

4TH ANNUAL

# LAM

LASER ADDITIVE MANUFACTURING  
WORKSHOP

February 29 - March 1, 2012

Sheraton North Houston Hotel • Houston, TX USA

## ADVANCE PROGRAM

- Rapid prototyping of functional parts
- Production of low volume; high value components
- Tailored surfaces (anti-wear; anti-corrosion) for new and used parts
- Repair/Refurbishment (cladding) for re-manufactured parts

## Profitable Laser Solutions for Today's Manufacturing Challenges!

Presented by:



**Laser Institute  
of America**

*Laser Applications and Safety*

[www.lia.org/lam](http://www.lia.org/lam)

13501 Ingenuity Drive, Suite 128  
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+1.407.380.1553 | 1.800.34.LASER

**ADVANCE PROGRAM**  
**LAM 2012**



This unique workshop will bring together industry specialists from around the world with the goal of applying these state-of-the-art processes (cladding, sintering and rapid manufacturing) to today's manufacturing challenges.



*Photo courtesy of Alabama Laser*

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## LAM General Chair Welcome

**Paul Denney**, Senior Laser Applications Engineer, Lincoln Electric, Cleveland, OH, USA

The Laser Additive Manufacturing 2012 (LAM 2012) Workshop is shaping up to be another success. This is the fourth year that the Laser Institute of America (LIA) has presented this workshop which has grown every year. The workshop, devoted to laser based processes for the deposition of material, continues to attract researchers, equipment builders/integrators and users, from industries ranging from Medical to Heavy Machinery. While the presentations may range from tailored fabrication of titanium implants to the repair of mining equipment, there are common areas of interest that are the foundation for this workshop. Advances in lasers,

process monitoring and control, types and management of clad materials and other areas cut across many industries and applications.

As the LAM General Chair, I invite you to attend LAM 2012 in Houston, TX, to learn more about the possibilities of lasers and additive manufacturing and what may be possible to help you and your needs.

### Who Should Attend?

- Process/R&D Engineers
- Maintenance Supervisors
- Laboratory Personnel
- Sales/Technical Staff
- Applications Engineers
- Construction Engineers
- Precision Parts Specialists
- Repair/Remanufacture Shop Managers
- Anyone interested in Laser Additive Manufacturing

### Industries Represented:

- Aerospace
- Agriculture
- Automotive
- Military
- Marine
- Oil and Gas industries
- On- and Off-Highway Transportation
- Power Generation
- Construction/Steel
- Laser/Surfacing Service Providers
- Research Institutions
- OEMs
- System Integrators
- Powder Production

**Profitable  
Laser Solutions  
for Today's  
Manufacturing Challenges!**

## LAM Keynotes



Sponsored by



**Terry Wohlers**, Wohlers Associates, USA

### The Future of Additive Manufacturing

No one can accurately forecast the future. With historical data and trend lines, however, it is possible to make some reasonable predictions. Wohlers will use this data and anecdotes to provide insight into where the industry is going. One thing is for sure: additive manufacturing systems are becoming less expensive and many more people are gaining access to the technology. Meanwhile, a growing number of organizations are applying advanced methods of additive manufacturing to the production of parts that end up in aircraft, consumer products and human bodies. With the number of new businesses and business models that are developing as a result, the years ahead are sure to be exciting.



**Dr. Ingomar Kelbassa**, RWTH Aachen University, Germany

### High-Speed LAM

Laser Additive Manufacturing (LAM) of parts and components fascinates due to process specific advantages such as nearly unrestricted geometrical freedom, material freedom and achievable properties of the parts built-up. The in layers build-up offers the possibility to manufacture components with graded physical, chemical and mechanical properties. Hence, adaptive parts and components can be manufactured, repaired and modified by LAM. This article presents the advances in speeding up the LAM techniques Laser Metal Deposition (LMD) and Selective Laser Melting (SLM) towards higher speeds and deposition rates. In the first part, LMD at high processing speeds of up to 200 m/min will be presented. Process basics, required equipment and achieved results in terms of layers are presented. This new process enables to produce dense layers with thicknesses from 25 µm up to 0.5 mm in one pass with very low dilution at high speeds, resulting in completely new advantages regarding economic efficiency of LMD processes. The second part focuses on investigations on build up increase for the powder bed based additive manufacturing process Selective Laser Melting (SLM). The main approach for higher build up rates is the use of higher laser power up to 1kW. A machine concept and process strategies for the efficient transfer of laser power into build up rate for different materials will be presented. The obtained results in build rate increase will be demonstrated for steel and aluminium parts.

