PROCEEDINGS OF SPIE

[SPIDigitalLibrary.org/conference-proceedings-of-spie](https://spiedigitallibrary.org/conference-proceedings-of-spie)

Front Matter: Volume 8603

, "Front Matter: Volume 8603," Proc. SPIE 8603, High-Power Laser Materials Processing: Lasers, Beam Delivery, Diagnostics, and Applications II, 860301 (11 March 2013); doi: 10.1117/12.2025035

SPIE.

Event: SPIE LASE, 2013, San Francisco, California, United States

PROCEEDINGS OF SPIE

High-Power Laser Materials Processing: Lasers, Beam Delivery, Diagnostics, and Applications II

Friedhelm Dorsch
Editor

5–7 February 2013
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 8603

Proceedings of SPIE 0277-786X, V.8603

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

High-Power Laser Materials Processing: Lasers, Beam Delivery, Diagnostics, and Applications II,
edited by Friedhelm Dorsch, Proc. of SPIE Vol. 8603, 860301 © 2013 SPIE
CCC code: 0277-786X/13/\$18 · doi: 10.1117/12.2025035

Proc. of SPIE Vol. 8603 860301-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *High-Power Laser Materials Processing: Lasers, Beam Delivery, Diagnostics, and Applications II*, edited by Friedhelm Dorsch, Proceedings of SPIE Vol. 8603 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819493729

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2013, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/13/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

vii *Conference Committee*

SESSION 1 BEAM SHAPING AND PHASE DISTORTION I: JOINT SESSION WITH CONFERENCES 8600 AND 8603

- 8603 02 **Active beam controlling of high power Q-switched Nd:YAG lasers for stable fiber coupling with small numerical aperture for material processing** [8603-1]
M. Goehre, Clean-Lasersysteme GmbH (Germany); C. Becker, Betewis GmbH (Germany)
- 8603 03 **In-situ optical phase distortion measurement of Yb:YAG thin disk in high average power regenerative amplifier** [8603-2]
T. Miura, M. Chyla, M. Smrž, S. S. Nagisetty, P. Severová, O. Novák, A. Endo, T. Mocek, Institute of Physics ASCR, v.v.i. (Czech Republic)

SESSION 2 BEAM SHAPING AND PHASE DISTORTION II: JOINT SESSION WITH CONFERENCES 8600 AND 8603

- 8603 05 **Recent results on bulk laser damage threshold of optical glasses** [8603-4]
R. Jedamzik, F. Elsmann, SCHOTT AG (Germany)
- 8603 07 **CVD diamond for high power laser applications** [8603-6]
A. M. Bennett, Element Six Ltd. (United Kingdom); E. Anoikin, Element Six Technologies, US Corp. (United States)
- 8603 08 **Analysis of temperature and thermal stress fields of K9 glass damaged by 1064nm nanosecond pulse laser** [8603-7]
Y. Pan, Z. Shen, J. Lu, X. Ni, Nanjing Univ. of Science and Technology (China)

SESSION 3 BEAM SOURCES

- 8603 09 **Essential building blocks for a flexible approach to laser source design (Invited Paper)** [8603-8]
J. Deile, TRUMPF Inc. (United States); J. Doberitzsch, TRUMPF Laser- und Systemtechnik GmbH (Germany)
- 8603 0A **Fiber lasers based on beam quality converters for diode lasers** [8603-9]
C. Bachert, G. Rehmann, A. Luft, A. Krause, M. Gerber, J. Song, V. Krause, Laserline GmbH (Germany)

- 8603 0B **Ultrafast disk technology enables next generation micromachining laser sources** [8603-10]
O. H. Heckl, TRUMPF Laser- und Systemtechnik GmbH (Germany); S. Weiler, TRUMPF Inc. (United States); S. Luzius, TRUMPF Laser- und Systemtechnik GmbH (Germany); I. Zawischa, D. Sutter, TRUMPF Laser GmbH & Co. KG (Germany)
- 8603 0C **Fiber laser performance in industrial applications** [8603-11]
S. McCulloch, A. Hassey, P. Harrison, SPI Lasers UK Ltd. (United Kingdom)

