2025 Optica OIC — Optical Interference Coatings Conference

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 15 May 2025. For updated and complete information with special events, reference the online schedule.

Monday, 19 May

08:15 -- 09:05
Room: Presidio IV
MA • Opening Remarks and Keynote Session I
Presider: Lars Jensen; TRUMPF SE & Co.KG, Germany and Anna Sytchkova; ENEA, Italy

MA.1 • 08:25 Keynote Submission
The Smaller the BIGGER — EUV Lithography Optics, Where Size Meets Precision, Christoph J. Zaczek[1]; [1]*Carl Zeiss SMT GmbH, Germany.* In the first half of 2024, the world's first EUV scanner for the High Numerical Aperture (NA) lithography was delivered to a semiconductor manufacturer, enabling a resolution of 8 nm in chip production. The optics that enable such resolution consist of aspherical mirrors up to one meter in size and are manufactured in series with a precision of sub-100-picometer.

09:05 -- 09:30
Room: Presidio IV
MB • Applications I
Presider: Astrid Bingel; Fraunhofer IOF, Germany

MB.1 • 09:05
Analysis of the Impact of Heat Treatment and the Presence of Hydrogen on the Optical Properties of WO_3 Thin Films Prepared by EBE, Jaroslaw Domaradzki[1], Michal Mazur[1], Damian Wojcieszak[1], Wiktoria Wichbrodt[1], Des Gibson[2]; [1]*Wroclaw Univ. of Science and Techno, Poland;* [2]*Inst. of Thin Films, Sensors and Imaging, UK.* The paper shown that annealing significantly affected the morphology and optical properties of the WO_3 film. Exposure of the film to hydrogen caused a reversible change in refractive index due to its reduction to WO_2.

MB.2 • 09:10
Hybrid Deposited With E-gun Evaporation and RF Magnetron Sputtering of Molybdenum Trioxide Doped Titanium Dioxide for Electrochromic Device, Yin Kun-Zu[1], Hsi-Chao Chen[1], Rong-Ling Ni[1], Yu-Xuan Zhuang[1], Yu-Tung Sung[1], Yguan-Liang Yu[1], Guan-Yuan Huan[1]; [1]*NYUST, Taiwan.* Molybdenum oxide (MoO_3) films were prepared with electron-gun evaporation and nickel oxide (NiO) as an auxiliary electrochromic layer. Titanium dioxide (TiO_2) was doped to MoO_3 using radio frequency (RF) sputtering for ITO/MoO_3:TiO_2/($LiClO_4$+PC)+PMMA/NiO/ITO complementary electrochromic devices.

MB.3 • 09:15
Form-Birefringence in $SiO_2/TiO_2/Al_2O_3$ Heterostructures, Adriana V. Szeghalmi[1,2], Jinsong Liu[1,2], Martin Miculka[1,2], Sven Schröder[2]; *[1]Friedrich-Schiller-Universität Jena, Germany; [2]Fraunhofer Inst. for Applied Optics and Precision Engineering IOF, Germany.* Atomically thin heterostructures deposited by atomic layer deposition show strong form-birefringence as determined by ellipsometry close to theoretical values. The form-birefringence depends on the period of the heterostructures indicating partial intermixing of the constituent layers.

MB.4 • 09:20
Advancing Transparent Flexible Electrodes via Polymeric Web-Assisted Nanostructures, Aleksandra Pajak[1], Oleg Zabeida[1], Bill Baloukas[1], Jolanta Klemberg-Sapieha[1], Ludvik Martinu[1]; *[1]Polytechnique Montréal, Canada.* Next generation optoelectronic devices rely on effective transparent flexible electrodes. Using polymeric webs as masks improves the electrodes' transparency through patterning, allowing additionally for their higher flexibility and durability.

MB.5 • 09:25
Development of a Compact Multi-Gradient Bandpass Filter for Hyperspectral Imaging in Smart Farming Applications, Philipp Farr[1], Chris Britze[1], Florian Gebert[1], Michael Vergoehl[1], Thomas Wettemann[2], Corneli Keim[2], Ralf Muenzenmayer[2], Christophe Buisset[3], Michel Tossaint[3], Pejman Nejadi[4]; *[1]Fraunhofer IST, Germany; [2]Airbus Defence and Space GmbH, Germany; [3]ESTEC, European Space Agency, Netherlands; [4]ESRIN, European Space Agency, Italy.* A compact multi-gradient bandpass filter for agricultural hyperspectral imaging in the spectral range 400-1700 nm is developed using magnetron sputtering. With lift-off processing, three independent filters are integrated onto a single 10 mm substrate.