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# 2012

## WORKSHOP AGENDA LAM 2012

### Wednesday, February 29, 2012\*

8:00am	Welcome
8:15am	Presentation 1 – Keynote Speaker, “The Future of Additive Manufacturing” Terry Wohlers; <i>Wohlers Associates</i>
9:00am	Presentation 2 – “Applications in Direct Part Manufacturing” Dr. Jim Sears; <i>Quad City Manufacturing Laboratory</i>
9:30am	Presentation 3 – “Direct Metal Laser Sintering - Injection Molding” Bob Evans; <i>EOS e-Manufacturing Solutions</i>
10:00am	Morning Break – Sponsored by <i>POM Group, Inc.</i>
10:30am	Presentation 4 – Laser Deposition and Laser Sintering Richard Grylls/Fabien Jouault; <i>Optomec/Phenix</i>
11:00am	Presentation 5 – “Laser-based Free Form” Nick Wald; <i>RPM and Associates, Inc.</i>
11:30am	Presentation 6 – “Comparison of Powder Delivery Systems” Chip Arata; <i>Carpenter</i>
12:00pm	Lunch – Sponsored by <i>IPG Photonics Corporation</i>
1:30pm	Presentation 7 – “MRO Focused on Wear and Corrosion Protection Applications” Tim Biermann; <i>Joining Technologies, Inc.</i>
2:00pm	Presentation 8 – “Laser Melting Manufacture of Aerospace Components” Maximilian Munsch; <i>The Hamburg University of Technology (TUHH); (Germany)</i>
2:30pm	Presentation 9 – “Reducing Wear with Laser Cladded Metal Matrix Composite Coatings” Filip Motmans; <i>VITO - Flemish Institute for Technological Research NV; Institute of Laser and System Technologies (ILAS)</i>
3:00pm	Afternoon Break – Sponsored by <i>TRUMPF, Inc.</i>
3:30pm	Presentation 10 – “Internal Bore Cladding” Dr. Jim Sears/David Hotchkiss; <i>South Dakota School of Mines &amp; Technology/Xaloy, Inc.</i>
4:00pm	Presentation 11 – “Thermal Spray vs. Laser Cladding” Steve Roy; <i>Hayden Laser Services, LLC</i>
4:30pm	Presentation 12 – Aravind Jonnalagadda; <i>Fraunhofer USA CCLA</i>
5:00pm-6:30pm	Exhibitor Reception – Sponsored by <i>Shermco Industries</i>

### Thursday, March 1, 2012\*

8:00am	Welcome
8:15am	Presentation 13 – Keynote Speaker, “High Speed LAM” Dr. Ingomar Kelbassa; <i>Fraunhofer Institute for Laser Technology (ILT)</i>
9:00am	Presentation 14 – “Die Repair” Christoph Olainck; <i>ThyssenKrupp Drauz Nothelfer</i>
9:30am	Presentation 15 – “Die Hardfacing and Remanufacturing” Bhaskar Dutta; <i>POM Group, Inc.</i>
10:00am	Morning Break – Sponsored by <i>Titanova</i>
10:30am	Presentation 16 – “Latest Development Work on Induction Assisted Laser Cladding Processes” Prof. Christopher Leyens; <i>Fraunhofer IWS</i>
11:00am	Presentation 17 – “Power Supplies for Hot Wire Cladding” Paul Denney; <i>Lincoln Electric Company</i>
11:30am	Presentation 18 – “Applications for Hot Wire Cladding” Wayne Penn; <i>Alabama Laser</i>
12:00pm	Lunch – Sponsored by <i>Joining Technologies, Inc.</i>
1:30pm	Presentation 19 – “Intelligent Manufacture from Powder by Advanced Laser Assimilation (IMPALA)” Emma Ashcroft; <i>TWI Technology Centre (Yorkshire) Ltd</i>
2:00pm	Presentation 20 – “Laser Cladding with Modern High Power Fiber Laser- Dynamic Beam Modification Characteristics to the Cladding Process” Joonas Perkkarinen; <i>Lappeenranta University of Technology</i>
2:30pm	Presentation 21 – “Advanced 8kW Direct Diode Laser Optimized for Large Area/High Deposition Rate Cladding” Keith Parker/John Washko; <i>Coherent, Inc.</i>
3:00pm	Afternoon Break
3:30pm	Presentation 22 – David Locke; <i>TRUMPF, Inc.</i>
4:00pm	Presentation 23 – “Repair” Kristin Schipull; <i>Caterpillar, Inc.</i>
4:30pm	Presentation 24 – “Mechanical Performance of Laser Cladded Structures” Filip Motmans; <i>VITO - Flemish Institute for Technological Research NV; Institute of Laser and System Technologies (ILAS)</i>

## Exhibitor Reception:

The Exhibitor Reception gives exhibitors and workshop attendees the opportunity to discuss equipment and applications in a relaxed setting. After completion of the technical sessions come share product ideas with your colleagues and suppliers. Limited space is still available! For more information on participating as an exhibitor, contact Jim Naugle [jnaugle@lia.org](mailto:jnaugle@lia.org) at +1.407.380.1553.

