Laser Beam Diagnostics and Process Monitoring
Tools for Competitive Materials Processing

October 24–27, 2011
Madison, Wisconsin

A practical course for...
☑ Process and project engineers
☑ Manufacturing and quality engineers
☑ R&D engineers
☑ Maintenance and set-up personnel
☑ Laser operators
☑ Quality auditors

Examine the technology and techniques available to profile, analyze, and diagnose industrial laser systems and laser beams for higher quality laser processing, improved performance, and compliance with ISO technical standards.

Optimize laser performance by using laser beam diagnostics
Monitor the laser process in real time
Comply with ISO and AWS laser standards
Apply these techniques to laser welding, drilling, and cutting
Increase productivity and reduce scrap
Remain competitive with your products and processes

Enroll today to succeed tomorrow

26 Professional Development Hours
2.6 Continuing Education Units

Please route this brochure to colleagues who would also benefit by attending.
Course Objectives
During this advanced course you will examine the technologies, techniques, and equipment used to profile and analyze your industrial laser beam. Whether being used for laser welding, laser cutting, or laser drilling, these devices and methods allow you to optimize the performance of the laser and quality of the laser-processed components. Relevant current ISO and AWS standards are used as references to assist in specifying key parameters and suggested limits. Properly applying these techniques and methods in adherence with ISO and AWS standards results in:

- Greater reliability of the laser
- Reliable predictive maintenance
- Consistent quality of the laser-processed components

Knowledge of the tools and methods will prepare you to:

- Validate the performance of the laser equipment
- Validate the performance of the beam delivery optics
- Optimize the performance of the laser and the optics
- Generate equipment and process validation documentation that complies with ISO technical standards
- Troubleshoot process problems that relate to the laser and the optics
- Select the proper laser based on the process requirements
- Generate laser equipment purchasing specifications
- Specify acceptance criteria for laser equipment and optics
- Develop effective preventive maintenance programs

Attend and Benefit
Throughout the course, the presentation and discussion will focus on practical information that covers step-by-step procedures to diagnose the various laser system components and to interpret the data collected. You will learn how to:

- Choose the devices to do the equipment validation
- Align the laser cavity
- Align the fiber optic beam delivery
- Align the conventional beam delivery optics
- Find the focus and the depth of field
- Measure temporal profiles and power stability

Those who will benefit include:

- Manufacturing engineers
- R&D engineers
- Maintenance supervisors
- Maintenance personnel
- Purchasing agents
- Laser operators
- Quality assurance engineers
- Corporate standards engineers
- Electrical technicians
- Laser equipment builders
- Laser repair service personnel

Course Instructor
Simon L. Engel is president of HDE Technologies, Inc., a consulting company specializing in industrial laser applications. Prior to starting HDE Technologies, Inc. in 1998, Simon was the owner and director of HDE Systems, Inc., a contract shop providing R&D and production services in laser-assisted materials processing and abrasive waterjet machining. In addition to his 22 years of real-world experience running HDE Systems, Inc., Simon brings to this course many years of consulting experience in laser material processing. He gained his understanding of the process, the associated documentation, and the training of personnel from many successfully completed assignments for major corporations. Simon received his B.A.Sc. degree in mechanical engineering from the University of British Columbia, Canada. A member of SME, LIA, and AWS, he holds eight patents and has written numerous articles on laser application techniques. Simon is a member of the AWS Laser Welding Subcommittee and a contributing author of AWS C7.4/C7.4M:2008 Process Specification and Operator Qualification for Laser Beam Welding. Simon also serves as the technical director for the University of Wisconsin–Madison’s Laser Welding Certificate Program.

Past Participating Organizations
3M
ATK Tactical Propulsion
Boston Scientific Corporation, Inc.
Chanellock
Chromalloy
EV 3 Inc.
Globe Engineering
Goodrich SIS
GreatBatch
Honeywell FM&T
Heartware, Inc.
Hypertherm
Johnson Controls
Kohler Company
Lake Region Manufacturing
Lear Corporation
Lockheed Martin
Los Alamos National Laboratory
Medtronic Inc.
Naval Undersea Warfare Center
Pall Aeropower Corporation
Pratt & Whitney
Special Devices, Inc.
Spectralytics Inc.
St. Jude Medical
The Lee Company
Varian X-Ray Products

Note: We recommend that you attend a process-specific course before you attend this course. Our process-specific courses include Laser Welding: Equipment and Process Validation and Industrial Laser Cutting and Drilling.
Course Outline

Welcome and Introduction
Elaine M. Bower
Program Director
Department of Engineering Professional Development
University of Wisconsin–Madison

Industry Technical Standards—a review
• ISO equipment-related standards
• ISO process-related standards
• AWS C7.4/C7.4M: 2008

Laser Beam Generators (Laser Head)
• Benchmarking present performance
• Temporal profile and power stability
• Calibrating the displays to meet ISO standards
• Alignment of the laser cavity
• Alignment of the intracavity apertures
• Establishing maintenance criteria and schedule
• Formal equipment validation documentation

