

Hub of Application Laboratories for Equipment Assessment
In Laser Based Manufacturing

Editorial

Dear APPOLO newsletter readers,



The time since the last issue of the APPOLO newsletter in August 2014 has been full of challenging and exciting events. One of the most important was the annual review of the project covering the achievements during the first year. Even though there were with some delays in particular activities, the overall results of the review were positive and encouraging. In addition, the modification of equipment to meet the specialized requirements of our end-users to enhance reliability, average power and control is finalised and assessments are proceeding with full engagement.

For example, a method for the on-line control of electrical properties in thin film scribing has been developed by IOM and validated by other partners. Complex assessment procedures were prepared to accumulate our knowledge and standardise the procedures for laser scribing validation. Optimized surface textures were found to release polymer parts with soft touch surfaces from their moulds. High speed surface texturing with advanced polygon scanner options and optimal use of laser pulse energy moved to higher precision. The LIFT process was approved with viscous silver paste and paves a way for novel technologies in metallisation of bus grids on solar cells. First sensors with electro-less metal plating on laser modified polymer surface were demonstrated, and the plating technology was developed further to undoped materials. Furthermore the APPOLO Project has announced an open competitive call for new assessment experiments and is awaiting proposals. To extend the coverage of the project, new partners are needed with innovative equipment and new emerging laser technologies to validate. Two webinars for potential applicants will be organized in collaboration with I4MS for up to 20 attendees. Further information concerning the open call can be found on page 5 of the newsletter.

APPOLO's second workshop dedicated to laser for photovoltaics was held at IOM in Leipzig with fruitful discussions between scientist and industry on current state and potentials of laser technologies in thin-film and silicon photovoltaics. Photonics West 2015 was again one of most important international events where results of the APPOLO project were actively presented.

We hope you enjoy this edition of the APPOLO newsletter,
Gediminas Račiukaitis, Project Coordinator

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Focus Topic

Laser direct writing for flexible electronics

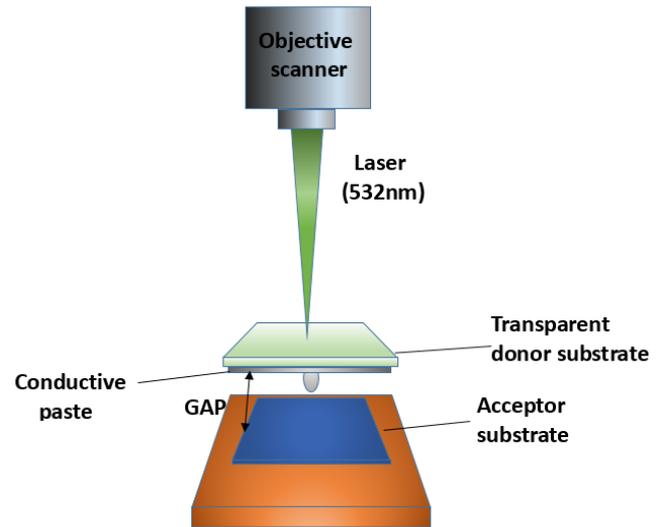
Some of the basic problems found in current state of the art technologies within the flex/3D electronics industry can be overcome by using laser techniques for material transferring as well as defining the metallic contacts onto flexible optoelectronics devices, especially in planar geometry. APPOLO researchers from Polytechnic University of Madrid (UPM), Mondragon Assembly (MONA), and Abengoa Solar New Technologies (ASNT) are working on the design and development of reliable schemes for direct writing of electronics and photovoltaics in planar geometry by means of Laser Induced Forward Transfer (LIFT) and post-deposit laser firing and curing techniques.

Laser Induce Forward Transfer

The LIFT process is a local technique to transfer different materials (especially metallic solid materials or material dissolved in an assisting matrix) of different sizes onto a number of different substrates. LIFT uses laser pulses to push thin disks of a ribbon material from a transparent substrate and deposit them onto an acceptor substrate. The laser beam is focused into the donor substrate or ribbon interface. During the pulse duration, the laser energy is deposited into the interface within the laser spot size, evaporating a little amount of the material and generating the expansion of the remaining material, accelerating the non-evaporated part of the metal film towards the acceptor substrate.

The LIFT made with ns pulses is a well-known technology to generate structured metallization onto substrates. But it has not yet been applied to define the fingers of front contact in a photovoltaic device in a single step.

In the ns range, the transfer of very precise geometries is difficult to control, but the use of ultrafast lasers may overcome this difficulty. Relative translation of the source and substrate, or the scanning of laser beam, allows the generation of complex pattern formation in three dimensions in a conformal way.



