

ICALEO® 2002



21ST INTERNATIONAL CONGRESS ON
APPLICATIONS OF LASERS & ELECTRO-OPTICS

Advance Program

Atoms to Applications...Don't miss this ICALEO®!

▼▼▼ **FEATURING:** ▼▼▼

Plenary Session - The Journey of Laser Processing

Laser Materials Processing Conference

Laser Microfabrication Conference

Poster Presentation Gallery

Laser Solutions Short Courses

Laser Industry Vendor Table Top Display

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Japan Laser Processing Society • Society of Manufacturing Engineers



ICALEO® 2002

General Chairs Welcome

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Welcome to Scottsdale, Arizona and ICALEO® 2002, the 21st International Congress on Applications of Lasers & Electro-Optics. ICALEO® features conferences on Laser Materials Processing and Laser Microfabrication in conjunction with a series of informative Laser Solutions short courses. The congress heads west to Scottsdale, Arizona, to discover new frontiers of knowledge and applications of lasers and electro-optics. While the global economy is going through a slow period, this is the perfect time to generate new ideas and plans - be ready for the up swing in the economy that is around the corner! Now is the time to invest in trying, testing, and creating new products that will give you and your business the edge. ICALEO® 2002 brings together the latest developments in manufacturing applications, photonics and biomedical applications, semiconductor and microelectronics, scientific research, and education. This year's congress has highly dedicated conference chairs and program committee members who have worked hard to make ICALEO® an intellectually stimulating, beneficial, and enjoyable conference. For four days, you will have a unique opportunity to interact with the best scientists, engineers, managers, sales and marketing professionals, and entrepreneurs from all over the world. Learn, Share and Network at the conference while you enjoy the beauty of the Sonoran Desert.



Eckhard Beyer
Fraunhofer Institute for Material and Beam Technology
Dresden, Germany



Rajesh Patel
IMRA America, Inc.
Fremont, CA, USA



Laser Institute of America's ICALEO® 2002 Conference is a bridge between many groups:

- It is an international bridge between scientists and engineers from many countries offering a pathway for the exchange of ideas and information.
- It is a bridge between the researcher in the laboratory and the user on the shop floor allowing one to see what is needed and the other to see what may be possible.
- It is a bridge between the modeler and the experimenter permitting one to test his beliefs and the other to predict his results.
- It is a bridge between academia, government, and industry who share the goal of advancing the technology of lasers and their applications.

MONDAY, OCT. 14	TUESDAY, OCT. 15	WEDNESDAY, OCT. 16	THURSDAY, OCT. 17
<p>Plenary Session The Journey of Laser Processing 8:00am - 12:00pm</p> <p>Invited Plenary Speakers <i>Paul Hilton</i> <i>William Clark</i> <i>Reinhard Wollerman Windgasse</i> <i>Eckhard Beyer</i></p>	<p>Technical Sessions 8:00am - 11:30am</p> <p>Laser Materials Processing Session 2 Welding of Light Materials</p> <p>Session 3 Surface Modification, Alloying & Heat Treatment I</p> <p>Session 4 Beam / Process Diagnostics</p> <p>Laser Microfabrication Session 2 Electronics Production II</p> <p>Laser Solutions Courses Course 2: Applications & Considerations for Hybrid & Remote Welding 8:00am - 10:00am <i>Instructor: Christian Walz</i></p> <p>Course 3: Laser Machining - The First 100,000 Picoseconds 10:30am - 12:30pm <i>Instructor: Michael Perry</i></p> <p>Poster Presentation Gallery 9:30am - 4:00pm</p>	<p>Technical Sessions 8:00am - 11:30am</p> <p>Laser Materials Processing Session 8 Laser / Material Interactions</p> <p>Session 9 Laser-Based Integrated Manufacturing Systems</p> <p>Session 10 Sensing & Control</p> <p>Laser Microfabrication Session 4 Laser Micro Welding Laser Micro Drilling</p> <p>Poster Presentation Gallery 9:30am - 4:00pm</p>	<p>Technical Sessions 8:00am - 11:30am</p> <p>Laser Materials Processing Session 11 Industrial Welding Applications</p> <p>Session 12 Laser Cladding I</p> <p>Session 13 Cutting & Drilling</p> <p>Laser Microfabrication Session 5 Microsystems Fabrication Biomedical Devices</p> <p>Laser Solutions Course 06: Diode Lasers: Fundamentals, Processing & Applications 8:00am-10:00am <i>Instructor: Stefan Heinemann</i></p>
<p>LUNCH BREAK</p>	<p>POSTER PRESENTER'S QUESTION / ANSWER SESSION</p>	<p>SCHAWLOW AWARDS LUNCHEON 12:00pm - 2:00pm</p>	<p>LUNCH BREAK</p>
<p>Technical Sessions 1:30pm - 5:00pm</p> <p>Laser Materials Processing Session 1 Science of Laser Welding</p> <p>Laser Solutions Course Introduction to MicroMachining using UV Lasers 1:30pm - 3:30pm <i>Instructor: Ronald D. Schaeffer</i></p> <p>Laser Microfabrication Session 1 Electronics Production I</p>	<p>Technical Sessions 1:30pm - 5:00pm</p> <p>Laser Materials Processing Session 5 Diode & Solid State Lasers</p> <p>Session 6 Surface Modification, Alloying & Heat Treatment II</p> <p>Session 7 Laser Forming</p> <p>Laser Microfabrication Session 3 Laser Sources for Micromachining</p> <p>Laser Solutions Course 04: Laser Welding Aluminum Alloys: Principles and Practice 1:30pm - 3:30pm <i>Instructor: D. Mark Douglas</i></p> <p>Poster Presentation Gallery 9:30am - 4:00pm</p>	<p>Facility Tour See www.icalfo.org for more information.</p> <p>Poster Presentation Gallery 9:30am - 4:00pm</p>	<p>Technical Sessions 1:30pm - 5:00pm</p> <p>Laser Materials Processing Session 14 Laser Processing of Exotic Materials</p> <p>Session 15 Laser Cladding II</p> <p>Laser Microfabrication Session 6 Micromachining of Photonic Components</p> <p>Laser Solutions Course 07: Building a Compelling Economic Business Case to Drive Laser Technology Implementation 1:30pm - 3:30pm <i>Instructor: Justin Koch</i></p> <p>Session 7 Laser Ablation</p>
<p>President's Reception 6:00pm - 7:30pm</p>	<p>Vendor Reception 5:00pm - 8:00pm</p>	<p>Poster Presentation Gallery 9:30am - 4:00pm</p>	<p>Poster Presentation Gallery 9:30am - 4:00pm</p>

Plenary Session

Monday, October 14 • 8:00am-12:00pm

The Journey of Laser Processing

Chair: William Steen, Emeritus Professor, The University of Liverpool, Liverpool, UK

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In the helter-skelter of change driven by the extraordinary pace of technological developments, the laser features as one of the major generic sources of growth. It is appropriate to get one's bearings by taking a long view from where laser processing started, where it is now and where it might possibly go.

The Journey of Laser Processing attempts to highlight the remarkable growth of our subject and the opening vista of opportunities there are for it. Starting with the thoughtful calculations of Einstein, stimulated emission was identified. Years later a small laser was built. Very quickly powerful lasers were engineered. This journey starts with some archival material taken a few years after Kumar Patel's invention of the CO₂ laser. It continues with papers on the current development of the laser from which new applications will follow, since we have not been slow to invent them in the past. Firstly into the new time domains for power control; then into new power sources and finally into new wavelengths, all hinting at the future applications of this most flexible industrial energy source. The overall story has some resemblance to the discovery of America. Columbus started with a beach but finished with a continent; get a glimpse of the future today!

Invited Plenary Speakers

In the Beginning

Paul A. Hilton, TWI, Abington, Cambridge, UK

New Time Domains

Bill Clark, Clark-MXR, Inc., Dexter, MI, USA

Development and Outlook of High Power Laser Sources

Reinhard Wollermann Windgasse, TRUMPF Lasertechnik GmbH, Ditzingen, Germany

EUV and X-Ray Wavelengths for Future Applications

Eckhard Beyer, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany

General Co-Chairs:

Eckhard Beyer

Rajesh Patel

Awards Chair:

Dana Marshall

LIA President:

Eckhard Beyer

LIA Executive Director:

Peter Baker

LIA Director of Conferences

Beth Cohen



Laser Institute of America sponsors ICALEO 2002 to provide an international forum fostering:

- *Exchange of technical information relevant to laser applications*
- *Laser technology transfer from developers to users*
- *Innovation in laser sources and equipment*
- *Cooperation between manufacturers and users of laser systems*

Facility Tour

Watch the ICALEO.org web site for details on a tour of a local Scottsdale facility!

Laser Materials Processing Conference

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ICALEO® 2002 Laser Materials Processing (LMP) conference will define the state of the art in laser materials processing and showcase emerging technologies facilitated through the continuing improvement of laser processing techniques. In response to industry needs, the research community is increasingly active in the development of novel laser materials processing technologies. The LMP conference is the premier venue for researchers and practitioners alike from around the world to exchange and learn the latest developments in the field of laser materials processing.

ICALEO® 2002 features updates on traditional processes including cutting, drilling, welding and surface modification techniques, in addition to innovative new applications ranging from laser cleaning, hybrid processes and systems, laser forming, and laser shock processing. New developments in laser sources, components and systems are also well represented. A special session in honor of Prof. Matsunawa of Osaka University highlights significant progress made over the last two decades in the scientific and technological aspects of laser welding. Interact with your peers throughout the week and leave ICALEO® 2002 with new perspectives and ideas!



Conference Chair:
Y. Lawrence Yao
Columbia University
New York, NY, USA

Program Committee:

Milan Brandt, Industrial Research Institute Swinburne (IRIS), Swinburne Univ. of Technology, Melbourne, Australia

Claus Emmelmann, TUHH Technische Universität Hamburg-Harburg, Hamburg, Germany

Richard Martukanitz, Applied Research Laboratory, The Pennsylvania State University, State College, PA

Jay Tu, Purdue University, West Lafayette, IN

Session 1: Science of Laser Welding - In honor of Prof. Matsunawa Monday, October 14 1:30pm - 5:00pm

Session Co-Chairs: Alexander Kaplan, Luleå Univ. of Technology, Sirius Laboratory, Luleå, Sweden; Jay Tu, Purdue Univ., West Lafayette, IN

Science of Laser Welding (101)
Akira Matsunawa, Joining & Welding Research Institute, Osaka Univ., Osaka, Japan

Physics, Chemistry and Microwelding . . (102)
Walt Duley, Univ. of Waterloo, Waterloo, Ontario, Canada

Basic Processes in Deep Penetration Laser Welding (103)
Rémy Fabbro, CLFA, Arcueil, Cedex, France

Laser-matter Interaction and Applications to In-process Monitoring in Keyhole Laser Welding (104)
Isamu Miyamoto, Osaka Univ., Osaka, Japan

Laser Welding of Aluminum Alloys: Problems, Approaches for Improvement and Applications (105)
Friedrich Dausinger, Peter Berger, Helmut Hügel, Univ. of Stuttgart, Stuttgart, Germany

Role of Recoil Pressure, Multiple Reflections and Free Surface Evolution during Laser Keyhole Welding (106)
J.Mazumder, H.S. Ki, P.S.Mohanty, CLAIM, Univ. of Mich., Ann Arbor, MI

Keyhole Laser Spot Welding (107)
Alexander Kaplan, Luleå Univ. of Technology, Sirius Laboratory, Luleå, Sweden; Masami Mizutani, Seiji Katayama, Akira Matsunawa, Osaka Univ., JWRI, Ibaraki, Osaka, Japan

Failure Recognition and Online Process Control in Laser Beam Welding (108)
Ernst Kreutz, C. Kratzsch, Lehrstuhl für Lasertechnik, Aachen, Germany; Peter Abels, Stefan Kaierle, Fraunhofer Institute for Lasertechnology, Aachen, Germany

Session 2: Welding of Light Materials Tuesday, October 15 8:00am - 11:30am

Session Co-Chairs: Friedrich Dausinger, Univ. of Stuttgart, IFSW, Stuttgart, Germany; Claus Emmelmann, TUHH Technische Universität Hamburg-Harburg, Hamburg, Germany

Laser Beam Welding of Aircraft Fuselage Panels (201)
Jörg Schumacher, Ingo Zerner, Gerhard Neye, Kai Thormann, Airbus Deutschland GmbH, Bremen, Germany

