laser welding technology opens exciting opportunities to build robust integrated robotic solutions for various automotive, sheet metal production and other material applications. Both companies have complementary expertise, strong market reputations and a passion for technological innovations. We look forward to integrating our similar entrepreneurial cultures and further strengthening our leadership position in fiber lasers and solutions."

The latest commercial product from COSY is the fiber-based Laser-Seam-Stepper for laser welding applications. Laser welding can be applied in car body plants and in the production of sheet metal components with the following advantages over traditional resistance spot welding process:

- Higher processing speed and shorter production cycle times
- Increased component strength with longer seams that create higher torsion stiffness
- Total cost of ownership comparable to today's modern resistance welding systems
- Flexible welding head and greater ability to handle the processing materials and
- Continued focus on laser safety requirements without the need for an enclosed cell.

For more information contact Bill Shiner, (508) 373-1144 or bshiner@ipgphotonics.com.



IPG Photonics Enters Emerging Middle-Infrared Laser Space with Acquisition of Photonics Innovations, Inc.

Middle-Infrared Capabilities Allow IPG to Target New Applications in Medical, Advanced Applications and Material Processing

IPG Photonics is proud to announce the acquisition of the outstanding shares of privately-held, Birmingham, Alabama-based Photonics Innovations, Inc. (PII), a maker of active and passive laser materials and tunable lasers for scientific, biomedical, technological, and eyesafe range-finding applications. The acquisition allows IPG to expand its product offerings to the middle infrared (approximately 2 to 5 micron). PII's core capabilities include novel optical and laser materials fabrication, solid state and tunable laser design, and optical and sensing systems development.

PII was established by researchers at The University of Alabama at Birmingham (UAB) to apply proprietary and patented optical materials, lasers, and spectroscopic technologies to the development and commercialization of state-of-the-art optical sensing instruments in rapid sensing, identification, and quantification of agents and materials. In addition to active and passive laser materials and tunable lasers, PII develops affordable and reliable middle-infrared microchip and external cavity broadly tunable light sources for scientific, sensing, medical and defense related applications. It also manufactures integrated state-of-the-art middle-infrared optical sensing instruments for rapid sensing, identification, and quantification of agents and materials.

"With the acquisition of Photonics Innovations, we plan to enhance IPG's product portfolio in middle-infrared spectral range – an exciting emerging market," said Dr. Valentin Gapontsev, IPG Photonics Chairman and CEO. "The combining of our state-of-the-art fiber laser technology with PII's proprietary transition metal doped ZnS and ZnSe based crystal laser materials has opened exciting opportunities to build new perfect hybrid laser sources in the range 2 to 5 um for various applications. Both companies have complementary expertise and a passion for technological innovations. We look forward to integrating our similar entrepreneurial cultures and further strengthening our leadership position in fiber lasers."

"We are delighted to join IPG Photonics," commented Dr. Sergey Mirov, President of Photonics Innovations, Inc. "As a result of this merger, the combined company now has significantly more resources and the ability to target many new applications in biomedical, sensing, instrumentations, advanced systems, and material processing. IPG is a natural strategic fit for PII and we believe this will benefit both companies' customers."

For more information contact Sergey Mirov, (205) 243-7498 or smirov@ipgphotonics.com.

LIA Northern California Meeting a Success

On April 21st, the Northern California (NorCal) Laser Institute of America's (LIA) Chapter welcomed 50 industry professionals for an evening of networking, good food and a much anticipated presentation by Dr. Ken Caldeira addressing climate change and its unfolding impact on the globe.

Ken Caldeira is an atmospheric scientist who works at the Carnegie Institution for Science, Department of Global Ecology. He researches ocean acidification, climate effects of trees, intentional climate modification, and interactions in the global carbon/climate system. Dr. Caldeira's presentation reviewed natural and man-made contributions to global warming, including scientific and socioeconomic perspectives of various options for dealing with these issues. Ken shared some of his personal experiences and insight to the exciting and direct role he plays in educating government and non-government sectors. For example, he gave us some insight as to an expanded, futuristic role high powered lasers might play in space for energy generation to earth or to orbiting space craft. Other laser applications might involve nuclear-powered vessels, like navy ships, as potential sources of laser directed energy to land-based PV receptors for power generation needs in remote locations or for emergency situations.