## Program Committee:

Milan Brandt, *RMIT University*  
John Hunter, *Carpenter Powder Products*  
Ingomar Kelbassa, *RWTH Aachen University*  
Thierry Marchione, *IREPA Laser*  
Wayne Penn, *Alabama Laser*  
Silke Pflueger, *Laserline, Inc.*  
Rob Scudamore, *TWI*  
Jim Sears, *South Dakota School of Mines & Technology*  
Bill Shiner, *IPG Photonics Corporation*

# LAM 2012 Sponsors

The Laser Institute of America would like to thank the following sponsors:

Sponsor Committee Chair: Bill Shiner - IPG Photonics

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Titanova  
Bronze Level  
*Thursday Morning Break*

TRUMPF



TRUMPF  
Bronze Level  
*Wednesday Afternoon Break*

## Cooperating Societies and Media Partners:



# LAM 2012 General Information

## Registration:

All registrations include admission to the Technical Sessions, Networking Luncheons and Exhibitor Reception.

## LAM On-Site Registration Desk Hours

Wednesday, February 29<sup>th</sup>: 7:00am - 5:00pm  
Thursday, March 1<sup>st</sup>: 7:30am - 12:00pm

## Exhibit Hours

Wednesday, February 29<sup>th</sup>: 10:00am - 6:30pm  
Thursday, March 1<sup>st</sup>: 7:30am - 3:30pm

## Exhibitor Reception

Wednesday, February 29<sup>th</sup>: 5:00pm - 6:30pm

## Networking Luncheons

Network with your peers and share ideas.  
Lunch is included with each registration.

## Special Needs

If you have any special needs that we can address to make your participation more enjoyable, please contact LIA by phone: +1.407.380.1553, Fax: +1.407.380.5588 or e-mail: [lam@lia.org](mailto:lam@lia.org)

## Substitutions and Cancellations

We understand that circumstances may occur to prevent you from attending the workshop. If you find that you cannot attend LAM, you have several options:

**1. Send a substitute.** Substitutions can be made at any time - even on-site at the workshop. (Please have the substitute bring your letter of confirmation to the registration desk.)

**2. Refund of monies.\***

*\*Note: Requests for refunds must be made in writing and received on or before January 12<sup>th</sup>.*

**3. There is a \$75 processing fee** applied to all refunds. All refunds will be processed after the workshop. No refund requests will be accepted after *January 12<sup>th</sup>*.

## Directions:

### From George Bush Intercontinental/Houston Airport (IAH):

Follow Interstate 45 South and exit at the airport facility which will continue to John F. Kennedy Boulevard for approximately 3 miles. Complimentary shuttle service to and from the airport is available upon request exclusively for the Sheraton North Houston Hotel guests.

**Parking:** Self-Parking: Complimentary

### Average February Temperatures:

High: 67°F Low: 44°F



## Hotel Accommodations:

### Sheraton North Houston Hotel

15700 John F. Kennedy Boulevard  
Houston, TX 77032

Phone: +1.281.442.5100

Fax: +1.281.987.9130

Web: [www.sheratonnorthhouston.com](http://www.sheratonnorthhouston.com)

**Reservation:** Special discount rates are available for speakers, workshop attendees and guests at the Sheraton North Houston Hotel. Please call +1.281.442.5100 and identify yourself as a LAM Workshop attendee to receive a discounted rate of \$99 per night.

**Please book online at:**

<https://www.starwoodmeeting.com/StarGroupsWeb/booking/reservation?id=1111041626&key=12836>

**After Saturday, February 4, 2012, group rates cannot be guaranteed and reservations will be made only on a space-available basis.**

## About Houston

As the fourth largest city in the United States, Houston is a leader in business, entertainment, the arts and so much more. While you are here have some out of this world fun, touch a moon rock or land a shuttle at Space Center Houston. Stroll along Kemah Boardwalk and choose from a variety of restaurants, ride the Ferris wheel and train for fun or just watch the sailboats from your table.

Explore a world of art, history and nature in the fourth largest museum district in the United States, featuring fifteen world-class museums that range from the Houston Museum of Natural Science to a very interactive Butterfly Center. Visit Houston, and you'll understand why it is a city of infinite possibilities.



## About LIA

Laser Institute of America (LIA), founded in 1968, is the professional society for Laser Applications and Safety. It is comprised of laser researchers, manufacturers, integrators and end users working together to increase the use and safe application of laser technologies. LIA individual and corporate members receive significant discounts on all LIA materials, training courses and conferences.

Contact LIA for all your laser application and safety needs at 1.800.34.LASER, +1.407.380.1553 or [www.lia.org](http://www.lia.org).