Processing of Laser Joined Aluminium-Steel Tailored Blanks in Overlap and Butt Joint Configuration (202)
Michael Kreimeyer, Gerd Sepold, Florian Wagner, Bremer Institut für Angewandte Strahltechnik, Bremen, Germany

Blast and Impact Resistance Studies of Laser Welded and Riveted Panel Structures . . (203)
Geoff Dearden, Ian McCarthy, Graham Schleyer, Martin Simmons, Ken Watkins, Univ. of Liverpool, Liverpool, UK

Laser Welding of Aluminium Alloy 5083. (204)
Panton Okon, Ken Watkins, Geoff Dearden, Laser Group, Dept. of Engineering, Liverpool, UK; Paul French, Martin Sharp, Lairdsie Laser Engineering Centre, Birkenhead, UK

Laser Vacuum Welding of Aluminium, Kovar and Ni-Fe Alloys for Hermetic Encapsulation of Electronic Components (205)
Tuan-Anh Mai, G.C. Lim, Singapore Institute of Manufacturing Technology, Singapore; Giok Hong Tay, Ee Wee Koh, DSO National Laboratory, Singapore

Laser Beam Welding of Magnesium Light Weight Structures (206)
Jens Standfuß, Dirk Dittrich, Knut Barthel, Berndt Brenner, Eckhard Beyer, Fraunhofer IWS Dresden, Dresden, Germany

Laser Welding of Nickel-Based Alloys . . . (207)
 Jiangang Xiong, Zhi Yuanli, Qing Hu, Liqun Wang, Huazhong Univ. of Science and Technology, Wuhan, Hubei, China; Aiqing Duan, Beijing Aeronautical Manufacturing Technology Research Institute, Beijing, China

Laser Consolidation of Ti-6Al-4V Alloy for the Manufacturing of Net-Shape Functional Components (208)
 Lijue Xue, Jianyin Chen, Andre Theriault, National Research Council Canada, London, Ontario, Canada

Experimental Study of CO₂ Laser Welding of Aluminum Alloy (209)
 Lei Hong, Tsinghua Univ. & Zhuzhou Electric Locomotive Works, Zhuzhou, China; Longju Zhu, Zhuzhou Electric Locomotive Works, Zhuzhou, China; Wuzhu Chen, Tsinghua Univ., Beijing, China; Chunlei Ju, Hunan Univ., China

Session 3: Surface Modification, Alloying & Heat Treatment I
Tuesday, October 15
8:00am - 11:30am

Session Co-Chairs: Terry Feeley, Laser Fare, Inc., Narragansett, RI; H.C. Man, Hong Kong Polytechnic Univ., Kowloon, Hong Kong

The Absorption of a Diode Laser Beam in Laser Surface Hardening of a Low Alloy Steel (301)
 Henrikki Panssar, Veli Kujanpää, Lappeenranta Univ. of Technology, Lappeenranta, Finland

High Power Laser Diode System for Surface Treatment (302)
 Mark Zediker, John Haake, Nuvoynx Inc., Bridgeton, MO

The Effect of Beam Shape in Laser Surface Treatment of Ceramics (303)
 Dimitrios Triantafyllidis, Lin Li, F. Howard Stott, UMIST, Manchester, UK

Surface Modification of 347 Stainless Steel by Rapid Mirror Scanning of a High Power CO₂ Laser Beam (304)
 Jorge Ramos, David L. Bourell, The Univ. of Texas at Austin, Austin, TX; Madhav Rao Govindaraju, KARTA Technologies Inc., San Antonio, TX

Surface Melting of Aluminium Alloys using an Ultra-Super-Pulsed CO₂ Laser (305)
 Francisco Villarreal, Howard Baker, Michail Tsagkarakis, Denis Hall, Heriot Watt Univ., Edinburgh, UK; Stuart Williams, BAE Systems Advance Technology Centre, Bristol, UK

Laser Coating of Carbon-Carbon Composite using a Two-Phase Mass Flow (306)
 Lloyd Snell, Pal Molian, Iowa State Univ., Ames, IA

Materials Modeling for Advanced Coating Systems (307)
 Richard Martukanitz, ARL, The Penn State Univ., State College, PA; Suresh Babu, Oak Ridge National Laboratory, Oak Ridge, TN

Laser Surface Nitriding and Texturing of NiTi Shape Memory Alloy for Bonding with Bioactive Glass (308)
 Hau Chung Man, Z.D. Cui, T.M. Yue, Hong Kong Polytechnic Univ., Kowloon, Hong Kong

Study on Laser Surface Modification and Repair Welding Technique for Neutron-Irradiated Austenitic Stainless Steels . . . (309)
 Masanori Kanno, JAPEIC, Urayasu-shi, Chiba, Japan; Tsuneyuki Hashimoto, Hitachi, Ltd., Hitachi, Japan; Wataru Kouno, Toshiba Corporation, Yokohama, Japan; Masato Koshiishi, NFD Co., Ltd., Ooarai, Japan

Session 4: Beam / Process Diagnostics
Tuesday, October 15
8:00am - 11:30am

Session Co-Chairs: Isamu Miyamoto, Osaka Univ., Suita, Osaka, Japan; Kenneth Watkins, Univ. of Liverpool, Liverpool, UK

Precision Microwelding of Thin Metal Sheet with Fiber Laser (400)
 Isamu Miyamoto, Seo-jeong Park, Osaka Univ., Osaka, Japan; Toshihiko Ooie, Institute for Marine Resource & Environment, AIST Takamatsu, Kagawa, Japan

New Method for Beam Profiling High Power CO₂ Lasers with an IR Camera-Based System (401)
 Lawrence Green, Spiricon, Inc., Logan, UT

The Accurate Measurement of Arc Current Density in Laser-TIG Hybrid Process . . . (402)
 Yanbin Chen, Jie Chen, Lin Wu, Liqun Li, Harbin Institute of Technology, Harbin, Hei Long Jiang, China

In Process Laser Beam Diagnostics (403)
 William O'Neill, Martin Sparkes, Univ. of Liverpool, Liverpool, UK; Jack Gabzdyl, BOC Gases, Guildford, UK

Logarithmic CMOS Camera Microscope for Beam Diagnostics - Profiling of High Power Q-Switch Lasers (404)
 Klaus Hänsel, HYPERBEL Laser Technology, Mömbris, Germany; Harald Schwede, Reinhard Kramer, Volker Brandl, Michael Klos, PRIMES GmbH, Pfungstadt, Germany

Calibration of Laser Power Meters for High Power Applications (405)
 Klaus Hänsel, HYPERBEL Laser Technology, Mömbris, Germany; Harald Schwede, Reinhard Kramer, Volker Brandl, PRIMES GmbH, Pfungstadt, Germany; Michael Klos, Laser Mechanisms Inc., Southfield, MI

Beam Diagnostics Enable High Efficiency Laser Beam Welding of Sandwich Panels Serial Production for Shipyard Industries (406)
 Klaus Hänsel, HYPERBEL Laser Technology, Mömbris, Germany; Michael Klos, Laser Mechanisms Inc., Southfield, MI

Spotsize Measurement for Nd:YAG Spot Welding Lasers (407)
 Phillip Fuerschbach, J.T. Norris, Sandia National Laboratories, Albuquerque, NM

Laser-Material Interaction and Process Sensing in Underwater Nd:YAG Laser Welding (408)
 Xudong Zhang, Wuzhu Chen, Tsinghua Univ., Beijing, China; Eiji Ashida, Fukuhisa Matsuda, Japan Power Engineering & Inspection Corporation, Hitachinaka, Japan

Creation of the Optimal Dimension Characteristics of Laser Beam, Using the Aberrations of Spherical Focusing Mirrors (409)
 Victor Roman, LOTIS, Kiev, Ukraine; Leonid Golovko, National Technical Univ. of Ukraine, Kiev, Ukraine

Session 5: Diode & Solid State Lasers
Tuesday, October 15
1:30pm - 5:00pm

Session Co-Chairs: Xiangli Chen, GE China R&D Center, Shanghai, China; Paul Denney, Edison Welding Institute, Columbus, OH

High Thickness Laser Welding using Nd:YAG Lasers up to 12 kW (501)
 Frederic Coste, CLFA, Arcueil, Cedex, France

High Brightness All-Solid-State Laser Systems with Fiber Phase Conjugate Mirrors (502)
 Thomas Riesbeck, Enrico Risse, Hans-J. Eichler, Technical Univ. of Berlin, Berlin, Germany; Alexander Binder, Thomas Metzger, David Ashkenasi, Gerhard Müller, LMTB GmbH, Berlin, Germany

Fiber-Coupled High Brightness, High Power Diode Laser for Solid-State Laser Pumping and Material Processing. (503)
 B. Ehlers, S. Heinemann, Fraunhofer Center for Laser Technology, Plymouth, MI

Applicability of High Power Diode Laser to Aluminum Alloy Welding (504)
 Nobuyuki Abe, Atsuhito Morikawa, Osaka Univ., Ibaraki, Japan; Koichi Maeda, Keizo Namba, Sumitomo Light Metal Industries, Ltd., Nagoya, Japan

Development of Hybrid Laser Processing Machine for Welding of Aluminium Alloys using Co-Axially Irradiated LD and LD Pumped YAG Laser Beams (505)
 Hiroshi Miura, Shizuoka Univ., Hamamatsu, Japan

Welding and Cutting Improvements with Super-Modulated, High BQ, Nd:YAG Lasers (506)
 Thomas Kugler, GSI Lumonics Corporation, Northville, MI; Mohammed Naeem, GSI Lumonics, Rugby, Warwickshire, UK

Effect of Welding Parameters on High Power Diode Laser Welding of Metal Catalytic Converters (507)
 Antti Salminen, Lappeenranta Univ. of Technology, Lappeenranta, Finland

High Power Disk Laser Technology - Design and Potential for Laser Macro Applications (508)
 Claus Emmelmann, Soenke Lunding, TUHH Technische Universität Hamburg-Harburg, Hamburg, Germany

Influence of Process Gases in Welding with Diode Lasers (509)
 Hubert Rawyler, AGA Gas, Inc., Independence, OH; Johann Härtl, IWB, Garching, Germany

Session 6: Surface Modification, Alloying & Heat Treatment II
Tuesday, October 15
1:30pm - 5:00pm

Session Co-Chairs: Palaniappa Molian, Iowa State Univ., Ames, IA; Rui Vilar, Instituto Superior Técnico, Lisbon, Portugal

Fe-Cr-C/NbC Composite Materials for Wear Resistant Coatings (601)
Rogério Colaço, Rui Vilar, Instituto Superior Técnico, Lisboa, Portugal

Effect of Water Film, Multiple Passes and Graphite Coating on the Tile Grout Removal using High Power Diode Laser (602)
Kanako Minami, Lin Li, R. Edwards, A. Gale, UMIST, Manchester, UK

Laser Based Hybrid Techniques for Surface Coating (603)
Steffen Nowotny, Siegfried Scharek, Roman Zieris, Tobias Naumann, Eckhard Beyer, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany

Laser Surface Modification of Ti-6Al-4V Alloy by Coating with SiC (604)
Abhijeet Joshi, Mario Arenas, Ramana Reddy, The Univ. of Alabama, Tuscaloosa, AL

Effects of Laser Irradiation on the Microstructure and Superconductivity of MgB₂ (605)
Pal Molian, Emrah Simsek, Alexandre Kisslinger Rodrigues, Dustin Hawbaker, Iowa State Univ., Ames, IA

Microstructure and Wear Behavior of Al-Transition Metal Alloys Developed by Laser Surface Alloying. (606)
Amelia Almeida, Rui Vilar, Instituto Superior Técnico, Lisboa, Portugal

Effect of Laser Hardening on Fracture Toughness of Steel (607)
Jari Rämö, Jyrki Latokartano, Tampere Univ. of Technology, Tampere, Finland

Computational Process Parameter Optimization for Laser Beam Transformation Hardening (608)
Gunther Goebel, Radebeul, Saxony, Germany; Steffen Bonns, Berndt Brenner, Eckhard Beyer, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany

Laser Roll Bonding of Mild Steel to Aluminium and Control of Intermetallic Compound Layer (609)
Muneharu Kutsuna, Manoj Rathod, Ammar Azar, Nagoya Univ., Nagoya, Japan

Session 7: Laser Forming
Tuesday, October 15
1:30pm - 5:00pm

Session Co-Chairs: Richard Martukanitz, ARL, The Pennsylvania State Univ., State College, PA; Y. Lawrence Yao, Columbia Univ., New York, NY