LIFT set-up for flexible electronics writing

©UPM

When using LIFT for metallization of electronic devices, such as solar cells, commercial silver pastes can be used as starting material to be transferred. These pastes have been designed for its application in conventional screen-printing techniques and are characterized for having a low curing temperature. However, they have the disadvantage of having a very large viscosity, making the parameterization of LIFT process more complicated than in the case of aqueous solutions typical used in LIFT.

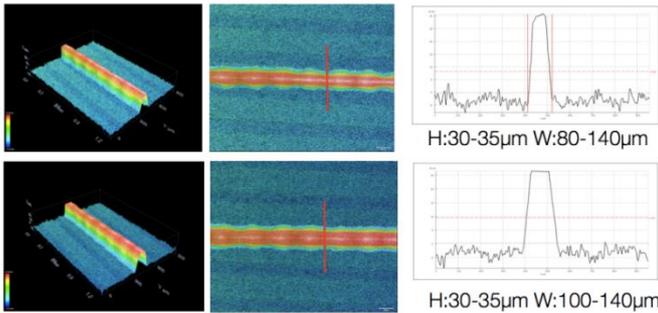


LIFT test bench for different ps-laser sources

©UPM

UPM currently has a working installation for LIFT. It is based on a ns-pulse diode pumped solid-state green laser. Using this station it is possible to transfer a large amount of material per laser pulse (hundreds of pL) and to deposited continuous metallic lines with aspect ratios up to 0.40. They are larger than those obtained with screen-printing techniques using the same pastes. In the

frame of the APPOLO project, MONA and UPM have designed and built a test bench for installing different ps-laser sources provided by laser manufacturers such as EKSPILA and OneFive GmbH. The results obtained with these new generation industrial lasers are being compared with those obtained using standard ns-lasers.



First test results of LIFT process

©UPM

As a proof of concept, an important milestone is included in the activity of APPOLO, targeting the full metallization of a CIGS solar cell on steel flex substrate with fingers and busses deposited by LIFT technology. In case the proposed process is competitive with the state-of-the-art screen printing technologies, ASNT, as end-user of the technology, will characterize metallic lines deposited to assess.

Functionalization of the deposited material

The conductive material deposited by LIFT needs to be thermally treated in order to evaporate the solvent, cure the paste and sinter and melt the metallic particles. This process can be done by laser heating of the deposited material using continuous wave laser sources. This laser process has the advantage of being a low-temperature process. Meaning that only the deposited material is heated up, avoiding any furnace steps that could affect the performance of the electronic device negatively.

This approach is valid not only for sintering conductive pastes deposited by LIFT, but also for the curing of some thermal adhesives and silicones of interest in flex electronics, deposited using very new concepts of nozzle designs made by MONA. Due to the fact that the appropriate lasers to cure the materials are essentially the same as those used to fire the metallic pastes, this approach could allow to design and commercialize a very innovative industrial machine able to deposit conductive/dielectric materials (via LIFT or nozzle) and functionalize them by the use of laser.

<<News<<<News

National Energetics and EKSPILA awarded contract to build 10 PW laser system

A consortium led by National Energetics (Austin, TX), in partnership with Ekspla (Vilnius, Lithuania), has been awarded a contract in excess of \$40 m. to develop and install an ultra-intense laser system for the European Union's Extreme Light Infrastructure Beamlines facility (ELI-Beamlines) in Dolní Břežany near Prague in the Czech Republic.

The laser system will be capable of producing peak power in excess of 10 PW, making it the most powerful laser of its class in the world. It will be one of the four major beamlines at the new ELI-Beamlines facility that will allow novel research in areas such as plasma and high-energy-density physics, particle acceleration, and investigations into molecular, biomedical, and materials sciences.

National Energetics has years of experience building and using petawatt-class high-energy ultrafast laser systems, and Ekspla brings extensive experience in lasers and power-supply manufacturing. In addition to the two main consortium team members, Lawrence Livermore National Labs (LLNL; Livermore, CA) will be under a subcontract for technology support and to manufacture the specialized gratings; ELI-Beamlines will collaborate directly with the consortium on timing and controls; and Schott (Mainz, Germany) will supply the laser glass, which will be used in the large-aperture laser amplifiers.

[Find the full article at](http://www.laserfocusworld.com/articles/2014/09/national-energetics-and-ekspla-awarded-contract-to-build-ten-petawatt-laser-system.html)

<http://www.laserfocusworld.com/articles/2014/09/national-energetics-and-ekspla-awarded-contract-to-build-ten-petawatt-laser-system.html>

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APPOLO workshop gathers laser-expertise in photovoltaics

The potential application of laser technologies in photovoltaics for greater efficient and economic production and usage of solar modules was discussed by 35 experts from six countries at a two-day workshop at the Leibniz Institute of Surface Modification (IOM) in Leipzig.