The evening's presentation was introduced by Neil Ball, LIA Chapter Chair, followed by Tony Hoult who set the evening's theme by presenting an overview of the role lasers play in PV/ green-energy applications. Meeting attendees included technologists and business management members and non-members from San Francisco-based solar, semiconductor, medical device, laser, safety and computer based organizations. We were especially delighted that our student guests, middle school through college, gained a lot from the presentations as well; "Tomorrow's innovators are enabled by today's mentors."

To be notified of future events or make topic suggestions contact LIA: kpollack@laserinstitute.org. We look forward to welcoming you to the next chapter event.



IPG Hosts Precitec for Two Seminars in Detroit



Precitec held two days worth of advanced seminars to discuss recently developed processes with IPG fiber lasers. IPG hosted the seminars in March at its Midwest Operations Facility in Novi (Detroit), MI. The event drew industry leaders interested in reviewing three new products from Precitec that were specifically developed to increase the utility of fiber lasers. The highlight of the hands-on demonstration showed an IPG 10 kW laser connected to the new Precitec "Wobble Tracker" optical head incorporating an oscillating weave pattern in the welding spot with seam tracking to bridge gaps in a non-linear butt joint seam.

About 100 people were present for this event that was supported by 10 other companies as well. EWI also presented high speed captured video of laser hybrid welding to visibly show what was seen in the weld pool.

All of the products introduced by Precitec are now available to customers. For more information, please contact Brad Trees, Sales Manager, Precitec Inc., 28043 Center Oaks Court, Wixom, MI 48393; +1 (248) 446 8100; bradt@precitec.com; www.precitec.com.



Spot Welding with Fiber Lasers

IPG Photonics has introduced a new laser that changes the industry status quo once again. For many years now, low heat input spot welding has been the preserve of flash lamp-pumped solid state lasers. Only recently has a progressive alternative to this technology been developed in IPG's cost effective and highly efficient quasi-cw (QCW) line of fiber lasers.

The inherent flexibility of fiber lasers allows modulation of the cw output to 10% beam-on to beam-off cycle. With pulse lengths in the range of 0.2-20 ms and a higher average output power ≥ 1 kW, it is possible to achieve multi-joule pulses for producing spot welds with the QCW fiber laser. IPG has leveraged expertise in pump diode design, development and manufacturing to produce single emitter diode pumps to produce high energy pulses. In contrast, this modulation regime is known to be problematic for diode laser bars that exhibit short lifetimes in this mode so it makes little sense to build a diode bar pumped laser for this application.

The new long pulse QCW lasers, such as the YLR-150/1500-QCW-AC, are a more cost effective solution as a great deal less laser infrastructure and far fewer pump diodes are required. This recently introduced laser uses the well-tried and tested IPG fiber laser design in conjunction with novel pump diodes not previously possible from fiber lasers. These highly efficient air-cooled lasers have a range of pulse length and pulse energy similar to those employed by flash lamp-pumped lasers and as shown below, the results produced are very similar. Both YLR units are air cooled lasers that only require single phase electrical power and fit into 4U high 19" rack mount units, whereas the YLS series is available in a 230 VAC, air-cooled NEMA 12 enclosure.

Parameters	Max Peak Power	Max Pulse Duration	Max Duty Cycle
YLR-150/750-QCW-AC	750 Watts	20 ms	20%
YLR-150/1500-QCW-AC	1500 Watts	10 ms	10%
YLS-400/4000-QCW-AC	4000 Watts	10 ms	10%
YLS-600/6000-QCW-AC	6000 Watts	10 ms	10%

Flash lamp-pumped lasers are inefficient with an approximate 3.5% wall plug efficiency. With wall plug efficiency almost an order of magnitude (10X) higher, this truly is a huge step forward in efficiency alone without considering all the other fiber laser benefits: 30% of the floorspace requirements, zero maintenance and the truly stable pulse-to-pulse performance for which fiber lasers are renowned.