Optimal Development of Doubly Curved Surface in Laser Forming (701)
Y. Lawrence Yao, Chao Liu, Columbia Univ., New York, NY

Forming Characteristics of Thin Metal Plate with Diode Laser Beam (702)
Toshiyuki Miyazaki, Tadashi Misu, Shunro Yoshioka, Chiba Institute of Technology, Narashino, Chiba, Japan; Masatoshi Saito, Miyachi Technos Corp., Noda, Chiba, Japan; Tsuyoshi Tokunaga, Polytechnic Univ., Sagamiara, Kanagawa, Japan

Strain Gauge Analysis of Laser Forming . (703)
Stuart Edwardson, K.G. Watkins, G. Dearden, P. French, Univ. of Liverpool, Liverpool, Merseyside, UK

Characterization of the Laser Bending under Different Cooling Conditions (704)
Liqun Li, Yanbin Chen, Lin Shangyang, Harbin Institute of Technology, Harbin, Hei Long Jiang, China

A Comparative Study of the Forming of EN3 Mild Steel Sheets with CO₂ and High Power Diode Lasers (705)
Jonathan Lawrence, Nanyang Technological Univ., Singapore

Line Induced Thermal Strain Forming . . (706)
David Peck, Trico Products Corp, Rochester Hills, MI; Jerald Jones, NA Technologies Co, Golden, CO

Continuing Development of a Laser Line Forming System (707)
Edward Reutzel, Richard Martukanitz, ARL, The Penn State Univ., State College, PA; Joseph Aburdene, Kevin Gombotz, Joshua Magnusen, The Penn State Univ., State College, PA

Orthotropic Automotive Light Truck Frame Design Considerations (without Hydroforming) (708)
Randolph Paura, Rumble Automation, Mississauga, Ontario, Canada

Analysis of Deformation Behavior of Pipe under Laser Welding (709)
Hideaki Shirai, Setsuo Sawamoto, Takafumi Satoh, Denso Corporation, Kariya-si, Japan

Session 8: Laser / Material Interactions
Wednesday, October 16
8:00am - 11:30am

Session Co-Chairs: Rémy Fabbro, CLFA, Arcueil, Cedex France; Aravinda Kar, CREOL, Univ. of Central Florida, Orlando, FL

The Physics of Laser Materials Processing (801)
Martien H.H. Van Dijk, Eldim b.v., Arcen, The Netherlands; Paul Bant, ILT, Enschede, The Netherlands

Optical Signal Detection of Interaction Modes and their Transitions in Laser Material Coupling (802)
Daniel Pfluger, Damien Harris, CSIRO Manufacturing Science & Technology, Woodville North, Australia

Vapour Flow Modelling in Deep Penetration Laser Welding (803)
E.H. Amara, CDTA, Baba Hassen, Algiers, Algeria; R. Fabbro, CLFA, Arcueil, Cedex, France; A. Bendib, USTHB/Quantum Elec. Lab., Bab Ezzouar, Algiers, Algeria

Porosity Formation and Prevention in Deep Penetration Pulsed Laser Welding (804)
Hai-Lung Tsai, W.H. Zhang, Univ. of Missouri-Rolla, Rolla, MO

Dynamic Keyhole Plasma Analysis and Beam Absorption Mechanism in 20KW CO₂ Laser Welding Processes (805)
Jay Tu, Purdue Univ., W. Lafayette, IN; T. Inoue, I. Miyamoto, Osaka Univ., Dept. of Manufacturing, Suita-shi, Osaka, Japan

Validating Predictions of Keyholing Phenomenon in Laser Weld Models (806)
Aaron Hall, Allen Roach, Gerald Knorovsky, Sandia National Laboratories, Albuquerque, NM

Energy Coupling and Process Efficiency in Double-Focus Welding with Nd:YAG (807)
Wolfgang Gref, Bernd Hohenberger, Friedrich Dausinger, Helmut Hügel, Univ. of Stuttgart, IFSW, Stuttgart, Baden-Württemberg, Germany

Plume Attenuation under High Power Nd:YAG Laser Welding (808)
Jose Greses, C.Y. Barlow, Univ. of Cambridge, Cambridge, Cams, UK; P.A. Hilton, TWI, Cambridge, UK; W.M. Steen, Univ. of Liverpool, Liverpool, UK

An Approach to Consider the Results of Previous Forming Processes in the Simulation of Laser Beam Welding (809)
Auer Florian, Michael Zaeh, Institute for Machine Tools and Industrial Management, Garching, Germany

Session 9: Laser-Based Integrated Manufacturing Systems
Wednesday, October 16
8:00am - 11:30am

Session Co-Chairs: Walter Duley, Univ. of Waterloo, Waterloo, Ontario, Canada; Leonard Migliore, Coherent Laser Group, Santa Clara, CA

Expert Systems in Manufacturing (901)
Thirupathi Reddy, Vasavi College of Engineering, Hyderabad, Andhra Pradesh, India

Robotized Laser Production Cells (902)
Jyrki Latokartano, Tampere Univ. of Technology, Tampere, Finland

Achievements of Laser Center in Prague. (903)
Pavel Koran, LAO, Prague, Czechoslovakia

High-Power, Tunable ps-Laser User Facility (904)
Michael Kelley, Thomas Jefferson National Accelerator Facility, Newport News, VA

Recent Developments in Laminated Tooling by Multiple Laser Processing (905)
Steffen Nowotny, Thomas Himmer, Anja Techel, Eckhard Beyer, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany

Laser Integrated Dry Cleaning of Mass Production Parts (906)
Wolfgang Schmidt, Univ. of Applied Sciences, Soest, Germany

New Developments on Laser Cladding in Tool Repair (907)
 Stefan Czerner, H. Haferkamp, A. Ostendorf, J. Bunte, Laser Zentrum Hannover e.V., Hannover, Germany; Birner, MTU Maintenance GmbH, Langenhagen, Germany

BION™: Reengineering the Hermetic Packaging (908)
 Jasspreet Singh, G. Loeb, AMI-USC, Los Angeles, CA

Finite Element Modeling of Thermal Behavior of Molten Pool in Closed-Loop Controlled Laser Based Additive Manufacturing (909)
 Dongming Hu, Radovan Kovacevic, Southern Methodist Univ., Richardson, TX

Session 10: Sensing & Control
Wednesday, October 16
8:00am - 11:30am

Session Co-Chairs: Dave Farson, The Ohio State Univ., Columbus, OH; William O'Neill, Univ. of Liverpool, Liverpool, UK

New Aspects of Monitoring with a CMOS Camera for Laser Materials Processing ...(1001)
 Joerg Beersiek, Prometec, Aachen, Germany; Birgit Beersiek, Aachen, Germany

Monitoring of Laser Welding Process using PCA Based 2-Step Sensor Fusion (1002)
 Xichu Chen, Elijah Kannatey-Asibu, Univ. of Michigan, Ann Arbor, MI

A System for Dynamic Shape Measurements during Laser Processing (1003)
 Mark Reeves, Maria D. Stoikou, Andrew J. Moore, Duncan P. Hand, Julian D.C. Jones, Heriot-Watt Univ., Riccarton, Edinburgh, UK

Real-Time Classification of Laser Welding Process Irregularities by using Multivariate Statistics (1004)
 Oliver Hillers, Hans Kurt Tönshoff, Andreas Ostendorf, Laser Zentrum Hannover e.V., Hannover, Germany

Increased Performance and Flexibility of Process Monitoring for Deep Penetration Laser Welding (1005)
 Matthias Stallmach, Tim Hesse, Klaus Körber, Hans-Kurt Tönshoff, Laser Zentrum Hannover e.V., Hannover, Germany

Modulated Laser Welding Process for Defect Reduction (1006)
 Dave Farson, Min-Hyun Cho, The Ohio State Univ., Columbus, OH; J.I. Kim, Mokpo National Maritime Univ./Marine Engineer, Mokpo, South Korea

Lubricated Adjustable Optical Wedge Beam Steerer (1007)
 George Dubé, Roland Juhala, Sam Bross, MetaStable Instruments, Inc., St. Charles, MO

Feedback Control for Optimal Production Speed in Laser Beam Welding of Mild Steel (1008)
 Sjoerd Postma, Ronald G.K.M. Aarts, Johan Meijer, Ben Jonker, Univ. of Twente, Enschede, Overijssel, The Netherlands

Evaluation of Coaxial Process Control Systems for YAG Laser Welding in Aeronautics

Application (1009)
 Aubry Pascal, Hervé Launais, Thierry Dubois, CLFA, Arcueil, France; Olivier Colin, SNECMA, France; Duncan P. Hand, Heriot-Watt Univ., Riccarton, Edinburgh, Scotland

Session 11: Industrial Welding Applications
Thursday, October 17
8:00am - 11:30am

Session Co-Chairs: Stefan Kaierle, Fraunhofer Institute for Lasertechnology, Aachen, Germany; Keng Leong, Diodetec, Inc., Pittsburgh, PA

Laser Welding of Tailored Blanks (1101)
 Tomas Forsman, Swedish Institute for Metals Research, Stockholm, Sweden

Laser Welding Application for Side Panel in Car Body Manufacturing (1102)
 Chang Jung, Heui Bom Lee, I.S. Chang, Tae Yong Kwon, Hyundai Motor Company, Ulsan Metropolitan City, South Korea

Welding of Thick Austenitic Stainless Steel using Nd:YAG -Laser with Filler Wire and Hybrid Process (1103)
 Tommi Jokinen, VTT Manufacturing Technology, Lappeenranta, Finland; Veli Kujanpää, Lappeenranta Univ. of Technology, Lappeenranta, Finland

Influence of the Process Parameters on the Welding Results of Laser-GMA Welding..(1104)
 Emil Schubert, Alexander Binzel, Schweissttechnik GmbH & Co. KG, Buseck, Germany; B. Wedel, High YAG Lasertech. GmbH, Stahnsdorf, Germany

The Effects of Wire Feed Parameters on Filler Wire Laser Beam Interaction (1105)
 Antti Salminen, Lappeenranta Univ. of Technology, Lappeenranta, Finland

Microhardness Mapping of Hybrid Welds in Structural Steels (1106)
 Paul Denney, EWI, Columbus, OH; Doug Moon, Edward Metzbowler, US Naval Research Lab., Washington, DC

Study of CO2 Laser Welding to Suppress the Defects in Thick Steel Plates Welding Bead (1107)
 Atsushi Sugihashi, Nippon Steel Corporation, Futtsu, Chiba, Japan

Increased Seam Quality for Laser-GMA-Hybrid Welding of Zinc-Coated Steel (1108)
 Pino Cordini, H. Haferkamp, J. Bunte, Laser Zentrum Hannover e.V., Hannover, Germany; M. Höfemann, Salzgitter AG, Salzgitter, Germany; J. Szinyur, Voest Alpine Division Stahl Linz, Linz, Austria

CO2 and Nd:YAG Laser Welding of Galvanized Steels using Novel Approaches of Vent Holes and Shaped Beam Profiles (1109)
 Satyen Patel, Iowa State Univ.(USA) / Brunel Univ.(UK), Ames, IA; Paul Ackerson, Iowa State Univ., Nevada, IA; Palaniappa Molian, Iowa State Univ., Ames, IA

Session 12: Laser Cladding I
Thursday, October 17
8:00am - 11:30am

Session Co-Chairs: Jyoti Mazumder, Univ. of Michigan, Ann Arbor, MI; Lijue Xue, National Research Council Canada, London, Ontario, Canada

Coaxial Laser Cladding Nozzle for use with a High Power Diode Laser (1201)
 Paul Hayhurst, Tampere Univ. of Technology, Tampere, Finland; Jari Tuominen, Tapio Mäntylä, Perti Vuoristo, Inst. of Materials Science/Tam, Tampere, Finland

Dimensional and Material Characteristics of Direct Deposited Tool Steel by CO2 Laser (1202)
 Joohyun Choi, Yusheng Hua, Univ. of Missouri Rolla, Rolla, MO

Direct Laser Deposition of Copper/Steel Functionally Graded Materials (1203)
 John DuPont, Rick Noecker, Lehigh Univ., Bethlehem, PA

A 3-D Transient Finite Element Model for Laser Cladding by Powder Injection. (1204)
 Ehsan Toyserkani, Amir Khajepour, Steve Corbin, Univ. of Waterloo, Waterloo, Ontario, Canada