The workshop “Laser Processing in Photovoltaics” was organized by the APPOLO network, which connects research institutes, laboratories and companies in the field of laser micromachining from all over Europe and which is financed as part of the 7th Framework Program of the EU.



APPOLO Workshop participants

©IOM

A review by Claus Zimmermann from Airbus Industries on photovoltaic modules as power sources for space applications opened the workshop with attendees from photovoltaic companies, system integrators, research institutes, universities, APPOLO partners and others. The two-day program included 16 keynote addresses and presentations on two competing technologies: crystalline silicon and thin film solar cells. State-of-the-art approaches for crystalline solar cells and possible applications of lasers in their production were discussed with Rico Boehme from InnoLas Solutions GmbH.

Alexander Braun, CTO of Solarion AG, presented the company’s view on pros and cons with monolithic interconnects in thin film solar cells on flexible substrates for production based on the roll-to-roll approach. He addressed

and encouraged the scientific community and machine suppliers to “continue your valuable developments – your efforts will pay out.”



Alexander Braun on monolithic interconnect

©IOM

“Lasers can help to produce photovoltaic modules faster and cleaner as well as improve their effectiveness and thereby will help European manufacturers to improve their competitiveness”, as Klaus Zimmer, leader of laser structuring at the IOM, stated within the workshop

The use of precise laser tools could for example, allow photovoltaics to increase the gross collection area thus improve efficiencies of the module, explains Dr. Zimmer.

Another goal of the workshop was to recognize future challenges beyond the state-of-art technology and to discuss questions of efficiency, sustainability and applicability. “It was an excellent opportunity to justify our potential with industry needs, future trends with barriers for realization. The photovoltaics market continues growing and new demand on equipment is increasing again which is a positive mark for European industry,” summarized Gediminas Račiukaitis, coordinator of the APPOLO project from the Center for Physical Sciences and Technology in Vilnius, Lithuania. “Thin-film CIGS technologies show significant progress in efficiency this year encouraging us to work more actively and collaborative in this field.”

Find the full press release at

http://www.iom-leipzig.de/uploads/media/APPOLO-Press_Release_IOM_Workshop_engl._20141203.pdf

APPOLO launches open call for new laser-experiments

Call Specifications

- Opening: January 12th, 2015
- Submission Deadline: March 18th, 2015 at 17:00 CET
- Expected Duration of Participation: July 2015- August 2017
- Foreseen Budget: ~ €1.2 m.
- Maximum funding request per proposal for new beneficiaries: €200,000

The project APPOLO, currently active in the Seventh Framework Programme, launches an Open Call for assessment experiments with new laser processing equipment for emerging manufacturing technologies based on ultra-short pulse (sub-ns). The projects running approximately two years aim at validation of the technologies needed for large and global markets. The equipment should be tested for the selected technological process in close-to industrial environment using the assessment service of laser application laboratories around Europe joined to APPOLO HUB. Validation will be performed in close collaboration between equipment supplier, end-user and an application laboratory connected to the APPOLO HUB. The new laser assessment experiments should provide business relevant technical investigations and demonstrate applicability of the new equipment for industrial applications.

Approximate 6 proposals will be selected for funding in this competitive call, including at least two new partners per proposal from equipment supply (preferable SME) and end-user sides with clear exploitation plans and one existing partner from APPOLO HUB in order to perform the equipment/technology assessment. Please note that the Seventh Framework program offers part-funding not full-funding of research activities.

A main goal of the open call is to increase overall impact of the APPOLO project by adding new applications and end-users, overlapping with running assessment value chains in terms of type of new equipment and applications will be scored as a weakness of the proposal.

Topics of the call

By processes

- Efficient laser treatment
 - High precision & speed texturing
 - High-speed large-area surface texturing
 - Roll-to-roll texturing
 - Functional surface texturing
- Laser post-processing
 - Moulds;
 - Laser sintered parts;
 - Polishing, texturing.