Laser Beam Metrology—Measuring the Performance of Beam Delivery Systems
• Benchmarking the total beam delivery
• Collimators
• Spatial filters
• Fiber optics
• Spatial profile converters
  – diffractive devices
  – refractive devices
  – reflective devices
• Beam splitting devices
• Focusing optics
  – asymmetrical beams
  – astigmatic beams
• Lens protective slides
• Depth of field
• Establishing maintenance criteria and schedule
• Formal equipment validation documentation

Basic Concepts
• Requirements to process different materials
• Introduction to the temporal characteristics of the laser beam
• Introduction to the spatial characteristics of the laser beam
• Operating characteristics of
  – CO₂ lasers
  – Nd:YAG lasers
  – solid-state lasers
  – fiber lasers
  – disc lasers
• Typical spatial and temporal behavior of industrial lasers
• Commercially-available devices to measure laser beam parameters
  – spatial profilers
  – imaging type
  – scanning type
  – energy/joule meters
  – power meters

Application of Laser Beam Metrology to Laser Material Processing
• Controlling temporal and spatial parameters and behavior to optimize
  – laser drilling
  – laser cutting
  – laser welding

Real-time Process Monitoring
• Sources of process information
• Devices for fixed optics systems
• Devices for moving optics systems
• Case study: Weld process monitoring

Note: Please bring a calculator for use during the problem-solving sessions. These sessions are designed to enhance the understanding of the relationships between the spatial and temporal characteristics of laser beams and material processing.

Course Notebook
You will receive a course notebook containing numerous illustrations, graphs, and charts to help you choose the correct technology and techniques to optimize, troubleshoot, repair, and validate your laser equipment.

Daily Schedule
Registration will begin at 8:00 a.m. on Monday, October 24, at The Madison Concourse Hotel, One West Dayton Street, Madison, WI.
The course will meet from 8:15 a.m. until 4:30 p.m. on Monday, 8:00 a.m. until 4:30 p.m. on Tuesday and Wednesday, and 8:00 a.m. until noon on Thursday. The daily schedule will include midmorning and midafternoon refreshment breaks and lunch at noon on Monday through Wednesday.

Bring Your Technical Data
We encourage you to bring your technical data as measured on your laser equipment for review and analysis by the course instructor. See how the concepts provided throughout this course can help you interpret your information, explore ways to make improvements, and generate ISO-compliant documentation.

Related Laser Course
For information about the following course, contact Elaine Bower, program director, at 800-462-0876, or e-mail her at bower@engr.wisc.edu

Laser Welding: Equipment and Process Validation
September 19–22, 2011
Las Vegas, NV
Course #M838
This course will provide you with the practical methodology and theoretical understanding for producing good, repeatable laser welds under production conditions. You’ll learn proven methods for validating the performance of both your laser and your laser welding process.
Four Easy Ways to Enroll

Course Information

- Please enroll me in Laser Beam Diagnostics and Process Monitoring
- Course #M778 October 24–27, 2011 in Madison, WI  Fee: $2095

Team Discount: $1900 per person when two or more enroll from the same organization.

Limited Enrollment

Personal Information  (Please print clearly.)

Name ________________________________________________________________
Title _________________________________________________________________
Company ____________________________________________________________
Address ____________________________________________________________
City/State/Zip _________________________________________________________
Phone (_______) __________________ Fax (_______) __________________
E-mail ______________________________________________________________

Billable Information

- Bill my company
- PO or check enclosed (payable in U.S. funds to UW–Madison)
- Bill my company
- PO or check enclosed (payable in U.S. funds to UW–Madison)

Cardholder’s Name _________________________________________________
Card No. __________________________________________________________
Expires __________

UW# ______________________________________________________________
Please check the box if you are a person with a disability and desire special accommodations. A customer service representative will contact you. Requests will be kept confidential.

Need to Know More?
Call toll free 800-462-0876 and ask for
Program Director: Elaine M. Bower
bower@engr.wisc.edu
Program Associate: Theresa Rodger
rodger@epd.engr.wisc.edu
or e-mail custserv@epd.engr.wisc.edu

General Information
Fee of $2095 Covers  Course notebook, break refreshments, lunches, and certificate. Course materials are distributed only to participants.
Cancellation  If you cannot attend, please notify us by October 17, and we will refund your fee. Because this course has limited enrollment, cancellations received after this date and no-shows are subject to the full course fee of $2095. You may enroll a substitute at any time before the course starts.
Location and Accommodations  This course will be held at The Madison Concourse Hotel, One West Dayton Street, Madison, WI. We have reserved a block of sleeping rooms ($110/single, $120/double) for course participants at The Madison Concourse Hotel. To reserve a room, call 800-356-8293 by October 4 and request the University of Wisconsin group rate #169854.