Net Shape Manufacturing of Porous Titanium Implants using Direct Laser Fabrication...(1205)
 Junfa Mei, X. Wu, The Univ. of Birmingham, Birmingham, West Midlands, UK

Laser Cladding on 3D-Surfaces: A Method for Optimizing the Operating Conditions . . (1206)
 Ingmar Kerp, Gert-Willem Römer, J. Meijer, Univ. of Twente, Enschede, The Netherlands

Comparison of CO2 and High Power Diode Laser (HPDL) Cladding (1207)
 Jari Tuominen, Jussi Laurila, Petri Vuoristo, Jorma Vihinen, Tampere Univ. of Technology, Tampere, Finland; Tuomo Peltola, LaserCo / KETEK, The Ostrobothnia Technology Servi, Tampere, Finland

A Comparative Study of Multiple Layer Laser Deposition using Water and Gas Atomised 316L Stainless Steel Powders (1208)
 Andrew Pinkerton, Lin Li, UMIST, Manchester, UK

Laser Casting and Laser Clad-Casting: New Processes for Rapid Prototyping and Production (1209)
 Hans Gedda, A. Kaplan, Luleå Univ. of Technology, Luleå, Norrbotten, Sweden; J. Powell, Laser Expertise Ltd., Nottingham, UK

Laser Materials Processing Conference
Continued on pg. 12

Laser Microfabrication Conference

Sponsored by:



Conference Chair:
Andreas Ostendorf

**Laser Zentrum Hannover e.V.,
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Willem Hoving, Philips Centre for Industrial Technology, Eindhoven, The Netherlands
Gnian C. Lim, Singapore Institute of Manufacturing Technology, Singapore
Marc Nantel, Photonics Research Ontario, Toronto, Ontario, Canada
Kunihiko Washio, NEC Corporation, Tokyo, Japan

The challenge and demand for developing new laser technologies for microfabrication is bigger than ever. The explosion of new ideas in the photonics and biomedical fields has created a unique need for fabrication of new miniaturized components. The Laser Microfabrication Conference at ICALEO® 2002 is a global forum for engineers and scientists from a variety of industry segments to meet and discuss use of laser microfabrication as a key technology for various applications. It provides an opportunity for sharing new ideas and experiences in developing and implementing this exciting technology.

This year's conference is bigger than ever with presentations discussing the use of lasers for microfabrication in photonics, biomedical, and microelectronics industries. A session on ultrashort pulse laser microfabrication and a session on ultrashort pulse laser modification will highlight new and exciting achievements in this advancing field. A session on electronics and ultraviolet laser microfabrication captures the advancement in microelectronics and related fields. The laser micro welding and micro-structure writing sessions points out some interesting possibilities for use of these technologies. Finally, a novel laser processes session has been dedicated to capture those unique and enabling laser technologies.

Session 1: Electronics Production I Monday, October 14 1:30pm - 5:00pm

Session Chair: Gnian Lim, Singapore Institute of Manufacturing Technology, Singapore

High-Performance Beam Positioning in Laser Micromachining (M101)
Corey Dunskey, ESI, Portland, OR

High Speed Videography of Microvia Formation and Melt Ejection in Laser Drilling of Circuit Substrates (M102)
Francisco Villarreal, Howard Baker, Kiran Gulia, Denis Hall, Duncan P. Hand, Heriot Watt Univ., Edinburgh, UK

Laser-Fabricated Metal-Semiconductor Junctions on Silicon Carbide Substrates (M103)
Islam Salama, Aravinda Kar, CREOL, Univ. of Central Florida, Orlando, FL; Nathaniel Quick, AppliCote Associates, Lake Mary, FL

Specially Developed Glass Fabrics for Ultimate Small Diameter Hole of High Density Board by Laser Drilling Method (M104)
Yasuyuki Kimura, Yoshinori Gondoh, Asahi-Schwebel Co., Ltd., Moriyama-shi, Shiga, Japan

Progress in Laser Annealing for Low-Temperature Semiconductor Processing and its Application to Advanced Electronics and Display Devices (M105)
Toshiyuki Sameshima, Tokyo Univ. of Agriculture and Technology, Tokyo, Japan

High Quality Laser Micro-Cutting of Difficult-to-Cut Materials such as Copper and Silicon Wafers (M106)
GC Lim, Tuan-Anh Mai, David Low, Singapore Institute of Manufacturing Technology, Singapore; Qiong Chen, ASA Ltd., Singapore

A Comparison Study of Micromachining using Mode-Locked and Q-Switched Diode Pumped Solid State Ultraviolet Laser (M107)
Mingwei Li, Andrew Held, Mark Keirstead, Spectra-Physics, Inc., Mountain View, CA

Session 2: Electronics Production II Tuesday, October 15 8:00am - 11:30am

Session Chair: Kunihiko Washio, NEC Corporation, Tokyo, Japan

Advanced Laser Applications in Microelectronics and Data Storage Devices (M201)
Yong Feng Lu, National Univ. of Singapore, Singapore

Processing of Silicon by Nd:YAG Lasers with Harmonics Generation (M202)
Udo Klotzbach, Michael Panzner, Thomas Kuntze, Hendrik Wust, Eckhard Beyer, Fraunhofer IWS, Dresden, Germany

Laser Machining of Silicon using Diode-Pumped Solid State Lasers (M203)
Tom Corboline, Anthony Hoult, Coherent Laser Applications Center, Santa Clara, CA

Laser-Induced Shock Cleaning of Silicon Wafers (M204)
Jong-Myoung Lee, Sung-Ho Cho, IMT Co. Ltd, Yongin, South Korea; Jin-Goo Park, Sang-Ho Lee, Hanyang Univ., South Korea

Dicing of GaAs with the Laser MicroJet: Challenges, Improvements and Safety Issues (M205)
Natalia Dushkina, The Gem City Engineering Co., Dayton, OH; Bernold Richerzhagen, Synova SA, Lausanne, Switzerland

Excimer-Laser Activation of Dopants in Silicon for Ultra Shallow Junction Application (M206)
Zahorski Dorian, Venturini Julien, SOPRA, Bois Colombes, France

Laser Enhanced Processing Methods for FPD Manufacturing (M207)
Brian Hoekstra, Roger Flannigan, Daniel Wegerif, Applied Photonics, Inc., Orlando, FL

Room assignments and exact times of presentations will be listed in the ICALEO® 2002 Technical Digest.
Program subject to minor changes.

Shock Pressure Measurements for the Removal of Particles of Sub-Micron Dimensions from Silicon Wafers (M208)
 Carmel Curran, K.G. Watkins, Univ. of Liverpool, Liverpool, Merseyside, UK; J.M. Lee, Laser Application Group, IMT Co. LTD., Kyunggi-Do, South Korea

**Session 3: Laser Sources for Micromachining
 Tuesday, October 15
 1:30pm - 5:00pm**

Session Chair: Heinrich Endert, IMRA America, Inc., Ann Arbor, MI

Laser Applications by using Third Harmonic Nd:YAG Lasers (M301)
 Wentao Hu, Kunal Shah, Qiang Fu, Quantronix Corp., East Setauket, NY

Design and Performance of Multilevel Phase Fan-Out Diffractive Optical Elements for Laser Materials Processing (M302)
 Keiji Fuse, Takayuki Hirai, Toshihiko Ushiro, Takeshi Okada, Kenichi Kurisu, Sumitomo Electric Industries, Ltd., Osaka, Japan

Comparison Excimer Laser - Solid State Laser (M303)
 Wieland Hill, Lambda Physik AG, Goettingen, Germany

Theoretical Study on SHG Conversion Efficiency for Focused Beam and Control of its Decline (M304)
 Kazufumi Nomura, Etsuji Ohmura, Isamu Miyamoto, Osaka Univ., Suita, Japan

Laser-Absorption Dependence of SHG Conversion Efficiency by Nonlinear Optical Crystal (M305)
 Etsuji Ohmura, Kazufumi Nomura, Isamu Miyamoto, Osaka Univ., Suita, Japan

Fiber Laser Technology with Temporal Pulse Shaping from fs to ns for "Tailoring" Flexible Laser Material Processing (M306)
 Heinrich Endert, Zaza Sartania, Michelle L. Stock, IMRA America, Inc., Ann Arbor, MI; Rajesh Patel, IMRA America, Inc., Fremont, CA

Development of an Ultra Short Wavelength Solid State Laser (M307)
 Muhammad Gualini, Pakistan Institute of Lasers and Optics, Islamabad, Pakistan

UV Ps-Laser with High Peak Power for Micromachining (M308)
 Gediminas Raciukaitis, Saulius Jacinavicius, Ekspla Ltd., Vilnius, Lithuania

High Average Power Femtosecond Sources for Micromachining (M309)
 Emmanuel Baubeau, Frédéric Saviot, Thales Laser, Orsay, France; Muriel Schwarz, Arnaud Brignon, THALES Research & Technology, Orsay, France

**Session 4: Laser Micro Welding / Laser Micro Drilling
 Wednesday, October 16
 8:00am - 11:30am**

Session Chair: Arnold Gillner, Fraunhofer Institute for Lasertechnology, Aachen, Germany

Fusion Zone Behavior in Micron-Size Laser Welding (M401)
 Gerald Knorovsky, Danny MacCallum, Sandia National Laboratories, Albuquerque, NM; Vladimir Semak, ARL, The Penn State Univ., State College, PA

Laser Joining of Non-Metallics for Optoelectronic and Biomedical Applications (M402)
 Hans Herfurth, Reiner Witte, Fraunhofer Center for Laser Technology, Plymouth, MI

Overcoming the Difficulty of Gap Formation between the Conductor Junction Areas during Laser Spot Micro-Welding (M403)
 Jehiad Zeadan, Laser Zentrum Hannover e.V., Hannover, Germany

Determination of Weld Quality in Pulsed Nd:YAG Laser Welds using IR and Acoustic Sensors (M404)
 Gregory Bates, Girish Kelkar, Unitek Miyachi International, Monrovia, CA

Process Control in Pulsed Laser Welding of Electronics (M405)
 Michael Schmidt, Bayerisches Laserzentrum, Erlangen, Germany

Influences on Hole Quality in High Precision Drilling of Steel with Ultra-Short Pulsed Laser Systems (M406)
 Christian Föhl, Univ. of Stuttgart, FGSW, Stuttgart, Germany; Detlef Breitling, Friedrich Dausinger, Univ. of Stuttgart, IFSW, Stuttgart, Germany

High Aspect-Ratio Laser-Drilling of Micro-Holes with a Nd:YAG Master-Oscillator Power-Amplifier (MOPA) System (M407)
 Alexander Binder, Thomas Metzger, David Ashkenasi, Gerhard Müller, LMTB, Berlin, Germany; Thomas Riesbeck, Technical Univ. of Berlin, Berlin, Germany

Generation of Flat-Top Focused Beams for Percussion Drilling of Ceramic (M408)
 Martyn Knowles, G. Rutterford, A.I. Bell, Oxford Lasers Ltd., Abingdon, Oxon, UK; D.W. Coutts, Univ. of Oxford Clarendon Lab., Oxford, UK; M.J. Withford, Macquarie Univ./JA Piper Ctr. for Las. & Appl., Australia

Optimized Laser Applications with Lamp-Pumped Pulsed Nd:YAG Lasers (M409)
 Ronald Holtz, Matthias Jokiell, LASAG AG, Thun, Switzerland

**Session 5: Microsystems Fabrication / Biomedical Devices
 Thursday, October 17
 8:00am - 11:30am**

Session Chair: Ronald Holtz, Lasag AG, Thun, Switzerland

Laser Ablative Micro-Machining and its Applications for Rapid Fabrication of Micro-Fluidic Components (M501)
 Tuan-Anh Mai, G.C. Lim, Stephen Wan, Ailin Xie, Singapore Institute of Manufacturing Technology, Singapore

Excimer Lasers in Fabrication of High-Aspect-Ratio Microstructures (M502)
 Ampere Tseng, Arizona State Univ., Tempe, AZ; Ying-Tung Chen, Kung-Jeng Ma, Chung Cheng Institute of Technology, Tashi, Taiwan

Laser-Induced Thermochemical Wet Etching of Titanium Foil for Fabrication of Microstructures (M503)
 Sungho Jeong, Yongsan Shin, Kwangju Institute of Science and Technology, Kwangju, North Korea

