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The Optical Society's 2016 topical meeting on optical interference coatings: introduction

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This feature issue of *Applied Optics* is dedicated to the 13th Topical Meeting on Optical Interference Coatings, which was held June 19–24, 2016, in Tucson, Arizona, USA. The conference, taking place every three years, is a focal point for global technical interchange in the field of optical interference coatings and provides premier opportunities for people working in the field to present their new advances in research and development. Papers presented at the meeting covered a broad range of topics, including fundamental research on coating design theory, new materials, and deposition and characterization technologies, as well as the vast and growing number of applications in electronic displays, communication, optical instruments, high power and ultra-fast lasers, solar cells, space missions, gravitational wave detection, and many others. © 2017 Optical Society of America

OICIS codes: (310.0310) Thin films; (230.4170) Multilayers; (120.2440) Filters; (350.2460) Filters, interference.

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2016 marked the 40th anniversary of OSA's Topical Meeting on Optical Interference Coatings (OIC). The next OIC decennial that coincides with the year of the conference will occur in 2046, because the OIC conference is held only every three years. Therefore, for the time being, it is instructive to give a brief review on the history of this important conference before moving on to the 2016 conference.

1. BRIEF HISTORY OF OIC CONFERENCES

The history of the OIC conference directly reflects the advancement made in optical interference coatings over the past 40 years. Between the 1950s and the mid-1970s, significant progress had been made in many areas of optical coatings: theory, computer-aided design, optical monitoring, deposition techniques, as well as physical and optical characterization techniques. With these advances, interference coatings became an essential part of many optical systems, and the thin film coating industry began to form across North America, Europe and elsewhere. However, while thin film activities were a strong component in the Optical Society of America's annual meetings, there was no conference dedicated to optical interference coatings.

In 1976, Philip Baumeister took the initiative and organized the very first topical meeting in Pacific Grove, California, USA.

The driving principle was to have a conference where people working in thin film research and the optical coating industry could come together and share their most important findings every four years, later changed to every three years following the increased speed in field development.

Before 2016, 12 OIC conferences had been held successfully, and OIC has become one of the longest running topical meeting series at OSA. Over the years, many pioneers and leading experts in the optical coatings from countries around the world have become General or Program chairs of the OIC conferences (Table 1) or members of the Program or Advisory committees. Their contribution has helped greatly in promoting this international conference and in ensuring its continuity and growing success.

For the past four decades, OIC has attracted scientists, researchers, engineers, and students from around the world, echoing the growing demands for optical coatings and their successful applications in numerous fields and industries. OIC has provided the premier platform for people to present, to learn, and to exchange ideas on the latest advancement of optical interference coatings, ranging from fundamental research on coating design theory, new materials, deposition, and characterization technologies, to the vast and growing number of applications in electronic displays, communication, optical instruments, high power and ultra-fast lasers, solar cells, space missions, gravitational wave detection, and many others.

Table 1. Past Topical Meetings on Optical Interference Coatings

No.	General and Program Chairs	Date	Location
1	P. Baumeister, V. R. Costich	February 24–26, 1976	Pacific Grove, USA
2	J. A. Dobrowolski	June 3–5, 1980	Oakland, USA
3	J. A. Dobrowolski, A. J. Thelen	April 17–19, 1984	Monterey, USA
4	A. J. Thelen, H. A. Macleod	April 12–15, 1988	Tucson, USA
5	H. A. Macleod, C. Carniglia	June 1–5, 1992	Tucson, USA
6	P. Baumeister, D. Smith	June 4–9, 1995	Tucson, USA
7	C. Carniglia, B. Sullivan	June 7–12, 1998	Tucson, USA
8	B. Sullivan, R. Shimshock	July 15–20, 2001	Banff, Canada
9	R. Shimshock, N. Kaiser	June 27–2, 2004	Tucson, USA
10	N. Kaiser, C. Stolz	June 3–8, 2007	Tucson, USA
11	C. Stolz, M. Tilsch	June 6–11, 2010	Tucson, USA
12	M. Tilsch, D. Ristau	June 16–21, 2013	Whistler, Canada

To ensure that the advances in optical coatings highlighted during the OIC conference are widely disseminated, a feature issue of Applied Optics is dedicated to the OIC conference.