SESSION 4 SPECIAL LASER PROCESSES

- 8603 0D **Induction of engineered residual stresses fields and enhancement of fatigue life of high reliability metallic components by laser shock processing (Invited Paper)** [8603-12]
J. L. Ocaña, J. A. Porro, M. Díaz, L. Ruiz de Lara, C. Correa, A. Gil-Santos, D. Peral, Univ. Politécnica de Madrid (Spain)
- 8603 0E **Lasers and applications in parts cleaning and surface pre-treatment** [8603-13]
T. Burdel, S. Weiler, TRUMPF Inc. (United States); B. Faißt, T. Schneider, O. Heckl, TRUMPF Laser- und Systemtechnik GmbH (Germany); J. Birkel, TRUMPF Laser Marking Systems AG (Switzerland); S. Luzius, TRUMPF Laser- und Systemtechnik GmbH (Germany)
- 8603 0F **An exhaustive model for the laser hardening of hypo eutectoid steel** [8603-14]
A. Fortunato, Univ. degli Studi di Bologna (Italy); L. Orazi, G. Cuccolini, Univ. degli Studi di Modena e Reggio Emilia (Italy); A. Ascari, Univ. degli Studi di Bologna (Italy)
- 8603 0G **Laser shock peening and warm laser shock peening: process modeling and pulse shape influence** [8603-15]
A. Fortunato, Univ. degli Studi di Bologna (Italy); L. Orazi, G. Cuccolini, Univ. degli Studi di Modena e Reggio Emilia (Italy); A. Ascari, Univ. degli Studi di Bologna (Italy)
- 8603 0H **CO₂-laser-assisted processing of glass fiber-reinforced thermoplastic composites** [8603-16]
C. Brecher, M. Emonts, R. L. Schares, J. Stimpfl, Fraunhofer Institute for Production Technology IPT (Germany)

SESSION 5 LASER BEAM WELDING

- 8603 0I **Characterization of disk-laser dissimilar welding of titanium alloy Ti-6Al-4V to aluminum alloy 2024 (Invited Paper)** [8603-17]
F. Caiazzo, V. Alfieri, F. Cardaropoli, G. Corrado, V. Sergi, Univ. degli Studi di Salerno (Italy)
- 8603 0J **Laser welding of dissimilar materials for lightweight construction and special applications** [8603-18]
M. Schimek, A. Springer, R. Pfeifer, S. Kaierle, Laser Zentrum Hannover e.V. (Germany)
- 8603 0L **Highspeed laser welding of steel using a high-power single-mode continuous-wave fiber laser** [8603-20]
J. Drechsel, U. Loeschner, S. Schwind, L. Hartwig, J. Schille, H. Exner, P. Huebner, A. Eysert, Hochschule Mittweida (Germany)

- 8603 OM **Process characteristics of laser beam welding at reduced ambient pressure** [8603-21]
C. Börner, T. Krüssel, K. Dilger, Technische Univ. Braunschweig (Germany)
- 8603 ON **Advanced welding techniques with optimized accessories for high brightness 1 μ m lasers** [8603-22]
D. Havrilla, TRUMPF Inc. (United States); V. Rominger, M. Holzer, T. Harrer, A. Andreev, TRUMPF Laser- und Systemtechnik GmbH (Germany)
- 8603 OO **Numerical and experimental evaluation of Nd:YAG laser welding efficiency in AZ31 magnesium alloy butt joints** [8603-23]
L. D. Scintilla, L. Tricarico, Politecnico di Bari (Italy)
- 8603 OP **Corrosion performance of laser-welded austenitic-ferritic connections** [8603-24]
M. Weigl, BLZ Bayerisches Laserzentrum GmbH (Germany); M. Schmidt, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany)

SESSION 6 PROCESS DIAGNOSTICS

- 8603 OQ **Hyperspectral and gated ICCD imagery for laser irradiated carbon materials** [8603-25]
C. D. Roberts, R. A. Acosta, M. A. Marciniak, G. P. Perram, Air Force Institute of Technology (United States)
- 8603 OR **Online characterization of laser beam welds by NIR-camera observation** [8603-26]
F. Dorsch, H. Braun, S. Keßler, D. Pfitzner, TRUMPF Werkzeugmaschinen GmbH + Co. KG (Germany); V. Rominger, TRUMPF Laser- und Systemtechnik GmbH (Germany)

SESSION 7 LASER BEAM DRILLING AND CUTTING

- 8603 OU **Laser cutting of lightweight alloys sheets with 1 μ m laser wavelength** [8603-29]
L. D. Scintilla, L. Tricarico, Politecnico di Bari (Italy)
- 8603 OV **On the laser beam cutting of metallic hollow sphere structures** [8603-30]
H. Riegel, J. Fruhstuck, M. Merkel, R. Winkler, Hochschule Aalen (Germany); A. Öchsner, Univ. Teknologi Malaysia (Malaysia)