Laser Microfabrication of Restrictor in a Micro Actuator (M504)
 Kwang-Ryul Kim, S.C. Ko, H.K. Park, Samsung Elec. Co. Ltd./Digital Printing Div., Suwon City, Kyungki-Do, South Korea; D.F. Farson, The Ohio State Univ., Columbus, OH; S. Satonaka, Kumamoto Univ., Kumamoto, Japan

Laser-Based Micro-Manufacturing of Complex 3D Micro-Components (M505)
 Xiaochun Li, Hongseok Choi, Yong Yang, Univ. of Wisconsin - Madison, Madison, WI

Laser Structuring and Modification of Surfaces for Chemical and Medical Micro Components (M506)
 Arnold Gillner, Elke Bremus-Koebberling, Fraunhofer Institut for Laser Technology, Aachen, Germany

Calcium Phosphate Coatings Produced by Laser: A Comparison of the Laser Cladding and the Pulsed Laser Deposition Techniques (M507)
 Juan Pou, Fernando Lusquinos, Jorge Arias, Mohamed Boutinguiza, Mariano Pérez-Amor, Univ. of Vigo, Vigo, Spain

Determining Cornea Elasticity with PulsESPI to Improve Excimer Laser Procedures (M508)
 Muhammad Gualini, Pakistan Institute of Lasers and Optics, Islamabad, Pakistan; Willibald Sixt, Hans Steinbichler, Steinbichler Optotechnik GmbH, Neubeuren, Germany; Wajid Ali Khan, Al Shifa Trust Eye Hospital, Rawalpindi, Pakistan

Use of Fiber Lasers for Micro Cutting Application in the Medical Device Industry (M509)
 Klaus Kleine, Brad Whitney, Guidant, Santa Clara, CA; Ken Watkins, Univ. of Liverpool, Liverpool, UK

Session 6: Micromachining of Photonic Components
Thursday, October 17
1:30pm - 5:00pm

Session Chair: Corey Dunsky, Electro Scientific Industries, Inc., Portland, OR; Andreas Ostendorf, Laser Zentrum Hannover e.V., Hannover, Germany

Reliable Refractive-Index Adjustment in Ge-Doped Silica-Core Planar Waveguides by High-Repetition Rate Femtosecond Laser Pulses (M601)

Kunihiko Washio, NEC Corporation, Control Systems Operation Unit, Minato-ku, Tokyo, Japan; Hikaru Kouta, NEC Corp., Functional Mat. Res. Lab., Kawasaki, Japan; Yutaka Urino, NEC Corp., Fiber Optic Devices Div., Ohtsuki, Japan; Kazuyuki Hirao, Kyoto Univ., Fac. of Eng., Sakyo, Kyoto, Japan

Laser Processing of Photonics Components using Multiple UV Wavelength Source...(M602)

Martyn Knowles, Heather J. Booth, E.K. Ily, Oxford Lasers Ltd., Abingdon, Oxon, UK

Writing Buried Optical Waveguides: Contrasts in Ultrafast and Ultraviolet Lasers (M603)

Peter Herman, Dragan Coric, Midori Wei, Jianzhou Li, Dept. of Electrical & Computer Engineering, Univ. of Toronto, Toronto, Ontario, Canada; Paul B. Corkum, Ravi Bhardwaj, David M. Rayner, Steacie Institute for Molecular Sciences, National Research Council, Ottawa, Ontario, Canada

Laser Induced Chemical Etching of THz Waveguides and Quasi Optical Devices(M604)

Christian Drouet d'Aubigny, Christopher Walker, Steward Observatory, Univ. of Arizona, Tucson, AZ

Diamond Micro-Optics for High-Power Lasers (M605)

Mikael Karlsson, The Angstrom Laboratory, Uppsala, Sweden; Fredrik Nikolajeff, Uppsala Univ., Uppsala, Sweden

Time Resolved Optomechanical Investigations on the Interaction of Femtosecond Pulses with Glass (M606)

Alexander Horn, E.W. Kreutz, R. Poprawe, Lehrstuhl für Lasertechnik, Aachen, Germany

Writing Refractive Index Gratings in Perspex and Polymer Optical Fibres (M607)

David Jones, Strathclyde Univ., Glasgow, Scotland, UK; P.J. Scully, Liverpool John Moores Univ., Liverpool, UK; D.A. Jaroszynski, Univ. of Strathclyde/Strathclyde Electron and Tera, Glasgow, Scotland, UK

Direct-Write Manufacturing of Optical Waveguides with Holographic Features..(M608)

Sean Kirkpatrick, Material & Manufacturing Directorate, Air Force Research Laboratories, Wright Patterson Airforce Base, OH; Ali Said, Mark Dugan, Translume, Ann Arbor, MI

Session 7: Laser Ablation
Thursday, October 17
1:30pm - 5:00pm

Session Chair: Udo Klotzbach, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany

Nanostructuring of Metal Layers and Transparent Materials with Femtosecond Laser Pulses (M701)

Frank Korte, Laser Zentrum Hannover e.V., Hannover, Germany

Atmospheric Affects on Ultrashort-Pulsed Material Processing (M702)

Larry Walker, Robert Maynard, William Clark, Clark-MXR, Inc., Dexter, MI

A Thin-Film Model for Flow of Molten Metal on a Substrate during Pulsed Laser

Micromachining (M703)

David Willis, Dept. of Mechanical Engineering, Southern Methodist Univ., Dallas, TX; Vladimir Ajaev, Dept. of Mathematics, Southern Methodist Univ., Dallas, TX

Quantifying Stresses Induced by Laser Micromachining using Micro-Raman

Spectroscopy (M704)

Larry Dosser, Kenneth E. Hix, Mound Laser & Photonics Center, Inc., Miamisburg, OH; Maher S. Amer, Wright State Univ., Dayton, OH; John F. Maguire, Air Force Research Laboratory, Wright-Patterson AFB

Numerical Analyses on Texture Formation on the Silicon Surface Irradiated by Nanosecond Laser (M705)

Jun Maehara, Takashi Yabe, Tokyo Inst. of Tech., Meguro-ku, Tokyo, Japan; Ryuusuke Komura, Wafer Marker Project Team, Research Center, Komatsu, Hiratsuka-shi, Kanagawa, Japan

Numerical and Experimental Investigation of Laser-Driven Micro-Airplane (M706)

Yoichi Ogata, Takashi Yabe, Masashi Yamaguchi, Ryo Nakagawa, Keiichi Aoki, Tokyo Inst. of Tech., Meguro-ku, Tokyo, Japan

Modeling Thermal Effects Produced by Nanosecond and Femtosecond Laser Pulses Applied to Metals (M707)

Stephane Valette, Ecole Nationale Supérieure des Mines, Saint-Etienne, France; Ronan Le Harzic, Nicolas Huot, Eric Audouard, LTSI, Saint-Etienne, Cedex, France; Roland Fortunier, Ecole des Mines, Saint-Etienne, Cedex, France

Laser Micro-Machining of Metals with Various Thermal Conductivities (M708)

Yu Zhang, Bernal Technologies, Rochester Hills, MI; Mingwei Li, Spectra-Physics, Inc., Mountain View, CA; Xiangkai Yuan, Xianghua Zeng, Donghua Univ., Shanghai, China

Effects of Gas Medium on Ultrafast Laser Materials Processing (M709)

Jun Sun, State Univ. of New York at Stony Brook, Stony Brook, NY

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Session 13: Cutting & Drilling
Thursday, October 17
8:00am - 11:30am

Session Co-Chairs: Cho Lik Chan, Univ. of Arizona, Tucson, AZ; William Lawson, Laser Machining, Inc., Somerset, WI

The Effect of Temporal Pulse Shape on Drilling Efficiency (1301)
 Cho Lik Chan, Univ. of Arizona, Tucson, AZ;
 David Campbell, Andrew Paul, Raytheon, Tucson, AZ

Increasing the Accuracy of 3-D Laser Cutting using CAD Model / Work Piece Adjustment (1303)
 Jörg Werhahn, Hans Kurt Tönshoff, Andreas Ostendorf, Laser Zentrum Hannover e.V., Hannover, Germany

Machining of Inorganic Materials with a Short-Pulse CO2 Laser (1304)
 Leonard Migliore, Coherent Laser Group, Santa Clara, CA; Arzu Ozkan, Coherent Laser Division, Santa Clara, CA

The Effect of Steel Composition on the Laser Cut Edge Quality of Carbon and C-Mn Steels (1305)
 Ariane Lugan, P.A. Hilton, D.W. Taylor, TWI Ltd., Cambridge, UK

Laser Rock Drilling by a Super-Pulsed CO2 Laser Beam (1306)
 Zhiyue Xu, Claude B. Reed, Argonne National Laboratory, Argonne, IL

Optimisation of Laser Percussion Drilling Process to Improve Repeatability (1307)
 Lin Li, G.K.L. Ng, H. Wang, UMIST, Manchester, UK

High Speed Laser Drilling of Metals with a Long Pulse XeCl Excimer Laser (1308)
 Cornelis Biesheuvel, Aart Schoonderbeek, Ramon Hofstra, NCLR, Enschede, The Netherlands; Klaus-J. Boller, Johan Meijer, Univ. of Twente, Enschede, The Netherlands

Laser Drilling and Micro-Deposition via Holes for Printed Wiring Boards (1309)
 Richard Martukanitz, ARL, The Penn State Univ., State College, PA

Session 14: Laser Processing of Exotic Materials
Thursday, October 17
1:30pm - 5:00pm

Session Co-Chairs: Edward Metzbowler, US Naval Research Laboratory, Washington, DC; Juan Pou, Univ. de Vigo, Vigo, Spain

Welding Thermoplastic Elastomers to Polypropylene with a Diode Laser (1401)
 Bobbye Baylis, Siemens VDO Automotive, Tilbury, Ontario, Canada; Stephan Naegeler, Steffen Sturm, Fraunhofer USA, Center for Surface & Laser Processing, Plymouth, MI; YingPing Huang, Dan Watt, Univ. of Windsor, Windsor, Ontario, Canada

Welding of Thermoplastics with High Power Diode Lasers (1402)
 Ulrich Russek, Gerd Otto, Matthias Poggel, Henrik Staub, Fraunhofer Institute for Laser Technology, Aachen, Germany

The Effect of Laser Wavelength on the Clearweld Plastics Welding Process ... (1403)
 Anthony Hoult, Coherent Laser Applications Center, Santa Clara, CA; LP Frieder, Gentex Corporation, Carbondale, PA

Advantages of Clearweld Technology for Polyamides (1404)
 Val Kagan, Honeywell International, Morristown, NJ; Nicole Woosman, Gentex Corporation, Carbondale, PA

Laser Preparation of Metal and Dielectric Double-Layer Structure for Fiber Capacitors (1405)
 Yonggang Li, Aravinda Kar, CREOL, Univ. of Central Florida, Orlando, FL; Nathaniel Quick, USF Filtration and Separations Group, Inc., DeLand, FL

Laser Welding of Dissimilar Alloys (1406)
 Arvind Bharti, N.D. Pandey, Defence Metallurgical Research Laboratory, Hyderabad, India

Towards a Solution of Laser Welding Zinc Coated Steel Sheets (1407)
 Muhammad Gualini, Pakistan Institute of Lasers and Optics, Islamabad, Pakistan

Laser Removal of Molded Flashes on Leadframe Packages (1408)
 Qiong Chen, Advanced Systems Automation Ltd., Singapore; HongYu Zheng, J.L. Tan, G.C. Lim, Singapore Institute of Manufacturing Technology, Singapore

Numerical Simulation of an Impinging Water Jet Applied to Cooling Human Skin ... (1409)
 Pezhman Akbari, E. Lansing, MI; Mohammad Behshad Shafii, Michigan State Univ., E. Lansing, MI

Session 15: Laser Cladding II
Thursday, October 17
1:30pm - 5:00pm

Session Co-Chairs: Milan Brandt, Industrial Research Institute Swinburne (IRIS), Melbourne, Australia; Minlin Zhong, Tsinghua Univ., Beijing, China

Nd:YAG Laser Cladding of Al/Si and Al7075 Powder on Al7050 and Al7075 Substrates (1501)
 Milan Brandt, Yvonne Durandet, IRIS, Swinburne Univ., Melbourne, Australia; Qianchu Liu, DSTO, Melbourne, Australia

Magnesium Alloys Laser (Nd:YAG) Cladding and Alloying with Side Injection of Aluminium Powder (1502)
 Sorin Ignat, Pierre Sallamand, Dominique Grevey, IUT Le Creusot, Le Creusot, Burgundy, France