By application areas: laser processes for

- Thin film & flexible electronics
- Security and defence
- Photovoltaics
- Bio-sensing

By materials

- Composite materials
- Transparent materials
- Silicon wafers
- Polymers

By equipment to assess

- Ultra-short pulse laser
- Novel wavelengths
- Temporal/spatial beam shaping
- Fast scanners
- Process sensing & monitoring

Find more information at

<http://www.appolo-fp7.eu/open-call.html>

Meet the Consortium

Polytechnic University of Madrid



POLITÉCNICA

©UPM

Polytechnic University of Madrid (UPM) is the oldest and largest Spanish technical university, with more than 4,000 faculty members, around 38,000 undergraduate students and 6,000 postgraduates in 21 Schools of study. UPM benefits from the heritage of its schools: the most ancient ones were founded in the 18th century. Nowadays UPM's Schools cover most of engineering disciplines, as well as Architecture, Computer Science and Geodesy & Cartography. Moreover, UPM as a top quality academic establishment has a strong commitment to R&D and Innovation, boasting over 225 Research Units and over 10 Research Institutes and Technological Centers, contributing significantly to the international scientific community with a high number of journal papers, conference communications, and PhD theses.

The UPM researchers have large expertise in research projects participation both at national and international level. The presence of UPM in the international R&D arena is ensured by its consistent participation in various EU programmes. As far as UPM's participation in the 7th Framework Programme is concerned, the University has taken part in 218 European R&D projects with almost €60 m. of funding received from the European Commission. The UPM has been recognized as the Spanish University with the highest number of projects approved.

The activities in this project are the responsibility of researchers from the UPM Laser Center. The Laser Center of the UPM was founded in 1998 with the intention to establish a relationship between the industry

Interview...

...with Prof. Carlos Molpeceres, Full Professor at UPM's Laser Center

What are the biggest challenges in the field of laser-based manufacturing today?

Laser technology is, nowadays, a mature manufacturing technology in different strategic industrial sectors like automotive, aerospace, etc. However, the quick development of new laser sources, especially those with pulse duration in the sub-ns range offer a huge potential to increase the number of industrial applications in which laser technology can be the tool of choice.

In addition the development of a new generation of irradiation-, optoelectronics-, and realtime process-control-systems may help laser suppliers and machinery integrators to expand their business to new applications and even new industrial sectors.

The fundamental problem is to assess to which extent particular equipment fits the specifications of an application required by a potential customer. Especially for complex applications, the equipment supplier doesn't have the necessary experience nor the appropriate characterization technique to assess the real adequacy of its equipment in this context.

To which extent can APPOLO help to face those challenges?

APPOLO project has mainly focussed on covering the gap between the real needs of industry and the need of suppliers increasing their business opportunities and minimizing their risks.

To do so the project uses the concept of a HUB, integrating reference laboratories, across Europe. Using accumulated knowledge and specific infrastructure available, those labs cover the gap, defining an appropriate parameterization of a solution for the particular customers' needs, checking if the performance of a particular equipment or arrangement of different equipment offers a reliable solution for the problem.

In that way, the HUB acts like a quite sophisticated and structured element that can boost economic activity in the field of laser technology.

and the university, and to promote the research, development and diffusion of the laser technology.



Characterization techniques at UPM © UPM

In these ten years, the Laser Center has led the Spanish Research area related to high power laser applications. Since 2001 the Laser Center of UPM, and in particular the group leading by Prof. Molpeceres, has focussed its research activity in laser microprocessing, with special interest in developing new concepts of laser processes for PV applications and establishing new approaches to process characterization and control.



Laser source at Laser Center of UPM © UPM

The center's contribution to the development of laser-based processes and new concepts for solar cells fabrication has acquired worldwide recognition.

Currently the facilities available at the Laser Center UPM cover a comprehensive range of laser sources (ns and ps DPSS lasers, high rep. rate ps sources, excimer, etc), positioning systems and characterization techniques (ranging from Interferometric Microscopy to MicroRaman

techniques) for developing laser processes for industrial applications.

Within the APPOLO Project, in addition to offering general services as a member of the HUB, UPM is leading the assessment experiments related with new metallization laser-based technics for photovoltaics and flexible electronics, and participate actively in experiments targeting the assessment of new equipment to improve the scribing processes, and therefore the performance and efficiency, of CIGS thin film photovoltaic modules.

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Onefive releases the first all-in-one, air-cooled microjoule femtosecond laser

With the Origami-XP Onefive GmbH releases the first air cooled high energy femtosecond laser as an all-in-one solution. It combines laser head, controller and air cooling system in one single box in the size of 280 x 498 x 155, weighing under 30 kg.

The laser is based on the unique low-noise ultra-stable Origami femtosecond seed laser. A simple and compact chirped pulse amplification system allows the reaching of 60 μ J pulse energy, 4 W average power and pulse duration below 400 fs. The center wavelength is 1030nm.

The laser can be completely controlled by RS232 and CAN. The laser has been designed for the easiest and most cost-effective system integration. It comes with removable handles, offers simple through hole mounting and contains precise mechanical reference planes for simple drop in applications.