Fig. 1 Top surface of butt welded titanium

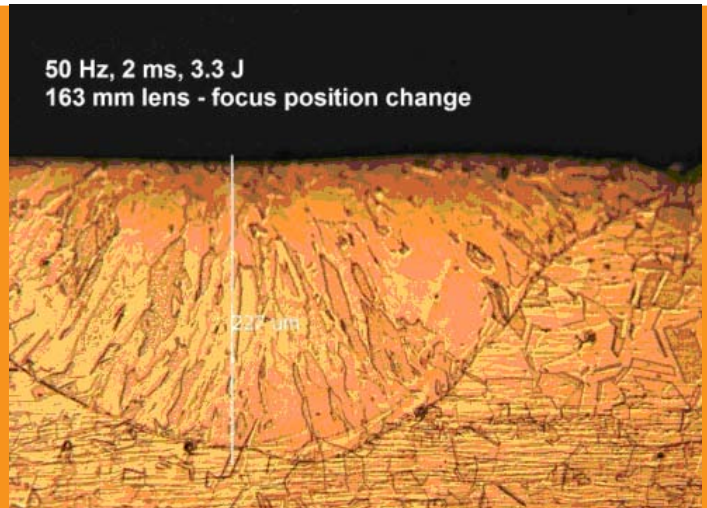


Fig. 2 Transverse section of bead-on-plate weld on 304 stainless steel

The high brightness of this laser could initially be considered a handicap for producing large 0.5 mm diameter spot welds typical of those employed for welding certain heat sensitive devices. These large spot sizes are often required either to increase weld strength or to bridge small gaps between parts. To provide a greater range of available parameters the QCW laser can be supplied with multi-mode delivery fibers from 50 to 200 μm diameters. Combining this with a choice of re-collimating and focus lenses allows a large range of spot diameters and hence weld spot diameters to be produced at the workpiece.

Figure 1 shows the top surface of a high-quality, low-duty seam weld made up of a series of overlapping spots that solidify between pulses. This was produced on stainless steel using argon cover gas. Figure 2 shows a metallographic cross-section of a bead-on-plate weld of exceptional weld quality with zero weld porosity even though no gas cover at all was employed for these trials.

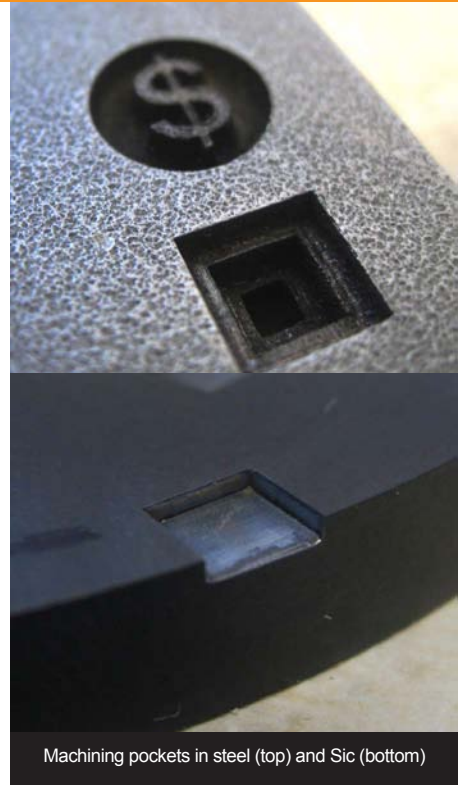
The cutting and drilling performance of this laser is also being investigated for high reflectivity materials. More information will be reported shortly; contact sales.us@ipgphotonics.com for more information.

1 mJ YLP Series Lasers for Deep Engraving Applications

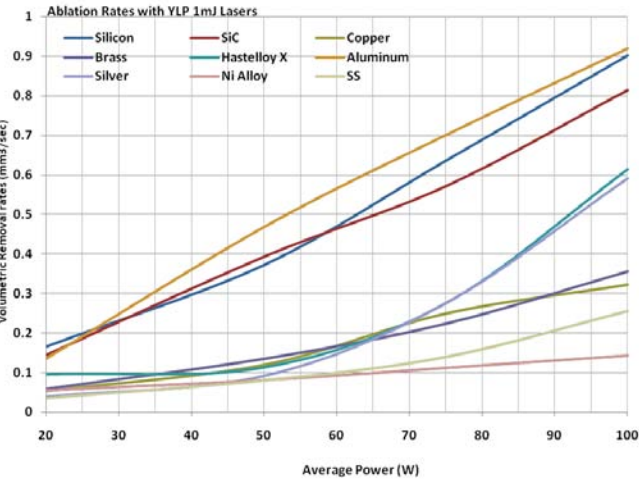
The YLP Series 1 mJ 20 W laser has been widely used for marking on a range of materials and applications. The new IPG 50 and 100 W 1 mJ high average power lasers have caused increased interest in deep engraving applications from our customers and OEM vendors. These high average power lasers can engrave deeper and substantially reduce cycle time; they are quickly becoming the “go-to” laser for these types of applications. The high power lasers have a peak power of 8.3 kW and can be pulsed up to 200 kHz. The pulse width is 120 ns with beam quality (M2) of 1.5.