New Coaxial Nozzle for Wire and Powder Laser Rapid Manufacturing (1503)
 Olivier Démure, P. Aubry, N. Coulon, P. Bourles, CLFA, Arcueil, France

Fundamental Investigations on Process Monitoring in the Laser Cladding Process (1504)
 Markus Kogel-Hollacher, Joann Schmid, JURCA Optoelektronik GmbH & Co. KG, Rodgau, Germany; Milan Brandt, IRIS Swinburne Univ. of Technology, Melbourne, Australia

Practical Aspects of Laser Cladding with High Power Lasers (1505)
 Trevor Anderson, Jarvie Engineering Pty. Ltd., Newcastle N.S.W., Australia

Effect of Zirconia on Laser Cladding of Hydroxyapatite Bioceramic on Ti-Alloy (1506)
 Jae-Do Kim, Inha Univ., Incheon, South Korea; Jiachen Liu, Tianjin Univ./Dept. of Material Science and Eng., Tianjin, South Korea

A Study of Sliding Friction Wear Resistance of Laser Cladded Ceramic-Metal Composite Coatings with Different Compositions ... (1507)
 Zeng Xiaoyan, Wu Xinwei, Tao Zengyi, Cui Kun, Huazhong Univ. of Science and Technology, Wuhan, China

Fabrication of In-Situ Composite Coating Reinforced with TiC Particles by Powder Feeding Laser Cladding (1508)
 Sen Yang, Minlin Zhong, Wenjin Liu, Tsinghua Univ., Beijing, China

Laser Synthesizing NiAl Intermetallic Compound Based Particulate Reinforced Composite (1509)
 Minlin Zhong, Xiangyang Xu, Tsinghua Univ., Beijing, China

About LIA



Founded in 1968, Laser Institute of America (LIA) is the professional membership society comprised of laser researchers, manufacturers, integrators, and users working together to increase the use and safe application of laser technologies. LIA membership is made up of individuals and corporations alike. Members are privileged to significant discounts on all LIA materials, training courses, and conferences.

Fulfilling its mission of fostering lasers, laser applications, and laser safety worldwide, LIA is the secretariat and publisher of the American National Standards Institute (ANSI) Z136 series of the laser safety standards. These documents provide a thorough set of guidelines for implementing a safe laser program. The ANSI Z136 series is recognized by OSHA, and is the authoritative laser safety document in the United States. LIA also offers a wide array of products and services including safety and application publications, training videos, signs and labels, Laser Safety Officer training, and conferences.

For membership or other information, contact the LIA at 800.34.LASER or go to www.laserinstitute.org.

Poster Presentation Gallery

Tuesday, October 15 & Wednesday, October 16

9:30am-4:00pm

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The Poster Presentation Gallery will be featured on Tuesday and Wednesday of ICALFO® 2002. Authors will be available on Tuesday, October 15 from 11:30am-1:30pm to answer questions; during this time a boxed lunch is available for all full conference attendees! Awards will be given for 1st, 2nd, and 3rd place and presented during the Annual Meeting/Awards Luncheon on Wednesday afternoon.

Congratulations to last year's Poster Presentation winners: 1st Place: Ali Khan, Univ. of Liverpool; 2nd Place: Jason Carroll, Univ. of Michigan, CLAIM; 3rd Place Juan Pou, Univ. de Vigo

Poster Presentation October 15 & 16

The Investigation on the Microstructural Characteristics and Properties of (1.2%Zr+40%WC)/FeCSiB Layer Produced by Laser Cladding (P501)
Minlin Zhong, Qingmao Zhang, Tsinghua Univ., Beijing, China

Laser Synthesizing Cemented Carbide and its Near Net Shape Manufacturing for Cutting Tool..... (P502)
Minlin Zhong, Yanxia Chen, Wenjin Liu, Guoqing Ning, Fengshen Li, Tsinghua Univ., Beijing, China

Femto-Second Laser-Machining of 3-D Structures (P503)
David Jones, Dino Jaroszynski, Strathclyde Univ., Glasgow, Scotland, UK

Femtosecond Pulsed Laser Processing of AlMg B14 and Polysilicon Thin Films for MEMS.(P504)
Pal Molian, Michael Stock, Iowa State Univ., Ames, IA

Exploiting Optical Fringes Methods to Realize a Laser Adaptive Control (P505)
Muhammad Gualini, Pakistan Institute of Lasers and Optics, Islamabad, Pakistan

Optimization of Laser Glazing Treatment for Performance Improvement of Railroad Rails (P506)
Zhiyue Xu, Claude B. Reed, Argonne National Laboratory, Argonne, IL

Laser Direct Write Microprocessing of Diamond (P507)
Islam Salama, Aravinda Kar, CREOL, Univ. of Central Florida, Orlando, FL; Nathaniel Quick, AppliCote Associate, Lake Mary, FL

Ultrashort Laser Pulse Layer Material Removal (P508)
Dang Engracia, Cho Lik Chan, Univ. of Arizona, Tucson, AZ

Recurrent Neural Network Based Analysis For Laser Cladding Dynamic Model Identification (P509)
Ehsan Toyserkani, Amir Khajepour, Steve Corbin, Univ. of Waterloo, Waterloo, Ontario, Canada

Micro-Structuring of Photo Resists by UV Laser Radiation (P510)
Frank Meyer, Laser Zentrum Hannover e.V., Hannover, Germany

Determination of Clad Geometry using Real-Time Image Processing (P511)
Ehsan Toyserkani, Amir Khajepour, Steve Corbin, Univ. of Waterloo, Waterloo, Ontario, Canada

From Macro to Micro -The Development of Laser Ablation (P512)
Michael Kuhl, Lasertec GmbH Pfronten, Kempten, Germany

Spot Size Measurements for Ultra-Small Laser Welds (P513)
Danny MacCallum, Gerald Knorovsky, Sandia National Laboratories, Albuquerque, NM

A Process Efficiency Comparison of Nd:YAG and CO2 Laser Cladding (P514)
Hans Gedda, A. Kaplan, Luleå Univ. of Technology, Luleå, Norrbotten, Sweden; J. Powell, Laser Expertise Ltd., Nottingham, UK

MoSi2 Powder Side Injection with Addition of Non-Stabilized ZrO2 under Nd:YAG Cw Laser - Double Injection Technique (P515)
Sorin Ignat, Pierre Sallamand, Dominique Grevey, LTM Lab./Univ. of Burgundy-France, Burgundy, France; Bernard Vannes, Central School of Lyon-France, Ecully, France; Alexandru Nichici, Politechnica Univ. of Timisoara, Romania

Laser-Processing of Microstructural Defects for Life Extension (P516)
Larry Dossier, Kenneth E. Hix, Mound Laser & Photonics Center, Inc., Miamisburg, OH; James L. Blackshire, Air Force Research Laboratory (AFRL/MLLP), Wright-Patterson AFB, OH

Preparation of Polyperinaphthalenic Organic Semiconductive Nano Particles by Excimer Laser Ablation and their Application to Optic and Electronic Devices (P517)
Satoru Nishio, Hiroshi Fukumura, Tohoku Univ., Sendai, Japan; Hiroyasu Sato, Mie Univ., Tsu, Japan; Nobuo Ando, Yukinori Hato, Kanebo, Hofu, Japan

Laser Surface Alloying of Mo-WC on Titanium Alloys (P518)
Wang Pang, H. C. Man, T. M. Yue, The Hong Kong Polytechnic Univ., Kowloon, Hong Kong

Measurement of the Thermal Properties of Slate by the Laser Flash Method (P519)
Juan Pou, Mohamed Boutinguiza, Fernando Lusquinos, Felix Quintero, Mariano Pérez-Amor, Univ. of Vigo, Vigo, Spain

Laser Forming of Metal Foil by Upsetting Mechanism (P520)
Ryugo Oba, S. Yoshioka, T. Miyazaki, K. Nakamura, Chiba Institute of Technology, Narashino, Chiba, Japan

Monitoring of YAG Laser Spot Welding-Detection of Porosity Defect by Acoustic Signal- ... (P521)
Yukimichi Sasaki, Tadashi Misu, Shunro Yoshioka, Toshiyuki Miyazaki, Chiba Institute of Technology, Narashino, Chiba, Japan

Microscale Laser Shock Processing (LSP) of Metal Thin Films (P522)
Wenwu Zhang, Columbia Univ., Schenectady, NY; Y. Lawrence Yao, Columbia Univ., New York, NY

Measurement of Focused Beam Waist of UV Pulse Laser and Material Processing Threshold...(P523)
Lian Zou, Weisheng Lei, Electro Scientific Industries, Inc., Portland, OR

Microstructure and Toughness of Laser Welded Joint of 400MPa Grade Ultra-Fine Grained Steel (P524)
Xudong Zhang, Wuzhu Chen, Cheng Wang, Tsinghua Univ., Beijing, China; Zhiling Tian, Center Iron & Steel Research Institute, Beijing, China

Laser Marking of Materials by Micro-Mirror-Arrays (P525)
Thomas Kuntze, Michael Panzner, Udo Klotzbach, Eckhard Beyer, Fraunhofer Institute for Material and Beam Technology, Dresden, Germany

Industrial Applications of Laser Cladding...(P526)
Thierry Marchione, Gremada, Inc., West Fargo, ND

Portable Laser Coating Removal System Demonstration/Validation (P527)
Robert Hull, Anteon Corp., Dayton, OH; Debora Meredith, AFMC/LGP-EV, WPAFB, OH; Tom Naguy, AFRL/MLQ, WPAFB, OH; Gerard Mongelli, SAIC, WPAFB, OH

Geometrical Modeling of Laser Ablation.(P528)
Raj Vatsya, Evgueni Bordatchev, Suwas Nikumb, IMTI - NRC, London, Ontario, Canada

Laser Safety in the High School Classroom (P529)
Pearl John, Richard Shanks, Renee Holtzhauser, Meadow Woodbury, Kenneth Canole, Columbia Area Career Center, Columbia, MO

Welding of Structural Shapes with High Power CO2 Laser (P531)
Richard Martukanitz, Paul Blomquist, Edward Reutzel, ARL, The Penn State Univ., State College, PA

Solid Free Form Fabrication of Nickel Nano and Micro Powders (P532)

Pal Molian, Rajeev Madhavannair, Irffan Nazar, Iowa State Univ., Ames, IA

Laser-Aided Manufacturing of Metallic Parts (P533)

Jeong-Hun Suh, InssTek, Inc., Taejon, South Korea; Haeseong Jee, Hong-Ik Univ., Seoul, South Korea

Laser Cladding of AS21 Magnesium Alloy with Al/Si/WC Powder to Increase Wear Resistance (P534)

Meity Mandagie, Milan Brandt, Yvonne Durnadet, IRIS, Swinburne Univ. of Technology, Melbourne, Australia; Mahnaz Jahedi, CSIRO Manufacturing Science and Technology, Woodville North, Australia

Crack-Free Welding of Low Weldability Carbon Steel by High Power Diode Laser (P535)

Juan Pou, Amadeo Sánchez-Castillo, Fernando Lusquiños, Ramon Soto, Mariano Pérez-Amor, Univ. of Vigo, Vigo, Spain

Cutting 50mm Shipbuilding Parts with less than 2kW of CO2 Laser Power (P536)

Wayne Penn, Alabama Laser, Munford, AL; Patrick Cahill, Bender Shipbuilding & Repair Co., Inc., Mobile, AL; Jack Gabzdyl, BOC Gases, Guild, UK; Justin Koch, Caterpillar, Inc., Mossville, IL

New Innovations in Diode Laser Cladding (P537)

Alexander Groth, Stephan Naegeler, Christian Walz, Fraunhofer Center for Surface and Laser Processing, Plymouth, MI

Study of Assist Gas Flow Behavior during Laser Welding (P538)

Mohammed Hamadou, Rémy Fabbro, CLFA, Paris, France; Georges Caillibote, Karim Chouf, Francis Briand, Air Liquide/Centre Technique des Applications du S, Saint Ouen l'Aumône, France

Laser Surface Aluminizing of Mild Steel: Microstructural and Corrosion Characteristics..(P539)

Hau Chung Man, F.T. Cheng, Hong Kong Polytechnic Univ.-Laser Processing, Kowloon, Hong Kong; C.T. Kwok, Univ. of Macau, Taipa, Macau, China

