PROCEEDINGS OF SPIE

Optical Manufacturing and Testing XI

Oliver W. Fähnle Ray Williamson Dae Wook Kim Editors

9–11 August 2015 San Diego, California, United States

Sponsored and Published by SPIE

Volume 9575

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers 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 religince thereon.

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

Author(s), "Title of Paper," in *Optical Manufacturing and Testing XI*, edited by Oliver W. Fähnle, Ray Williamson, Dae Wook Kim, Proceedings of SPIE Vol. 9575 (SPIE, Bellingham, WA, 2015) Six-digit Article CID Number.

ISSN: 0277-786X

ISSN: 996-756X (electronic) ISBN: 9781628417418

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 © 2015, 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/15/\$18.00.

Printed in the United States of America Vm7 i ffUb 5 ggc WJUhY gž ₺ Wži bXYf "JWY bgY 'Zfca 'GD-9.

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



SPIEDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print. Papers are published as they are submitted and meet publication criteria. A unique citation identifier (CID) number is 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.

Contents

vii Authors

x Conference Committee

SESSION 1	OPTICAL SYSTEMS I
9575 02	Examination of the quality of 120 degree silicon double mirror for a micro-optical laser gyroscope [9575-1]
9575 04	JWST pathfinder telescope integration [9575-3]
9575 05	JWST pathfinder telescope risk reduction cryo test program [9575-4]
SESSION 2	OPTICAL SYSTEMS II
9575 06	Optomechanical design and tolerance of a microscope objective at 121.6 nm [9575-5]
9575 08	Metrology requirements for the serial production of ELT primary mirror segments [9575-7]
SESSION 3	OPTICAL MANUFACTURING I
9575 09	Surface roughness when diamond turning RSA 905 optical aluminium [9575-10]
9575 0A	Aspects of ultra-high-precision diamond machining of RSA443 optical aluminium [9575-11]
9575 OB	The role of robotics in computer controlled polishing of large and small optics [9575-12]
9575 0C	Evaluation and control of spatial frequency errors in reflective telescopes [9575-13]
9575 0D	Correction of mid-spatial-frequency errors by smoothing in spin motion for CCOS [9575-57]
SESSION 4	OPTICAL MANUFACTURING II
9575 OH	Fabrication of freeform optics [9575-17]
9575 OJ	Measuring skew in average surface roughness as a function of surface preparation [9575-49]

SESSION 5	OPTICAL MANUFACTURING III
9575 OL	Status of the Advanced Mirror Technology Development (AMTD) phase 2, 1.5m ULE® mirror [9575-21]
9575 OM	Improving profitability through slurry management: a look at the impact of slurry pH on various glass types [9575-22]
9575 ON	Material removal characteristics of orthogonal velocity polishing tool for efficient fabrication of CVD SiC mirror surfaces [9575-23]
9575 00	Surface errors in the course of machining precision optics [9575-24]
9575 OP	The effect of deep HF etching on the surface quality and figure of fused silica optics [9575-59]
SESSION 6	OPTICAL MANUFACTURING IV
9575 0Q	Using frictional power to model LSST removal with conventional abrasives [9575-26]
9575 OR	Influence of coolant on ductile mode processing of binderless nanocrystalline tungsten carbide through ultraprecision diamond turning [9575-27]
9575 OS	Influence of temperature difference on surface figure controlling during continuous polishing [9575-60]
SESSION 7	OPTICAL TESTING I
9575 OW	Subaperture stitching surface errors due to noise [9575-32]
9575 OX	An iterative subaperture position correction algorithm [9575-33]
SESSION 8	OPTICAL TESTING II
9575 11	Measuring and quantifying scatter from non-isotropic sources [9575-36]
9575 12	Fabrication and qualification of roughness reference samples for industrial testing of surface roughness levels below 0.5 nm Sq [9575-37]
SESSION 9	OPTICAL TESTING III
9575 14	Oil defect detection of electrowetting display [9575-40]
9575 15	Deflectometry measurement of Daniel K. Inouye Solar Telescope primary mirror [9575-41]
9575 16	The use of diffractive imitator optics as calibration artefacts [9575-42]

POSTER SESSION

9575 19	Investigation of rapidly solidified aluminum by using diamond turning and a magnetorheological finishing process $[9575-45]$
9575 1A	Optical diffraction interpretation: an alternative to interferometers [9575-46]
9575 1C	Noninvasive method for determination of parameters of cemented doublet [9575-48]
9575 1D	Detection of subsurface defects and measurement of thickness of screen layers made of graphene and carbon nanotubes with application of full-field optical coherence tomography in Linnik configuration [9575-50]
9575 1G	Designing null phase screens to test a fast plano-convex aspheric lens [9575-53]
9575 1H	Null screens type Hartmann to test simple lenses [9575-54]