10:00 -- 11:00
Room: Presidio IV
MC • Deposition Technologies I
Presider: Des Gibson; Univ. of the West of Scotland, UK and Markus Tilsch; Viavi Solutions Inc, USA

MC.1 • 10:00 (Invited)
Ion Beam Sputter Deposition of Low Loss Optical Coatings on Large Substrates, Ramin Lalezari[1], Eric Baltz[1], Howard Champoux[1], Zach Gerig[1]; *[1]Five Nine Optics, USA.* Abstract: Recent applications of high energy lasers have created a demand for large area complex coatings with low absorption and high LIDT on meter scale mirrors. We describe system design considerations and results for production of such coatings.

MC.2 • 10:25
Development of an IBS Coating System for Optics with a Diameter of 2 Meters, Tarik Kellermann[1], Morten Steinecke[1], Marco Jupé[1], Kai Starke[2], Andreas Wienke[1], Detlev Ristau[1]; *[1]Laser Zentrum Hannover e. V., Germany; [2]Cutting Edge Coatings GmbH, Germany.* An upscaling concept of the ion beam sputtering process for large area optics is presented with a novel approach including a movable ion and deposition material source. First deposited single layers show promising results.

MC.3 • 10:30
Magnetron Sputtering for High Performance Infrared Optical Coatings up to 14 µm, Florian Gebert[1], Martin Bischoff[1], Chris Britze[1], Philipp Farr[1], Michael Vergoehl[1]; *[1]Fraunhofer IST, Germany.* In the 4.5-14 µm infrared spectral range data of only few materials with low absorption are available. Results on sputter-deposited coatings are presented, focusing on optical properties, layer stress and environmental stability.

MC.4 • 10:35
Ion-Beam-Sputtered Mid-Infrared Coatings for Hybrid Supermirrors, Lukas W. Perner[1], Valentin J. Wittwer[1,2], Gar-Wing Truong[3], Garrett D. Cole[3], Thomas Südmeyer[1]; *[1]Laboratoire Temps-Fréquence, Institut de Physique, Université de Neuchâtel, Switzerland; [2]UTOM AG, Switzerland; [3]Thorlabs Crystalline Solutions, USA.* We report details on the design, manufacturing, and characterization of low-loss ion-beam-sputtered mulitlayers used for amorphous-crystalline hybrid supermirrors for mid-infrared applications, including details on anti-reflective and highly reflective coatings

MC.5 • 10:40
Ion Beam Sputtering for Substrate Deposition with a Size of 2m: Simulation and Optimization, Holger Badorreck[1], Tarik Kellermann[1], Dennis Barton[2], Morten Steinecke[1], Marco Jupé[1], Detlev Ristau[1,3], Andreas Wienke[1,3]; *[1]Laser Zentrum Hannover e.V., Germany; [2]Fraunhofer-Institut für Schicht- und Oberflächentechnik (IST), Germany; [3]Cluster of Excellence PhoenixD, Leibniz Univ. Hanover, Germany.* The deposition process by ion beam sputtering is scaled to a huge substrate size. Homogeneous coatings are optimized by adjusting the moveable target positions. A digital twin model combines gas flow and atomistic growth simulations.

MC.6 • 10:45
Ion-Beam-Sputtered Silica-Tantala Alloys for Nanophotonics, Grisha Spektor[1], David Carlson[1], Zachary Newman[1], Chang Kristina[1], Daniel Hickstein[1], Ann Fitzgerald[2], Brett Buchholtz[2], Mark Jablonski[2]; *[1]Octave Photonics, USA; [2]Plasma Optik, USA.* We present a nanophotonic platform of ion-beam-sputtered silica–tantala (SiO2–Ta2O5) alloys, where compositional tuning tailors linear and nonlinear optical properties, enabling low-loss waveguides that enhance supercontinuum generation from near-infrared to visible and significantly advance integrated photonics.