Cavitation Erosion and Corrosion Behaviours of Laser Surface Alloyed Stainless Steel 316 with WC (P540)

Hau Chung Man, KH Lo, FT Cheng, Hong Kong Polytechnic Univ.-Laser Processing, Kowloon, Hong Kong, China; CT Kwok, Univ. of Macau, Taipa, Macau, China

Micro Machining of Micro Fluidic Devices using a High-Brightness Diode-Pumped Nd:YAG Laser (P541)

Daniel Lim, Brenda Cho, Shuichi Takayama, Jyoti Mazumder, Univ. of Michigan, Ann Arbor, MI

Microstructures of Laser Welded Steels..(P542)

Norman McPherson, BAE Systems, Glasgow, Scotland, UK; Neville Baker, Natalia Suarez-Fernandez, Univ. of Strathclyde, Glasgow, Scotland, UK; Harry Samson, BAE Systems, Barrow, UK

High Power CO2 Dual Beam Laser Weldin (P543)

Barbara Previtali, Politecnico di Milano, Milano, Italy

Laser Micro-Welding for Opto-Electronic Components (P544)

Frank Laas, Elektronik Laser System GmbH, Bedford, TX

An Experimental and Theoretical Analysis of Axial Powder Stream Concentration in the Coaxial Direct Laser Deposition Process (P545)

Andrew Pinkerton, Lin Li, UMIST, Manchester, UK

A Fully Packaged True Time Delay Module for a K-band Phased Array Antenna System Demonstration (P546)

Yihong Chen, Ray Chen, The Univ. of Texas at Austin, Austin, TX

Proceedings 2002

ICALEO®2002 Conference
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*LIA Handbook of Laser Materials
Processing now available*

(Pub. #105) Price: \$240,
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Published by the Laser Institute of America, this handbook provides extensive data, including comparisons of technologies and their costs, set-up information, properties of components, guidelines on selecting lasers, achieving necessary wavelengths, and information on various methodologies. The reference guide treats a broad range of specific materials, both metals and non-metals. It also covers common and specialized processes, such as cutting, welding, marking, beam monitoring, guidance techniques, rapid prototyping, micro applications, repair, and much more. (715 pgs)

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Student Paper Award Contest

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Award Co-chairs: Xiangli Chen, GE China R&D Center, Shanghai, China
Aravinda Kar, CREOL, University of Central Florida,
Orlando, FL

Announcing the 3rd Annual ICALEO® Best Student Paper Award. LIA appreciates the importance of student contributions to ICALEO® by offering the opportunity to have their work recognized with this award. Students with accepted papers will be judged by an international panel on the following criteria: Originality of Topic/Material presented, Scientific and Technical Merit, and Presentation Quality. Professors do not judge their own student's papers. Prize winners will be notified after the conclusion of ICALEO® 2002 and will be announced through an article in the *LIA Today* newsletter featuring the ICALEO® 2002 wrap-up.

Congratulations to last year's Student Paper Award winners: 1st Place Tie: Yonggang Li, CREOL, Univ. of Central Florida; Tara Plew, The Penn State Univ.; 3rd Place: Sorin Ignat, Univ. of Burgandy

Cash awards will be presented to 1st, 2nd, 3rd place winners
1st place paper will be published in the *Journal of Laser Applications*®
(paper will go through peer review process)

Laser Industry Vendor Reception & TableTop Display

Tuesday, October 15
5:00pm-8:00pm

The Laser Industry Vendor Program gives vendors and conference attendees the opportunity to discuss equipment and applications in a relaxed setting. After completion of the technical sessions, share wine, cheese and product ideas with your colleagues and suppliers! Limited space is still available! For more information on participating as a vendor, contact Beth Cohen at 407.380.1553 or e-mail: bcohen@laserinstitute.org.

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Laser Solutions 2002

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ICALEO® 2002 offers a series of short courses designed to provide manufacturing professionals a choice of laser related topics, each addressing the capabilities of lasers to improve manufacturing methods. Registered conference participants are welcome to attend at no additional cost. For planning purposes please indicate on the ICALEO® 2002 registration form which course(s) you wish to attend. **Class Sizes are Limited**

Chair: Justin Koch, Caterpillar Inc., Peoria, IL, USA

Course 1: Introduction to MicroMachining using UV Lasers
 Ronald D. Schaeffer
 Photomachining, Inc., Pelham, NH
 Monday, October 14 • 1:30pm - 3:30pm

This course will discuss several different aspects of UV micromachining technology. First, a comparative review will be made of other laser technologies with respect to using UV photons. Several different types of UV lasers will then be discussed including frequency shifted solid state and excimer lasers. UV material/photon interaction, basic optical components and system integration will also be discussed. Finally, real applications from the medical, microelectronic, aerospace and other fields will be presented.

The objectives for this course are:

1. Understand how UV lasers compare to other laser sources and where they are best applied
2. Understand and be familiar with several kinds of UV micromachining lasers on the market
3. Understand the material/photon interaction and why UV lasers are different than IR lasers
4. Become familiar with UV beam delivery techniques
5. Become familiar with some real applications

The course will benefit anyone with an interest in small scale industrial laser machining, achieving the best edge quality, highest resolution and cost effectiveness.

Course Level: *Beginner to Intermediate*

Course 2: Applications & Considerations for Hybrid & Remote Welding
 Christian Walz
 Fraunhofer USA, Center for Surface and Laser Processing, Plymouth, MI
 Tuesday, October 15 • 8:00am - 10:00am

This course will present the technical and some economical aspects of the remote and hybrid welding process. Current applications of both processes will be shown. The remaining problems will be reviewed and possible solutions will be presented.

The objectives of the course are:

1. Laser and System fundamentals of remote welding system
 2. Technical solutions of remote welding systems
 3. Technical description of hybrid welding process
 4. Industrial application of both processes
 5. Economical aspects of both processes
- This course will benefit anyone who is interested in new promising laser processes in the macro business.

Course Level: *Beginner and Intermediate*

Course 3: Laser Machining - The First 100,000 Picoseconds
 Michael Perry
 Lawrence Livermore National Laboratory, Livermore, CA
 Tuesday, October 15 • 10:30am - 12:30pm

The purpose of this course is to provide an introduction to the basic material interaction mechanisms over the range of a few femtoseconds to the more conventional 100 nanosecond regime. By examining initial absorption, plasma and/or vapor formation and heat transfer into the material, the utility of the femtosecond, picosecond and nanosecond regimes for laser machining of different materials can be evaluated. The course will cover both theoretical and experimental evaluation of laser machining a variety of different materials.

The objectives for this course are:

1. To provide an analytical understanding of the various regimes of laser matter interaction and elucidate the phenomenology associated with femtosecond, picosecond and nanosecond laser machining
2. To provide experimental evidence of these different regimes over a host of widely differing materials: metals, semiconductors, dielectrics
3. To examine the effect of laser wavelength in these regimes
4. Review the state of the art in laser technology associated with these regimes
5. Provide sufficiently detailed information that an engineer trying to determine which laser regime is best for a given process can make an informed decision weighing factors of machining speed, quality and cost

This course will benefit laser engineers, scientists and laser users who are either using or anticipating the use of femtosecond to conventional nanosecond laser systems for high precision machining.

Course Level: *Beginner to Advanced*

Course 4: Laser Welding Aluminum Alloys: Principles and Practice
 D. Mark Douglass
 Visteon Corporation, Dearborn, MI
 Tuesday, October 15 • 1:30pm - 3:30pm

Aluminum use in components and structures is growing and if there are joining operations proper weld design is critical. In particular, laser welding of aluminum necessitates the understanding of many phenomena: metallurgy, welding physics, mechanical properties, laser-material interaction and optics. This course will present the principles underlying proper weld procedures and the latest advances in aluminum laser welding technology.

The objectives for this course are:

1. Learn aluminum metallurgy and mechanical properties of aluminum alloys
2. Compare laser welding with other joining processes
3. Provide insight into laser welding physics and resulting weld properties
4. Highlight component and process design considerations (e.g. joint design, beam delivery, shield gases, etc.)
5. Give attention to state of the art welding procedures and applications

This course will benefit those interested in understanding the subject of joining aluminum alloys and developing laser welding procedures for aluminum alloys.

Course level: *Beginner to Intermediate*



Course 5: The Subtle but Important Role of Assist Gas Selection in Laser Processing
Hubert Rawyler

AGA Gas, Inc., Independence, OH
Wednesday, October 16 • 8:00am - 10:00am

The importance of assist gas selection is usually overlooked and left to be resolved at the last minute in the shop environment; the consequence is often delays and cost overruns. By looking at an early stage, not just at the assist gas itself, but also at the means of feeding it into the process, ideal conditions can be created.

The objectives for this course are:

1. Understand the need for assist gas by process
2. Understand the need for assist gas by material
3. Understand the ideal supply into the process
4. Understand the influence of gas quality on the process
5. Understand the economic consequence of assist gas selection

This course will benefit Design Engineers, Manufacturing/Process Engineers, and Quality Assurance Personnel.

Level: Beginner to Intermediate



Course 6: Diode Lasers: Fundamentals, Processing & Applications
Stefan Heinemann

Fraunhofer USA,
Center for Laser Technology, Plymouth, MI
Thursday, October 17 • 8:00am - 10:00am

This course will review the manufacturing and assembly process of high power diode lasers used for pumping solid state laser and for materials processing. Main issues such as scaling the output power, extending the lifetime and increasing the beam quality will be discussed. The state of the art will be reviewed and exemplary applications will be discussed. Future trends will be highlighted.

The objectives for this course are:

1. To give a basic understanding of the technology involved in assembling high power diode lasers
2. To give an understanding about the main issues determining the lifetime and output power of diode lasers
3. To give attendees a basic understanding of how to improve the beam quality
4. To review the main applications of high power diode lasers
5. Outlook for the next several years

This course will benefit anyone with an interest state of the art of high power diode lasers, its current applications and future trends.

Course Level: Intermediate

Course 7: Building a Compelling Economic Business Case to Drive Laser Technology Implementation
Justin Koch

Caterpillar Inc., Peoria, IL
Thursday, October 17 • 1:30pm - 3:30pm

Technical success is often measured by its impact in final implementation or commercialization. During this final stage, economic drivers often become more influential rather than technical. Because technologists are not well versed in the language and metrics of the business world, frustration is commonplace. Hence, technologies worthy of implementation frequently remain unused or stalled for lack of a compelling business case. This course introduces “techy’s” to the basic concepts and metrics commonly used by the business-minded decision makers.

The objectives for this course are:

1. Provide a perspective of what drives decisions for a plant manager or small company owner
2. Give practical examples of ROI (Return on investment) and NPV (net present value) concepts
3. Differentiate cost into fixed & variable, up-front & consequential, and direct & indirect
4. Provide practical examples of “cost-based” versus “value-based” analysis
5. Create “bilingual” engineers capable of communicating effectively with business-minded decision makers

This course will benefit industrial researchers, academic researchers, and technical professionals tired of hearing, “Show me the money,” and not being able to respond confidently.

Course Level: Advanced

Special Thanks to the ICALEO® 2002 International Advisory Board

David Belforte, Industrial Laser Solutions, Sturbridge, MA

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Dresden, Germany

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MEET & GREET FIESTA

Sunday, October 13
4:00pm-6:00pm



Sponsored by:



Join us Sunday afternoon for a Meet & Greet Fiesta Party! Start ICALEO® off right! See your old friends & colleagues and make new ones. Help us welcome our 1st time attendees. Casual dress required! Margaritas and munchies will be available!

ICALEO® 2002

Speaker & Session Chair
Appreciation Breakfast

NEW for 2002!
Monday, October 14
7:15am

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Speakers, Poster Presenters and Session Chairs are invited to the Kick-Off Breakfast Monday, October 14 at 7:15am. Speakers will be seated within their session and meet the session chairs and other speakers. Audio-Visual Tips will be given as well as any last minute updates and an overview of the week. Please plan to arrive to attend this important Breakfast.

Please contact Beth Cohen, e-mail: bcohen@laserinstitute.org for more information.

President's Reception

Monday, October 14
6:00pm-7:30pm

Sponsored by:



The opening day of ICALEO® 2002 features an evening reception presided over by LIA 2002 President Eckhard Beyer. Meet the LIA officers, board members, newly named fellows and senior members and show appreciation for ICALEO® 2002 General Chairs, Eckhard Beyer and Raj Patel. and the conference chairs and session chairs. Meet the LIA staff, mingle with old friends, and celebrate ICALEO® 2002.

