PROCEEDINGS OF SPIE

Advances in Metrology for X-Ray and EUV Optics X

Lahsen Assoufid Haruhiko Ohashi Frank Siewert

23 August 2023 San Diego, California, United States

Sponsored and Published by SPIE

Volume 12695

Proceedings of SPIE 0277-786X, V. 12695

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

Advances in Metrology for X-Ray and EUV Optics X, edited by Lahsen Assoufid, Haruhiko Ohashi, Frank Siewert, Proc. of SPIE Vol. 12695, 1269501 © 2023 SPIE · 0277-786X · doi: 10.1117/12.3012884

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 reliance thereon.

Please use the following format to cite material from these proceedings: Author(s), "Title of Paper," in Advances in Metrology for X-Ray and EUV Optics X, edited by Lahsen Assoufid, Haruhiko Ohashi, Frank Siewert, Proc. of SPIE 12695, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510666047

ISBN: 9781510666054 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2023 Society of Photo-Optical Instrumentation Engineers (SPIE).

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 fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center 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.

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.



Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE 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

Conference Committee

MIRROR SLOPE PROFILOMETRY

12695 02	Towards a new generation long trace profiler LTP-2020: optical design of pencil beam interferometry sensor [12695-1]
12695 03	Development of an inner surface profile measurement system for precise electroformed Wolter mirrors for x-ray telescopes [12695-2]
12695 05	Towards new generation long trace profiler LTP-2020: system design with different sensors in different operation modes [12695-4]
12695 06	Developing bendable air bearing slide supporting long trace profiler to compensate gravity effect during measuring process $[12695-5]$
	X-RAY/EUV OPTICS TESTING AND MEASUREMENTS WITH INTERFEROMETRY
12695 07	Metrology and characterization of two optical delay line mirrors before and after B4C coating at European XFEL [12695-9]
12695 08	Modeling and characterizing transmission windows for in-situ interferometric measurements of cryogenically cooled mirrors [12695-11]
	OPTICS TESTING, CALIBRATION, POLARIZATION-RESOLVED REFLECTANCE, AND WAVEFRONT CORRECTION
12695 09	The multiple array detector optical lever deflection angle metrology for x-ray mirrors, and semiconductor applications [12695-24]
12695 OA	Diamond-VeNOM: a high-speed slope profiler for characterizing x-ray mirrors [12695-23]
	AT-WAVELENGTH WAVEFRONTS SENSORS, MEASUREMENT, AND CONTROL
12695 OB	X-ray wavefront sensor development at the Advanced Light Source [12695-17]
12695 OC	Design, manufacturing, and characterization of x-ray optics for the cavity-based x-ray free-electron laser project [12695-19]

POSTER SESSION

12695 OD	Advances in at-wavelength metrology of x-ray optics at the Advanced Photon Source [12695-22]
12695 0E	Preparing for cost-effective soft x-ray metrology for 3D chip architecture [12695-25]

Conference Committee

Program Track Chairs

Ali Khounsary, Illinois Institute of Technology (United States) **Ralph James**, Savannah River National Laboratory (United States)

Conference Chairs

Lahsen Assoufid, Argonne National Laboratory (United States)Haruhiko Ohashi, Japan Synchrotron Radiation Research Institute (Japan)

Frank Siewert, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany)

Conference Program Committee

Simon G. Alcock, Diamond Light Source Ltd. (United Kingdom)
Raymond Barrett, European Synchrotron Radiation Facility (France)
Roman Chernikov, Canadian Light Source Inc. (Canada)
Uwe Flechsig, Paul Scherrer Institut (Switzerland)
Ralf D. Geckeler, Physikalisch-Technische Bundesanstalt (Germany)
Lei Huang, Brookhaven National Laboratory (United States)
Mourad Idir, Brookhaven National Laboratory (United States)
Jangwoo Kim, Pohang Accelerator Laboratory (Korea, Republic of)
Bernard Kozioziemski, Lawrence Livermore National Laboratory
(United States)

Bernd C. Meyer, Centro Nacional de Pesquisa em Energia e Materiais (Brazil)

Hidekazu Mimura, The University of Tokyo (Japan)

May Ling Ng, SLAC National Accelerator Laboratory (United States) **Josep Nicolas**, ALBA Synchrotron (Spain)

Kawal J. S. Sawhney, Diamond Light Source Ltd. (United Kingdom)

Frank Scholze, Physikalisch-Technische Bundesanstalt (Germany)

Peter Z. Takacs, Brookhaven National Laboratory (United States)

Kazuto Yamauchi, Osaka University (Japan)

Valeriy V. Yashchuk, Lawrence Berkeley National Laboratory (United States)