POSTER SESSION

- 8603 OW **Propulsion of targets with different confinement geometries in water by Nd: YAG laser at 1064nm** [8603-31]
J. Chen, B.-B. Li, H.-C. Zhang, B. Han, Z.-H. Shen, X.-W. Ni, Nanjing Univ. of Science and Technology (China)
- 8603 OY **Research of pulse CO₂ laser produced tin plasma** [8603-33]
T. Wu, Huazhong Univ. of Science and Technology (China) and Wuhan Institute of Technology (China); X. Wang, D. Zuo, Huazhong Univ. of Science and Technology (China); P. Lu, Wuhan Institute of Technology (China)

- 8603 0Z **Fiber profilometer for measurement of hard-to-access areas** [8603-34]
Z. Liu, A*STAR Singapore Institute of Manufacturing Technology (Singapore) and Nanyang Technological Univ. (Singapore); X. Yu, A*STAR Singapore Institute of Manufacturing Technology (Singapore); Q. J. Wang, Nanyang Technological Univ. (Singapore); S. W. Kok, Y. Zhang, A*STAR Singapore Institute of Manufacturing Technology (Singapore)
- 8603 11 **Highspeed laser ablation cutting of metal** [8603-36]
F. Ullmann, U. Loeschner, L. Hartwig, Hochschule Mittweida (Germany); D. Szczepanski, Otto-von-Guericke-Univ. Magdeburg (Germany); J. Schille, S. Gronau, T. Knebel, J. Drechsel, R. Ebert, H. Exner, Hochschule Mittweida (Germany)
- 8603 12 **Energy characteristics of cutting of thick steel sheets by a CO₂ and fiber laser** [8603-37]
A. M. Orishich, V. B. Shulyatyev, A. G. Malikov, A. A. Golishev, Khristianovich Institute of Theoretical and Applied Mechanics (Russian Federation)

Author Index

Conference Committee

Symposium Chairs

Bo Gu, Bos Photonics (United States)
Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und
Feinmechanik (Germany) and Friedrich-Schiller-Universität Jena
(Germany)

Symposium Cochairs

Friedhelm Dorsch, TRUMPF Werkzeugmaschinen GmbH + Co. KG
(Germany)
Alberto Piqué, U.S. Naval Research Laboratory (United States)

Program Track Chair

Gregory J. Quarles, BE Meyers & Company Inc. (United States)

Conference Chair

Friedhelm Dorsch, TRUMPF Werkzeugmaschinen GmbH + Co. KG
(Germany)

Conference Program Committee

Edward Chlebus, Wroclaw University of Technology (Poland)
Ingomar Kelbassa, RWTH Aachen (Germany)
Wolfgang Knapp, Cooperation Laser Franco-Allemande (France)
Isamu Miyamoto, Osaka University (Japan)
Carlos Lee, European Photonics Industry Consortium (France)
Silke Pflueger, ULO Optics Inc. (United States)
Michael H. Schmidt, Friedrich-Alexander-Univ. Erlangen-Nürnberg
(Germany)
Anja Techel, Fraunhofer IWS Dresden (Germany)
Luigi Tricarico, Politecnico di Bari (Italy)
Kunihiko Washio, Paradigm Laser Research Ltd. (Japan)

Session Chairs

- 1 Beam Shaping and Phase Distortion I: Joint Session with Conferences
8600 and 8603
Friedhelm Dorsch, TRUMPF Werkzeugmaschinen GmbH + Co.
KG (Germany)

- 2 Beam Shaping and Phase Distortion II: Joint Session with Conferences
8600 and 8603
Lutz Aschke, LIMO Lissotschenko Mikrooptik GmbH (Germany)
- 3 Beam Sources
Carlos Lee, EPIC (France)
- 4 Special Laser Processes
Wolfgang Knapp, Cooperation Laser Franco-Allemande (France)
- 5 Laser Beam Welding
Silke Pflueger, ULO Optics, Inc. (United States)
- 6 Process Diagnostics
Stefan Kaierle, Laser Zentrum Hannover e.V. (Germany)
- 7 Laser Beam Drilling and Cutting
Friedhelm Dorsch, TRUMPF Werkzeugmaschinen GmbH + Company
KG (Germany)