PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 10985

, "Front Matter: Volume 10985," Proc. SPIE 10985, Window and Dome Technologies and Materials XVI, 1098501 (18 June 2019); doi: 10.1117/12.2537636

SPIE.

Event: SPIE Defense + Commercial Sensing, 2019, Baltimore, MD, United States

PROCEEDINGS OF SPIE

Window and Dome Technologies and Materials XVI

W. Howard Poisl

Editor

18 April 2019

Baltimore, Maryland, United States

Sponsored and Published by
SPIE

Volume 10985

Proceedings of SPIE 0277-786X, V. 10985

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

Window and Dome Technologies and Materials XVI, edited by W. Howard Poisl, Proc. of SPIE
Vol. 10985, 1098501 © 2019 SPIE · CCC code: 0277-786X/19/\$18 · doi: 10.1117/12.2537636

Proc. of SPIE Vol. 10985 1098501-1

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 [SPIDigitalLibrary.org](https://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 reliance thereon.

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

Author(s), "Title of Paper," in *Window and Dome Technologies and Materials XVI*, edited by W. Howard Polisl, Proceedings of SPIE Vol. 10985 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510626355
ISBN: 9781510626362 (electronic)

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](https://spie.org)

Copyright © 2019, 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/19/\$18.00.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

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

**SPIE. DIGITAL
LIBRARY**

[SPIDigitalLibrary.org](https://spiedigitallibrary.org)

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five 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.

Contents

v	Authors
vii	Conference Committee

OPTICAL/ELECTRICAL PROPERTIES OF INFRARED WINDOW AND DOME MATERIALS

10985 02	Measurements of weak scattering and absorption in spinel and sapphire from the near infrared to the visible [10985-1]
10985 03	Optical properties of undoped and neodymium doped polycrystalline yttrium aluminum garnet [10985-2]
10985 04	Angle dependent scatter in CVD ZnSe and single crystal CaF₂ from the infrared through the NIR [10985-3]

INFRARED WINDOW AND DOME TECHNOLOGY OVERVIEWS

10985 07	Evaluation of sapphire at II-VI Optical Systems for HEL applications [10985-7]
----------	---

ADVANCES IN MID-WAVELENGTH INFRARED COATING TECHNOLOGY

10985 0A	Small particle erosion of coated and uncoated electro-optical materials [10985-10]
10985 0B	Sun blocking filter for satellite based laser communication terminals [10985-11]
10985 0C	Advanced window coatings for drone and ground based applications [10985-12]
10985 0E	Peridynamic analysis of indentation and impact of coated and uncoated electro-optical materials [10985-14]

INFRARED WINDOW AND DOME PROCESSING AND MANUFACTURING TECHNOLOGY

10985 0F	Scale up of large ALON windows [10985-15]
10985 0G	Conformal ALON and spinel windows [10985-16]

10985 OI **Challenges in size scale up of freeform polishing processes** [10985-18]

10985 OJ **Recent advances in machines, software and processes for manufacturing complex optical components** [10985-19]

POSTER SESSION

10985 OK **A computer code for modeling optical properties of materials II** [10985-20]

10985 OL **Sources of variability in the sand erosion testing of electro-optical materials** [10985-21]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Airola, M. B., 02, 04	Wolfs, Franciscus, 0J
Barnett, Matthew W., 0L	Xu, Wen-Qing, 03
Barrett, Ian, 0C	Young, Judith, 0L
Bechtold, Patrick, 0J	
Becker, H.-W., 0B	
Blalock, Todd, 0I	
Blaney, D., 04	
Brunelle, Matt, 0I	
Cahill, Michael, 0J	
Cohen, Scott, 0C	
Colavecchia, Ron, 0J	
Coniglio, Jen, 0I	
DeFisher, Scott, 0J	
DeGroote Nelson, Jessica, 0I	
Ferralli, Ian, 0I	
Finnell, Terrance, 0C	
Fredell, Markus, 0C	
Glick, B., 07	
Goldman, Lee M., 0F, 0G	
Groß, T., 0B	
Güven, Ibrahim, 0A, 0E	
Hahn, D. V., 04	
Hibbitts, K., 04	
Hübner, M., 0B	
Hunt, Gabriella, 0K	
Jarvis, Gregg, 0C	
Jha, Santosh, 0F, 0G	
Johnson, Robert, 0C	
Kashalikar, Uday, 0F	
Kraisinger, Charles J., 03	
Lynch, Tim, 0I	
Ma, J., 02, 04	
Mann, Robert, 0C	
Mohring, David, 0J	
Münzberg, M., 0B	
Myer, Brian, 0I	
Poisl, W. Howard, 0A, 0E, 0L	
Rahmlow, Thomas, 0C	
Ramisetty, Mohan, 0F, 0G	
Sastri, Suri, 0F, 0G	
Sczupak, Robert, 0C	
Seitz, Melissa, 07	
Smith, Mark, 0F, 0G	
Snyder, Matthew J., 03	
Spicer, J. B., 02	
Stoddard, N., 07	
Stover, J. C., 07	
Thomas, Michael E., 02, 04, 0K	
Waxman, Rachel, 0A, 0E	

Conference Committee

Symposium Chairs

Jay Kumler, JENOPTIK Optical Systems, LLC (United States)
Ruth Moser, Air Force Research Laboratory (United States)

Symposium Co-chair

John Pellegrino, Electro-Optical Systems Laboratory, Georgia Institute of Technology (United States)

Conference Chair

W. Howard Poisl, Raytheon Missile Systems (United States)

Conference Program Committee

Lee Cambrea, Naval Air Warfare Center Weapons Division (United States)
Rick Gentilman, Raytheon Integrated Defense Systems (United States)
Daniel C. Harris, Naval Air Warfare Center Weapons Division (United States)
John S. McCloy, Washington State University (United States)
Richard Porter, Air Force Research Laboratory (United States)
Melissa Seitz, II-VI Optical Systems (United States)
Michael E. Thomas, Johns Hopkins University Applied Physics Laboratory (United States)
Marc Tricard, Zygo Corporation (United States)
Ted Turnquist, Meller Optics, Inc. (United States)
Martin Winterling, UTC Aerospace Systems (United States)

Session Chairs

- 1 Optical/Electrical Properties of Infrared Window and Dome Materials
Melissa Seitz, II-VI Optical Systems (United States)
- 2 Infrared Window and Dome Technology Overviews
John S. McCloy, Washington State University (United States)
- 3 Advances in Mid-Wavelength Infrared Coating Technology
Daniel C. Harris, Naval Air Warfare Center Weapons Division (United States)

- 4 Infrared Window and Dome Processing and Manufacturing Technology
Brian T. Anderson, Air Force Research Laboratory (United States)