2. 2016 OIC CONFERENCE

The 2016 OIC conference was held June 19–24 in Tucson, Arizona, USA. In total, 310 people from 20 countries attended the conference with 192 invited and contributed papers. Figure 1 shows the historical OIC conference trends in terms of attendees and submitted papers, and Fig. 2 shows the distributions of the contributed papers by continents at the 2016 OIC conference.

A. Conference Chairs, Program and Advisory Committees

Detlev Ristau was the General chair of the 2016 OIC conference and Li Li was the Program chair. They were supported by the Program and Advisory committees. The Program Committee consisted of optical coating experts around the world, including Claude Amra, James Barrie, Hsi-Chao Chen, Xinbin Cheng, Mireille Commandré, Svetlana Dligatch, Angela Duparré, Henrik Ehlers, Karen Hendrix, Chang Kwon Hwangbo, Michael Jacobson, Jennifer Kruschwitz, Cheng-Chung Lee, Bincheng Li, Xu Liu, Roland Loercher, Ludvik Martinu, Carmen Menoni, Claude Montcalm, Hiroshi Murotani, Ekishu Nage, James Oliver, Angela Piegari, Robert Sargent, Robert Schaffer, Ulrike Schulz, Noriaki Toyoda,

Michael Trubetskov, and Alfons Zoeller. The Advisory Committee, made up of mostly General chairs of previous OIC conferences: Norbert Kaiser, Angus Macleod, Ric Shimshock, Douglas Smith, Christopher Stolz, Brian Sullivan, Alexander Tikhonravov, and Markus Tilsch, provided important advice for the preparation of the OIC conference.

B. Sponsors, Corporate Contributors and Exhibitors

The 2016 OIC conference was organized by the Optical Society. It had received generous financial contributions from many sponsors and corporate contributors—Shincron Co. Ltd., American Elements, Agilent Technologies, Evaporated Coatings Inc., KM Labs, Laser Zentrum Hannover e. V, Lightmachinery, Optics Balzers, Spica Technologies Inc., Techport, Iridian Spectral Technologies, Viavi Solutions, and Carl Zeiss, Inc. In addition, 22 companies also exhibited at the conference. The financial contributions provided essential funding for the conference to support students, speakers and many other activities held at the conference. We would like to thank all the sponsors, corporate contributors and exhibitors for their supports.

C. Program

The 2016 OIC conference featured five days of technical sessions, one day of short courses, a technical exhibit, three contests in design, manufacturing and measurement and special evening presentations.

2016 OIC conference kicked off on Sunday with seven short courses geared to the needs of different learners: beginner,

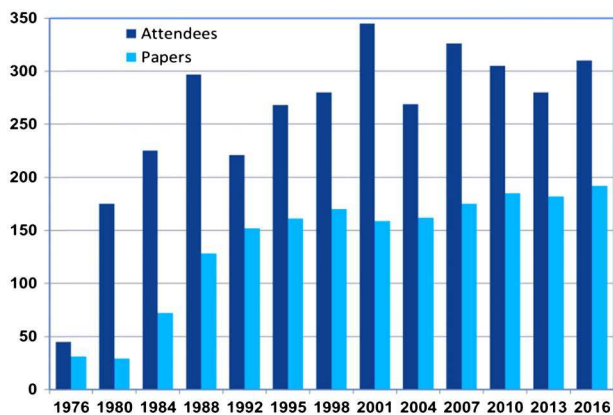


Fig. 1. Historic trend of OIC conferences.

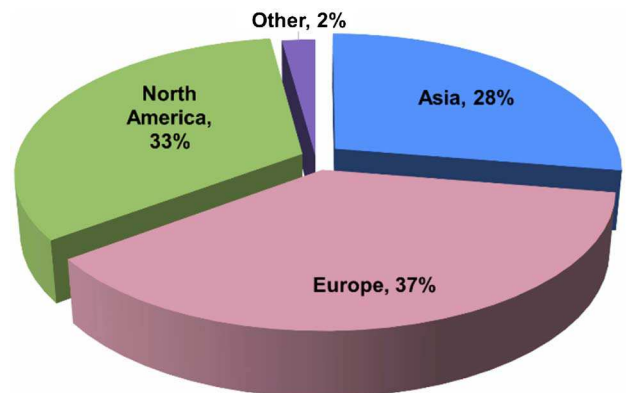


Fig. 2. Distributions of 2016 OIC contributed papers by continents.