Source:

http://www.onefive.com/pdf/Onefive_PressRelease_12January2015.pdf

Mondragon Assembly



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Mondragon Assembly is a part of the world's largest cooperative group: The Mondragon Corporation. Started in 1954 it is today comprised of more than 255 Companies and 90,000 employees with consistent growth.



Mondragon Assembly facilities in Aretxabaleta ©Mondragon

Mondragon Assembly is a solid international group specialized in the development of integrated automation solutions. The mother company in Spain was founded in 1977 as one of the pioneers in high technology processes such as robotics, vision, dispensing, gluing, soldering or test machines. It has since become an international group with manufacturing plants in Spain, France, Germany, Mexico, China and Brazil. Additionally, the group has a strategic network of different subsidiaries and partners worldwide at its disposal.

Mondragon Assembly is highly represented in the manufacturing field, especially in the design and manufacturing of systems and equipment for process automation. Mondragon integrates a wide range of commercial elements in their systems and develops tailor-made solutions to adapt to customer's requirements, providing the most profitable solution in each individual case.

Mondragon Assembly has been in business for over 35 years, providing cost-effective solutions in close collaboration with clients, in order to match their needs for automation of the assembly processes.



Equipment for manufacturing switchgears ©Mondragon

The main sectors of activity for Mondragon Assembly are automotive, household appliances, photovoltaics, medical and cosmetic. Machinery development for the cutting-edge sectors involves a wide range of technologies to be implemented and precise control-monitoring techniques to be handled.

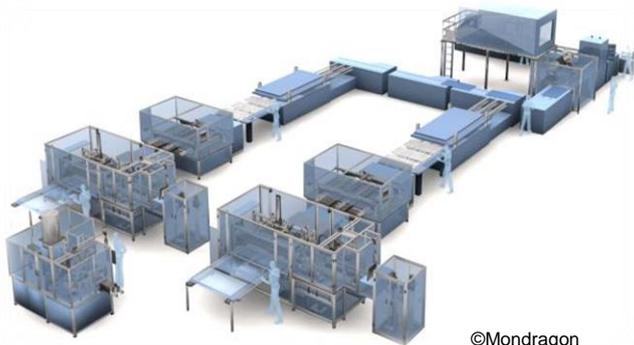
Mondragon Assembly's products are characterized by their precision, their proven reliability and their high level of productivity. They are developed as a result of the application of innovative technologies (handling systems, robotics, dispensing technologies, transfer system, vision system, soldering, laser, etc.), appreciated by customers leading their industries in innovation and efficiency.

Mondragon Assembly development lines are mainly dedicated to assuring a high quality standards and robust process control.

Mondragon Assembly has accumulated decades of experience in the solar industry, which has delivered projects around the world including Asia, Africa, Europe and America. Increasingly more solar energy facilities are coming online; from the 16 GW in 2008 to an increase of 40 GW in 2010 and expected to grow to 250 GW by 2020.

In 1999 utilizing the experience garnered through many years of innovation with state of the art technologies, Mondragon started the development of high quality equipment for module manufacturing in the photovoltaic industry. The company has been successfully active in this sector for over a decade. From 10 MW to over 100

MW, and in semiautomatic to full auto turnkey lines including the complete machinery settlement and development and with a range of services that go from module design up to certification guarantee, raw material specification and process know how training. Individual machines such as tabber & stringer, bussing or interconnections, cell tester/sorter, flash tester, laminator and EL are supplied.



©Mondragon

Turnkey line for manufacturing of PV modules

The products of Mondragon Assembly start from standard solar PV modules but range to more innovative solutions such as for example extra thin glass-glass modules for BIPV (Building Integrated) special high tech modules with different shape strings or small special purpose modules with cut cells.

For the APPOLO project, Mondragon Assembly will develop two laser systems dedicated to CIGS scribing and LIFT process. These set-ups will be installed at the Universidad Politecnica de Madrid, and will serve to test new laser sources provided by the partners, as well as new scanner and monitoring systems. This R&D work will bring a new product branch for Mondragon Assembly, focused on the integration of picosecond lasers for highly exigent applications in terms of accuracy and speed (up to 2 m/s).

In 2003 Mondragon Assembly established an R&D center in collaboration with other companies from the Mondragon Group. This R&D center is dedicated to the innovation and development of new products that are especially focused on the needs of Mondragon Assembly.

They apply their products and services to a large number of technologies and are a pioneer in the development of new ways of automation. Their dedication to innovation, excellent management and close relationships with clients are the three values that

have made Mondragon Assembly a worldwide reference point and a valued member in the APPOLO Project.