Laser engraving is quite economical and produces detailed artwork, text or graphics compared to mechanical engraving. Advantages over the mechanical process include substantial cost savings in setup, process time,

fine detail engraving and the ability to engrave on curved surfaces. The most popular applications for laser engraving are making molds, engraving of jewelry and engraving parts for tracking that will be used in rugged environments. The most common materials engraved are steels, ceramics and highly reflective materials such as gold, silver, brass. These metals can be easily machined without concerns as the YLP lasers are equipped with a heavy duty optical isolator that eliminates back reflections and also improves output pulse stability. The YLP lasers are opening up other nonconventional applications in the engraving domain such as milling of trenches and other materials like Silicon carbide (Sic), Inconel and thermal barrier coatings.



Machining pockets in steel (top) and SiC (bottom)



Ablation rates of different materials

surface roughness also influence parameter settings. When engraving at low average power the quality of the work is much finer and controlled but the process extremely slow. Work performed with a higher power laser is much faster but the engraving is not as fine. Techniques using a combination of high and low power settings will achieve optimal engraving results. Engraving tests were performed on a variety of materials from 20 W to 100 W with 1 mJ pulses; the chart above shows a rough estimate of ablation rates based on data gathered. These numbers can vary depending on optical configuration, laser settings, scanner delays and software settings. A system with proper software capabilities can achieve a variety of high quality engraving such as positive and negative 2-D and 3-D layering with the use of fiber lasers.



Deep engraving in Inconel (left), anodized AL (middle) and silver (right)

The 1 mJ YLP Series of pulsed fiber lasers is designed to be easily integrated into an OEM application such as 2-D and 3-D deep engraving machining systems. These lasers deliver high peak power (up to 10 kW) and high average power (up to 100 W) with sub 120 nanosecond pulse durations. The increased power levels allow end users to achieve faster ablation rates and make the process more efficient. These lasers embody all of the advantages of IPG's fiber laser technology including ultra reliable pump diodes, compactness, high efficiency and reliability at a very competitive price. The factory sealed YLP lasers are robust, maintenance and service free and require no consumables. Contact IPG to discuss your specific application at sales.us@ipgphotonics.com.

Cutting of Thick Steels with IPG's Fiber Lasers

Recent Updates



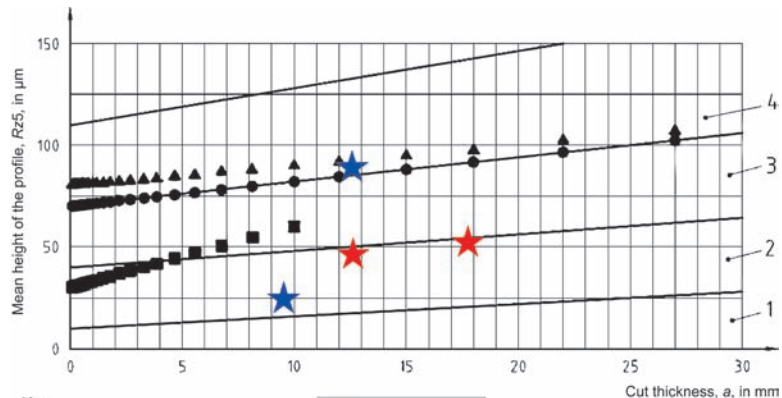
Fig 1 16 mm thick mild steel cut surface

IPG's fiber lasers are highly efficient and provide excellent cut quality for cutting thin steels up to a few millimeters in thickness. The high brightness of fiber lasers produces a more efficient cutting process in terms of power per unit length of cut, so a 1.5 kW fiber laser can often cut the same thickness of steel as fast as a 2 kW CO₂ laser.