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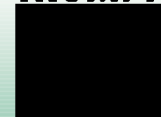
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Schawlow Award Sponsored by:

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Wednesday, October 16 • 12:00pm-2:00pm

Laser Institute of America first presented the Schawlow Award in 1982 to recognize individuals who have made distinguished contributions to applications of lasers in science, industry or education. The Award presentation consists of a silver medal, a \$1000 cash award and a framed citation. Awardees become Lifetime Members and a Fellow of LIA.

About Arthur L. Schawlow

Prof. Schawlow received a Nobel Prize for Physics in 1981 for "his contribution to the development of laser spectroscopy." He co-authored, with Prof. Charles H. Townes, the book *Microwave Spectroscopy*, and the first paper describing optical masers. For this latter work, the pair were awarded the Stuart Ballantine Medal by the Franklin Institute (1962), and the Thomas Young Medal and Prize by the Physical Society and Institute of Physics (1963). Dr. Schawlow was also awarded the Morris N. Liebmann Memorial Prize by the Institute of Electrical and Electronic Engineers (1964). As the first honoree in 1982 of this award, it is fitting that LIA's highest achievement award is given in Prof. Schawlow's name.

GUEST / EXCURSION INFORMATION

Guests are cordially invited to attend ICALEO® 2002! Guests may attend the Awards Luncheon and all receptions (Meet & Greet Fiesta, President's and Vendor Reception) by purchasing tickets. No guests will be admitted to any function without an ICALEO name badge. See the registration web site for more details and pricing.

Attendees and Guests are also invited to experience ICALEO® Excursions and Tours - Scottsdale, Arizona & Beyond! Go to www.ICALEO.org for more details and pricing!

EXCURSIONS AVAILABLE:

Southwestern Jeep Tour* Sunday, October 13

This adventure will take you in spacious four-wheel-drive vehicles on a tour of the Sonoran Desert below the McDowell Mountains, the Verde River and the Utey Pass Territory in the Tonto National Forest.

Sedona Tour * Monday, October 14

Sedona has awe-inspiring red rock formations plus the splendor & diversity of Oak Creek Canyon, it is considered a locality equal or superior to many national parks. Don't miss this beautiful city!

Heard Museum & Desert Botanical Gardens Tour * Tuesday, October 15

Tour two of the Southwest's most unique visitor attractions: the Heard Museum and the Desert Botanical Garden.

Grand Canyon Day Tour * Friday, October 18

Measurements do no justice to the Canyon's grandeur: spanning 277 miles across northern Arizona, it averages 10 miles wide and one mile deep. One must stand on the rim and marvel at its splendor, watching the continuous show of shadows, patterns and colors as the sun moves across the sky. Explore this Natural Wonder of the World as you take off on an incredible day tour of the stunning Grand Canyon!

Also available: Grand Canyon Air Option - get a bird's eye view of the Grand Canyon!

*LIA reserves right to cancel tour if minimum number of guests is not achieved. LIA will refund money paid if LIA cancels tour. No refunds will be made on cancellations for any other reason. See www.ICALEO.org for more details.

GENERAL INFORMATION

Registration:

Full congress registration includes admission to the Plenary Session, receptions (Meet & Greet Fiesta, President's, and Vendor Reception), all technical sessions, Laser Solutions Courses, Awards Luncheon, and a technical digest.

One Day Registration includes admission to technical sessions, Laser Solution Courses and receptions on that day only, and a technical digest. (Luncheon is not included, but may be purchased separately).

Student Registration includes admission to the Plenary Session, receptions (Meet & Greet Fiesta, President's, and Vendor Program), all technical sessions, Laser Solution Courses, and a technical digest. (Luncheon is included.) Valid student ID required to process registration.

Guests may attend the Awards luncheon and all receptions by purchasing tickets. Please pre-register via the form on pgs. 21-22.

Early Bird registrants should be paid in full by Sept. 16. Complete the registration form on Pgs. 21 & 22 and attach a check (US funds only, drawn on a US bank) payable to the Laser Institute of America or indicate credit card number or purchase order number (payment must be received in full by Sept. 16 to qualify for discount). Bank transfers will not be accepted as payment.

On-Site Registration Times

Sunday, October 13	11:00am-4:00pm
Monday, October 14	7:00am- 5:00pm
Tuesday, October 15	7:00am- 5:00pm
Wednesday, October 16	7:00am- 4:00pm
Thursday, October 17	7:00am- 12:00pm

Purchase orders will not be accepted for on-site registration.

Special Needs

If you have any special needs that we can address to make your participation more enjoyable, please contact LIA by Phone: 407. 380.1553, Fax: 407.380.5588 or E-mail: bcohen@laserinstitute.org

Substitutions and Cancellations

We understand that circumstances may occur to prevent your attending the conference. If you find that you cannot attend the 21st International Congress on Applications of Lasers and Electro-Optics, you have several options:

1. Send a substitute. Substitutions can be made at any time - even on-site at the conference. (Please have the substitute bring your letter of confirmation to the registration desk.)
2. If you cannot send a substitute, we are able to transfer your conference fees to next year's conference.*
3. If you would like a refund, we will gladly process one for you.*

*Note: Requests for conference fee transfers received on or before Sept. 16, 2002 will receive a full transfer of funds. Requests for refunds must be made in writing and received on or before Sept. 16, 2002. There is a \$75.00 processing fee applied to all refunds. No refunds or transfers will be accepted after Sept. 16, 2002.

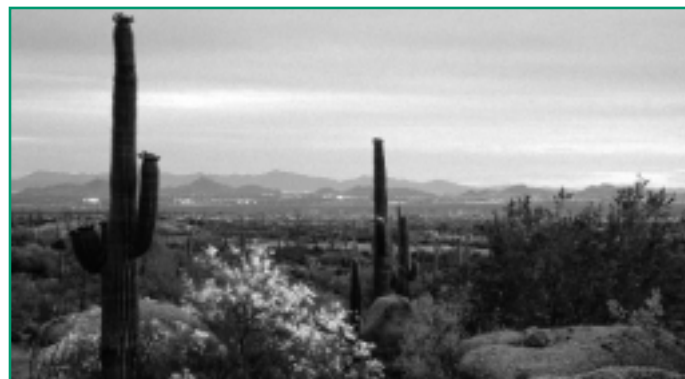
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Scottsdale, a new city with an old soul. This contemporary center is built on three, rich cultures: Native American, Spanish, and western pioneer. Each society left its imprint. Each presence can be tasted in the foods served, experienced in the architecture built, and appreciated in the art displayed in galleries and public spaces. This is the spirit of Scottsdale. And it is yours to experience, any time you choose.

Average October Temperatures:
88° F/ 31° C High 61° F/16° C Low

ICALEO® 2002 REGISTRATION FORM



Register online at www.icaleo.org
 or Mail/Fax this Form (use one form for each Registrant)
 Laser Institute of America/ICALEO® 2002
 13501 Ingenuity Dr., Ste. 128 • Orlando, FL 32826
 Phone: 407.380.1553 • Fax: 407.380.5588

For Office Use Only

Date: _____
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Emergency Contact: Name _____ Phone _____

Note: All above information must be provided in order to process registration

Please check all that apply:

- LIA Board of Directors LIA Fellow LIA Senior Member
- First Time Attendee?** YES Referred by colleague _____ Promotional Mailer code: _____
 NO Years of attendance? _____ years

Membership Status (if applicable): LIA Corporate Member LIA Individual Member
Not an LIA member? Join Today and take advantage of reduced member rates for ICALEO® 2002. See next page for information!
Membership must be valid through October 2002 to take advantage of member rates.

- Check here if you have any special needs and LIA will contact you.
 Check here if you do not want your name on the published ICALEO® 2002 attendee mailing list.

A. Full Registration

Includes admission to all receptions, Plenary Session, all technical sessions, Laser Solution Courses, Awards Luncheon, and a technical digest.

Check member status: Member of LIA APMI AWS AILU CLP WLT JLPS MPIF SME
 Membership # _____

Payment Received by Sept. 16, 2002

<input type="checkbox"/> Member	\$595	<input type="checkbox"/> Full Time Student Member	\$125*
<input type="checkbox"/> Non-Member	\$695	<input type="checkbox"/> Full Time Student Non-Member	\$165*
<input type="checkbox"/> Retired LIA Member (LIA Member for 10 or more years)	\$100		

Payment Postmarked or Received Sept. 16, 2002 - Oct. 9, 2002

<input type="checkbox"/> Member	\$645	<input type="checkbox"/> Full Time Student Member	\$145*
<input type="checkbox"/> Non-Member	\$745	<input type="checkbox"/> Full Time Student Non-Member	\$185*
<input type="checkbox"/> Retired LIA Member (LIA Member for 10 or more years)	\$110		

Special Dietary Needs (luncheon) Vegetarian Kosher Standard

*** Please note: Awards Luncheon included with student registration. Registration will not be processed without a copy of your Valid Student ID. Please include with Registration form.**

Pre-register/Pay in Full and Save. After Oct. 9 and On-Site Registration fee \$660 member, \$760 non-member.

B. One Day Registration

Includes admission to technical sessions, Laser Solution Courses and receptions on that day only, and a technical digest. **(Luncheon is not included.)**

Check member status: Member of LIA APMI AWS AILU CLP WLT JLPS MPIF SME
 Membership # _____

Date of Attendance: Mon. Oct. 14 Tues. Oct. 15 Wed. Oct. 16 Thurs. Oct. 17

Payment Received by Sept. 16, 2002 Member \$220 Non-Member \$245

Payment Postmarked or Received Sept. 16, 2002 - Oct. 9, 2002 Member \$250 Non-Member \$275

Pre-register/Pay in Full and Save. After Oct. 9 and On-Site Registration fee \$265 member, \$290 non-member.

Subtotal This Side \$ _____

Continued on next page...

ICALEO[®] HOTEL ACCOMMODATIONS



5401 North Scottsdale Rd
 Scottsdale, Arizona 85250
 www.doubletree.com

Special ICALEO[®] rate of S/D \$149 prior to
 September 16, 2002 cut-off.

Use Housing Form or call:
 480.947.5400
 or Fax 480.946.1524

Resort features:

- 22 acres of lush gardens, glistening fountains and breezy palm trees
- 387 luxurious, spacious guest rooms
- 2 restaurants for relaxed elegance and casual dining
- State-of-the-art health club with Spa services and amenities
- 2 sparkling pools
- Business Center
- Local Area Transportation - (free shuttle to Old Town Scottsdale, based on availability)
- Tour Desk can arrange tee times or other activities like horseback riding and hot-air ballooning.
- On-site AVIS car rental

RESERVATION REQUEST - return DIRECTLY to Doubletree Paradise Valley Resort, by September 16, 2002.

Doubletree Paradise Valley Resort, Fax Number: 480.946.1524. In making your reservation, an advance deposit or credit card guarantee of the first night's stay is required. If advance deposit is for more than one person, please indicate the individual names that will be covered by the deposit.

Deposits will be refunded only if cancellation notification is given at least 72 hours prior to arrival.

PLEASE PRINT OR TYPE

First _____ Last _____ M.I. _____

Address _____ City/State/Zip _____ Country _____

Phone Business _____ Fax _____ Home _____

Please reserve _____ No. of Rooms for _____ People

Name(s) of person(s) sharing accommodations:

Additional room if applicable: _____

Any Special Needs or requests: _____

Arrival Date _____ Arrival Time _____

Departure Date _____ Departure Time _____

Check or money order enclosed VISA MasterCard

Discover AMEX Carte Blanche Diners Club

Amount \$ _____

Credit Card Number _____ Exp. Date _____

Name on Credit Card _____ Signature _____

I authorize the DoubleTree Paradise Valley Resort to charge my account for one night's deposit and all applicable taxes.

Check-in time is 4:00PM. Check-out time is 12:00PM

**Reservations requested beyond the cut off date are subject to availability. Rooms may still be available after the cut-off date but not necessarily at the same rate. Apply 11.67% Sales/Occupancy tax to the above rates. Room type based upon availability at time of check-in.*

ICALEO[®] 2002

DoubleTree Paradise Valley Resort
October 14-17, 2002

\$149 Per Room/Single or Double
Reservation cut-off date is September 16, 2002*

Smoking Non-Smoking
 Single Double

Upon check-in, guests will be asked to verify their departure date.
 Departure extensions are based on availability.

Hilton HHonor Program # _____

ICALEO[®] 2002 Housing Form

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