Interview...

...with Jean P. Aguerre, Director of R&D at Mondragon Assembly

What are the biggest challenges in the field of laser-based manufacturing today?

From Mondragon Assembly's point of view, laser technology is a very promising technology for a lot of assembling processes. It enables very fast and accurate welding processes and also curing of adhesives without damaging other parts or sub-parts.

The main challenge of laser technology today is to become affordable in terms of costs. This technology is ready to be introduced in a variety of markets enabling better process performances. Very often however, laser sources are prohibitively expensive making it unattractive to use.

To which extent can APPOLO help to face those challenges?

The APPOLO Project brings together the entire value chain, from laser manufacturers to end-users and applications. This represents a very good opportunity to focus on solving real industrial needs for concrete applications which can help manufacturers to optimize the compromise between cost and requirements.

On the other hand laser integrators like us are also present in the project, which is a very good way for reducing integration costs by sharing alternatives of beam delivery, auto-focusing, on the fly line tracking approaches and many more.

At the end of the project, we expect now expensive laser technologies, such as picosecond based ones, to become more affordable with processes improving quality and competitiveness of the end-users.

Abengoa Solar New Technologies

ABENGOA SOLAR

Solar power for a sustainable world

©ASNT

Abengoa solar business unit is a global solar power generation company that offers proven proprietary technologies (CSP & PV), innovating in the development of solar technology, as well as developing and operating solar plants. Currently a total installed capacity of 1,603 MW is in commercial operation by Abengoa, 360 MW is under construction and 320 MW is in the pre-construction phase, distributed over 32 plants worldwide.

Abengoa leads the solar thermal industry with solar thermal electric power tower and parabolic trough technology, thermal energy storage systems, hybrid solar plants, conventional and high concentration photovoltaic installations. Abengoa solar plants operate under long-term bilateral power purchase agreements. They design, manufacture and market key components for their own plants and third-party projects. Abengoa also provides engineering, procurement and construction turnkey services of its solar thermal and photovoltaic plants. The fostering of relationships with the communities, Abengoa tools are developed at and the creation of local value is one of Abengoa's major social responsibilities. Above all, Abengoa constantly innovates in all aspects of solar technology to address the world's contemporary energy needs better than ever before.



©ASNT

Solar power towers (PS10/20) in commercial operation

Abengoa is the pioneer in solar tower technology. They designed, built and operate the world's first and second commercially used towers PS10 and PS20. The technology consists of a field of heliostats that constantly

track the sun to reflect solar radiation into a receiver placed at the top of a tower. In the receiver the heat of the sun is transferred to a heat transfer fluid (HTF) producing the steam needed to drive the turbine and thereby generate electricity. Abengoa commercializes an innovative receiver design that uses molten salt as HTF. This innovation enables them to produce superheated steam at 540 °C and 90 bars of pressure which represented a leap forward in efficiency. Due to the high operating temperatures, molten salt thermal energy storage systems can be integrated into a plant which allows for dispatchability. Abengoa commercializes super-heated steam tower technology that reaches higher temperatures during the electrical production. Abengoa is currently constructing the first commercial tower with this technology in the world, Khi Solar One in South Africa.

The Parabolic Trough technology, with more than 30 years of successful deployment worldwide, consists of a set of mirrors mounted on a parabolic trough structure tracking the sun. The mirrors concentrate solar power on a receiving tube that carries a fluid which absorbs the heat and reaches high temperatures. This fluid boils water to generate steam which drives a turbine to produce clean electricity. Abengoa operates more than 800 MW in parabolic trough technology, including the world's largest plant using this technology, Solana (Arizona, U.S.).



©ASNT

E2 trough collectors in Mojave

Abengoa has made important developments in thermal energy storage systems that enable power generation in case of limited access to the primary power source. This introduces dispatchability to solar energy production which better meets energy demand. Storage offers a more stable supply and a significant advance in the integration of renewable energy into the grid. Abengoa operates a unique thermal energy storage system in Solana, which is able to generate electricity for 6 hours at full capacity without sunshine. This means that it can operate the same way as conventionally fuelled plants.

Interview...

...with Emilio Sánchez, Business developer at Abengoa Solar

What are the biggest challenges in the field of laser-based manufacturing today?

The thin film group at Abengoa Solar, led by myself, has focused on the research and development of photovoltaic CIGS cells. The main Abengoa Solar objective in the APPOLO project is to adapt the best knowledge for the improvement and validation of the module interconnection of their CIGS cells, using picosecond laser sources. A reliable and stable interconnection process is essential to meet with industrial standards, as well as to achieve a scribing speed of more than 2m/s and minimize the losses due to the interconnection regions.