immediate and advanced, including. The technical sessions started on Monday morning and ended on Friday at noon with 190 presentations, of which, 168 were contributed papers and over 20 were in-depth invited talks by leading researchers in the most fields. To mark the 40th anniversary of OIC, Prof. Angus Macleod presented a special talk on the growth in understanding of interference effects from the 17th to 19th centuries, beginning with the first careful observations of color in thin transparent layers through to the development of Maxwell's equations. In the keynote presentation, Dr. Markus Tilsch of Viavi Solutions presented the important applications of optical interference coatings, the markets and industry trends. To mark the occasion of the first detection of gravitational waves, a special technical session on optical coatings for gravitational wave detection was held on Monday with three invited and eleven contributed papers that addressed the latest developments and the future directions of optical coatings for this application. Throughout the week, people learned of the many new developments in various areas of optical coatings, including both the technologies and applications covering wavelength range from x -rays to the far infrared. This spreads from complex coating designs to ultra-fast and high power laser coatings, from laser damage investigations to coating process control and monitoring. Advances in technologies of different types of deposition techniques such as physical vapor deposition techniques (PVD) like sputtering deposition, electron-beam evaporation and atomic layer deposition, or chemical vapor deposition (CVD) methods were reported. Developments in thin film measurements and characterization were under focus as well as coating

materials topics with a particular session dedicated to fast developing branch of new nanostructured coatings.

A specific approach employed at this conference enables a single linear session of papers rather than parallel sessions. Contributed papers are introduced with a five-minute oral presentation, followed by a dedicated poster time at a poster session aimed toward a more in-depth explanation. This gives the presenter and the audience plenty of opportunities and time for detailed discussions and arrangements of cooperative scientific activities. Through this format we have seen an enormous spectrum of energizing scientific information, lively discussions and stimulating ideas for the future development of optical coatings and their applications.

Similarly to previous OIC meetings, the results of three challenging contest problems in the design, manufacturing and measurement of complex optical coatings were presented in three invited talks: design (Tuesday), manufacturing (Wednesday) and measurement (Thursday). The contests attracted participants from all over the world. The results of the problems presented distinctive insights about the current capability of optical coatings and the technical challenges of the present and future.

As is tradition at OIC, two special evening presentations were contributed: on Monday, NASA's James Webb Space Telescope by Dr. Joseph Howard, and on Tuesday, Optics in Nature—Blue Skies, Bluer Skies, Red Sunsets, Mirages, Snakes, Mosquitoes, Humming Birds, Glaciers and More by Prof. Willam Wolfe.

An added benefit to attendees, OIC provides many opportunities to network with peers, including poster sessions,



Fig. 3. 2016 OIC conference group photo.

exhibitions, the conference welcome reception and banquet, the evening presentations, the special tour of University of Arizona Large Mirror Labs, and get-togethers during common breakfasts and lunches. These gatherings provided ample chances to network with fellow researchers, catch up on old friends and discuss new perspectives in research areas. Figure 3 shows a group photo taken on Wednesday during the conference reception.

D. Feature Issues of *Applied Optics*

Unlike the OIC conference proceedings, where papers are limited to three pages, the selection of papers included in this dedicated feature issue of *Applied Optics* provide new and more in-depth information compared to the conference presentation and paper.

E. Tragedy

Although we had a very successful 2016 OIC conference, we are also very sad to report that during the 2016 OIC conference we lost two of our dear colleges Dr. Stefan Guenster and Marcus Turowski. They died tragically during a hiking excursion. Dr. Stefan Guenster was a world-leading expert on

laser coatings. Marcus Turowski was a young and very promising Ph.D.-student near to finish his thesis on the mechanisms of layer growth. We have selected a figure from his prepared presentation as the cover of the feature issue.

F. Outlook of the Future

The thin film community has been constantly pushing the boundary of optical interference coatings, which in turn, has propelled the advancements in many other technical fields. One very good example is the development of high performance laser mirror coatings, which as seen during the 2016 OIC conference presentations, led to the successful detection of a gravitational wave by LIGO for the first time in history. We expect such a positive propulsion to continue for many new optical coating applications. We are confident the information shared at the conference and presented in this feature issue will spark new ideas, advance our understanding of optical interference coatings and improve our capability to make complex optical coatings for a growing number of applications. We look forward to the 2019 OIC conference, and more information about this conference will be announced on the OSA website.