For thicknesses of 5 mm - 8 mm, the cut quality achieved with fiber lasers is equivalent to those obtainable from higher power CO₂ lasers. Until recently, the waviness on the lower part of the laser cut surface was unacceptable above 8 mm.

During the laser fusion cutting process, the oxygen assist gas is usually provided through a co-axial nozzle to the cut. An exothermic reaction then provides a large part of the energy delivered to the cut. For this reason most results for cutting thick steels > 12.5 mm thick are very similar in terms of cut speed.

When working with thick steels, the first step is to identify a technique to quantify cut quality. Measuring surface roughness and plotting on a DIN standard 9013 chart is a widely accepted technique based on analysis of the surface roughness of the roughest part of the cut, this allows definite quantitative comparisons to be made between different results. Figure 1 shows recent results achieved by IPG Applications Lab in Burbach, Germany. These results are now equivalent to those produced by most CO₂ lasers. Detailed cutting results are available; contact IPG to discuss your specific application at sales.us@ipgphotonics.com.



Key

- Oxyfuel flame cutting
- ▲ Plasma cutting
- Laser cutting

- ★ 2009 results
- ★ 2010 results

Typical cutting qualities achievable with mean height of the profile, Rz5-
Work piece thickness up to 30 mm

Results plotted on DIN 9013 chart

Application and Technical Notes Now Available on IPG website

IPG Photonics continually develops new fiber laser technology; new lasers and capabilities allow previously unexplored applications and processes to be identified and studied. IPG's Applications Facilities have produced Application and Technical Notes that outline new process and laser developments. Go to http://www.ipgphotonics.com/apps_notes.htm to download; more notes will be added as written.

Now available:

Application Note #01: Laser Scribing for Thin Film PV Panels with a Novel Pulsed Green Fiber Laser

Application Note #02: Further Improvements to Nanosecond Pulsed Lasers

Application Note #03: Dark Oxide Marking on 304 Stainless Steel

Application Note #04: Applications of Fiber Lasers for Solar Cell Manufacturing

Application Note #05: Cutting with Long Pulse Fiber Lasers YLR 150/1500-QCW-AC

Technical Note #01: YLP-HC Model Lasers

Contact any of IPG's four Application Facilities to arrange complimentary sample processing, evaluation & project planning.

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UPCOMING EVENTS

June 8-10	LASYS, Stuttgart, Germany	Hall 1, Booth #G52
June 15-18	DEPS Advanced High-Power Laser Review, Broomfield, CO	
June 28-July	5th International Symposium on High-Power Fiber Lasers and Their Applications, St. Petersburg, Russia	
September 13-15	FTTH Conference & Expo, Las Vegas, NV	Booth #330
September 20-22	ECOC 2010, Torino, Italy	Stand #410
September 27-30	ICALEO 2010, Anaheim, CA	
October 12-14	MD&M Minneapolis, Minneapolis, MN	Booth #1645
November 2-4	FABTECH 2010, Atlanta, GA	Booth #7203

The Power to Transform®

Don't be in the Dark About Your Lamp-Pumped YAG Laser
REPLACE = SAVE ENERGY = SAVE MONEY
 Go **GREEN** with IPG Photonics' New Quasi-CW Fiber Laser



IPG Photonics' NEW Quasi-CW line of fiber lasers now feature up to 6 kW peak power with 600 Watts average output power. The QCW line of lasers allows for high energy without the high cost, making it the perfect solution for a multitude of applications such as spot welding, seam welding, microwelding, drilling and cutting.



YLR-150/1500-QCW-AC
 4U 19" rack mountable
 (W x D x H) 448 x 500 x 177 mm



YLS-400/4000-QCW-AC
 NEMA 12 enclosure
 (W x D x H) 604 x 605 x 804 mm

IPG's QCW Line of Fiber Lasers Feature:

MODELS NOW AVAILABLE:

YLR-150/750-QCW-AC
YLR-150/1500-QCW-AC
YLS-400/4000-QCW-AC
YLS-600/6000-QCW-AC

- >30% Wall Plug Efficiency •
- Compact/ Rugged Design •
- Plug & Play Construction •
- 750, 1500, 4000 or 6000 W Peak Powers Available •
- Pulse Width 0.2 - 20 ms •
- Pulse Shaping •
- 250 - 600 W Average Power (CW) •
- Color Touchscreen Interface on YLR Version •
- Air Cooling •

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