To which extent can APPOLO help to face those challenges?

The APPOLO project gives the company the opportunity to work together with laser manufacturers and laser specialists in order to create new processes and new equipment that guarantee the optimization of the final product.

In addition, the connection to the laser HUB provides us with knowledge about laser processes that could be used for different technical approaches.

Abengoa was a pioneer in hybrid technology by developing the first two ISCC (integrated solar combined cycle) plants worldwide in Algeria and Morocco. They developed a new commercial hybrid technology: hybrid solar thermal tower plants using molten salt as a heat transfer fluid with a natural gas combined cycle. This hybrid technology is more efficient and drastically reduces the emissions of conventional plants.

Abengoa also supplies innovative photovoltaic products to clients worldwide. Their high concentration photovoltaic modules offer important advantages in terms of efficiency, production curve, tracking precision and synergy with final energy markets.

Innovation and the development of new technologies are a top priority for Abengoa. One of their strategic pillars is

the development of new technologies to increase efficiency and reduce the cost of solar energy. With 162 filed and granted patents, Abengoa maintains an industry-leading position through the development of proprietary technology. This R&D effort enables Abengoa to offer a catalogue of solutions that can be adapted to each project or market.



©ASNT

CPV Tracker

Abengoa takes a proactive approach by leading social and environmental initiatives in areas where their plants are located, as well as having numerous permanent social development programs in different locations like South America, Europe, and Asia. Additionally, the company is committed to the local business sector, promoting and encouraging wealth generation through their supply chain as means for mutual growth and sustainability.

<News<<<News<

NST scanner assessed with EKSPLA Atlantic laser

High precision line-based material processing (drilling, grooving, 2.5D micromachining) demands high repeatability. To secure such repeatability, NST developed SuperSync™ technology for MOPA picosecond and femtosecond pulsed laser sources, a proprietary bi-directional interface to reduce the effect of timing-jitter when scanning at high speeds.

Find full press release at: <http://nextscantechology.com/new-certified-laser-interfaces/>

Upcoming Events 2015

03.03. – 04.03.	Fuerth, Germany	18 th LEF Laser in electronics production and precision mechanics
16.03. – 17.03.	Basel, Switzerland	13 th National photovoltaic conference
28.03. – 30.03.	Huwei, Taiwan	38 th International MATADOR Conference
22.04. – 23.04.	Aachen, Germany	UKP ultra short pulse Workshop
26.05 – 29.05.	Fukuoka, Japan	7 th LAMP international congress on Laser Advanced Material Processing
02.06. – 04.06.	Lappeenranta, Finland	NOP Northern Optics & Photonics 2015
22.06. – 25.06.	Munich, Germany	LiM Laser in Manufacturing
25.08. – 27.08.	Lappeenranta, Finland	15 th NOLAMP 2015

LEF 2015

The **18th LEF Seminar** will take place from March 3rd until 4th 2015 in Fuerth, Germany.

The seminar line **Laser in Electronics Production and Precision Mechanics** dedicates itself to the topics of micro laser manufacturing. Every year specifically selected topics are discussed and put into the seminars focus. A program of introductive presentations builds the foundation of the seminar, whereas further sessions within particular working groups are motivated. Within specific sessions the seminars participants exchange information on specific technological processes, physical foundations and R&D trends.

An associated industrial exhibition enhances the presentation program and offers further information on products, trends and developments within the laser branch.

<http://www.lef.info/>

Photovoltaic Conference (Switzerland)

The **13th national photovoltaics conference** of Switzerland will take place from the 16th until the 17th of March 2015 in Basel, Switzerland.

The conference is a meeting spot for the photovoltaic branch with over 600 participants. It offers important help for orientation and the opportunity of information exchange within the dynamic market of photovoltaics. Furthermore latest R&D – results are introduced and discussed.

http://www.swissolar.ch/ueber-swissolar/agenda/detail/?tx_ncevents_events%5Bevent%5D=63&tx_ncevents_events%5Baction%5D=sHOW&cHash=189682e20e99f10dbf5ec1172d11f149

<News<<<News<

ASNT signs power purchase agreement for 100 MW solar thermal plan in South Africa

By signing the power purchase agreement for Xina Solar One Abengoa Solar New Technologies (ASNT) secures the financing of a project with an approximated total investment of around \$1 bn. After the start of operation Xina Solar One will supply clean electricity to Eskom, South Africa's power utility, under the 20-year power purchase agreement.

Xina Solar One will be located close to Pofadder, in the Northern Cape Province, next to KaXu Solar One. These two 100 MW plants will jointly shape the largest solar complex in Africa. Xina Solar One will belong to a consortium, 40 % of which is controlled by Abengoa. Other constituents of the consortium are IDC, PIC, and KaXu Community Trust.

Xina Solar One will produce enough energy to serve more than 90,000 households and will prevent the emission of more than 398,000 metric tons of CO₂ per year when compared to a natural gas burning power plant.

Xina Solar One will be the third project of Abengoa in South Africa, along with Kaxu Solar One (100 MW) and Khi Solar One (50 MW), both under advanced stage of construction. These three projects contribute to South Africa's goal to introduce up to 17,800 MW of renewable energy by 2030 and reduce its dependence on oil and natural gas.

Source:

http://www.abengoasolar.com/web/en/acerca_de_nosotros/sala_de_prensa/noticias/2014/abg_20141211-2.html

MATADOR

The 38th International **MATADOR** Conference will take place from March 28th until 30th, 2015 in Huwei, Taiwan.

The 38th International MATADOR Conference will provide a forum for the presentation and discussion of original contributions to the principles, techniques and applications in the areas of Manufacturing Processes, Technology, Systems Design and Integration, Metrology and Management. In addition to keynote lectures, there will be special themes. A prize of \$160 will be given to the best paper winner presented at the conference.

<https://www.meeting.co.uk/confercare/matador2015/>

UKP Workshop

The **UKP Workshop** of the Fraunhofer ILT will take place from April 22nd to 23rd, 2015 in Aachen, Germany.

In addition to the basics of ultrafast laser technology, the workshop presents an overview of current beam source developments and new system technologies that make it possible to utilize the available energy. In the area of process engineering, discussions include the latest applications and process methods that are expanding today's boundaries with respect to material spectrum as well as processing speed and quality.

Laser manufacturers and users from various sectors of industry and science meet to share their experience, find out more about the latest trends in ultrafast laser technology, and get new ideas for future activities.

<http://www.ultrakurzpuls laser.de/en/ultrafast-laser-workshop.html>

LAMP 2015

The **LAMP 2015** consisting of the 16th International Symposium on Laser Precision Microfabrication and the 7th International Symposium on High Power Laser Processing will take place from May 26th until 29th, 2015 in Fukuoka, Japan.

LAMP is the world's number one meeting of the laser user community where the most advanced developments and recent trends in laser application for fine and precise fabrication of diverse materials are discussed between industry, research and academia.

<http://www.ilps.gr.jp/lamp/lamp2015/>

NOP 2015

The **Northern Optics and Photonics 2015** conference will take place from June 2nd until 4th, 2015 in Lappeenranta, Finland.

In the International Year of Light and Light-Based Technologies 2015 it is our great pleasure to organize the next edition in the series of Northern Optics conferences that brings together optical scientists from the Nordic and Baltic countries.

The previous meetings were held in Uppsala (2000), Espoo (2003), Bergen (2006), Vilnius (2009), and Helsingør (2012). Northern Optics & Photonics 2015 (NOP 2015) will be arranged on 2-4 June 2015 near the city of Imatra (in Lappeenranta region) in South-Eastern Finland, a 2.5 hour train trip from Helsinki.

<http://www.photonics.fi/nop2015/>

LiM 2015

The **LiM** conference of the WLT will take place from June 22nd to 25th, 2015 in the International Congress Center in Munich, Germany.

The **LiM-Lasers in Manufacturing** is the perfect platform for efficient knowledge transfer in the field of lasers and their applications. The LiM focuses on the latest developments as well as future trends in the field of laser materials processing. The conference topics addresses everyone who is interested in the potential of lasers in manufacturing is the theory and application. It is the aim to bring together international experts from research and industry in order to match scientific advances and economic need for mutual benefit.

The LiM is a part of the World of Photonics Congress 2015. This allows the coordination of joint sessions in order to highlight topics at the interface of the thematic areas covered by the participating conferences.

<http://www.wlt.de/lim/>

NOLAMP

The 15th **NOLAMP** will take place from 25th until 27th of August 2015 in Lappeenranta, Finland.

The purpose of the **NOLAMP conference** is to bring researchers, industrialists and students together for discussions in open your mind spirit and innovative platform on applications of lasers in materials processing. The main objectives are:

- to provide a forum for presentation and discussion of current university, institute and industrial laser research and development
- to assist in identifying future requirements with regard to process and equipment developments in laser-based fabrication
- to provide a special opportunity for younger scientists to present results of research work

<http://developmentcenter.lut.fi/koulutukset.asp?kid=496>

Consortium

appolo

<http://appolo-fp7.eu/>



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