MC.7 • 10:50 Postdeadline Submission
From Near Infra-red to the Deep Ultra Violet: Low Loss Coatings With Oxides Using an Ion Beam Sputtering System., Alex Ribeaud[1], Jürgen Pistner[1], Isabel Vela-Perez[1], Christian Mühlig[2], Thomas Gischkat[2], Harro Hagedorn[1], Sven Schröder[2]; *[1]Bühler Leybold Optics, Germany; [2]Fraunhofer IOF Jena, Germany.* The optical performance of dielectric mirror coatings at 1064nm, 532nm, 355nm and 193nm deposited using a dual Ion Beam sputtering system are being presented and discussed.

13:15 -- 14:30
Room: Presidio IV
MD • Sustainability and Reliable Coatings
Presider: James Oliver; Vacuum Innovations LLC, USA and Michael Vergoehl; Fraunhofer IST, Germany

MD.1 • 13:15 (Invited)
Working Collectively to Improve Sustainability in Optics Manufacturing – a Deeper Look into Efforts in Coating Processes, Jessica DeGroote Nelson[1], Estefania Cervantes[1], Mathias Mende[1]; [1]*Edmund Optics Inc., USA.* This presentation explores sustainability in optics manufacturing, highlighting material selection, waste reduction, energy-efficient coatings, and eco-friendly packaging. Industry collaboration is key to balancing performance with environmental responsibility and driving future sustainable innovations.

MD.2 • 13:40 (Invited)
Aspects of Sustainability in Optical Filter Manufacturing, Marc Lappschies[1], Jan Brossmann[1], Stefan Jakobs[1]; [1]*Optics Balzers Jena GmbH, Germany.* Minimizing consumption of energy and resources in industrial manufacturing processes does not only reduce costs, but also impacts all related environmental issues. One key is computational pre-production analysis allowing for an efficient operation in a rapid-prototyping regime.

MD.3 • 14:05
Reliability of Optical Thin Film Filters, Charles H. Fields[1], Markus K. Tilsch[2]; [1]*Optical Security and Performance (OSP), USA;* [2]*VIAVI Solutions, USA.* We have performed accelerated temperature life tests on optical thin film filters. The results show an activation energy of 1.08 eV and extracted a mean-time-to-failure of more than 43 years at T = 50°C.

MD.4 • 14:10
Development of a Methodology to Produce Gradient-Index Optical Filters, Roberto Sangines[1], Ramon Rodriguez Lopez[1,2], Kevin R Maldonando-Dominguez[1], Noemi Abundiz-Cisneros[1], Estrella Teran-Hinojosa[1], Juan Aguila-Muñoz[1], Roberto Machorro-Mejia[1]; [1]*Universidad Nacional Autonoma de Mexico, Mexico;* [2]*CICESE, Mexico.* In this work we have developed a methodology that correlates the plasma emission to the target poisoning and hence the ability to produce different film compositions with their respective deposition rate with high process control.

MD.5 • 14:15
Long-Term Aging Characterization of PIAD SiO_2 and HfO_2 Layers, Eric A. Lavastre[1], Arthur Soutenain[1], Marine Chorel[2], Cédric Ducros[4,2], Christelle Dublanche-Tixier[3]; [1]*CEA, France;* [2]*CEA, France;* [3]*IRCER, France;* [4]*Univ. of Grenoble Alpes, France.* This work deals with the long-term behavior of PIAD SiO_2 and HfO_2 monolayers used in specific LMJ coatings. Spectral and mechanical variations are observed on SiO_2 layers only. Climate chamber tests can stabilize these layers.

MD.6 • 14:20
Effects of Spit Defects in Vapor-Deposited IR Coatings, Chelsea D. Appleget[1], Peter D. Fuqua[1], Paul M. Adams[1], John Chaney[1], Vania Jiao[1], James D. Barrie[1]; [1]*The Aerospace Corporation, USA.* Circular freckle features were observed in ZnS/Ge multilayer coatings,

originating at centralized spit defects. These defects yielded subtle variations in structural morphology, cathodoluminescence, and sputter yield response, and remained largely stable under further environmental testing.

MD.7 • 14:25
Multifunctional Nanorough Optical Coatings on ZnS Windows for Electro-Optical Systems, Nadja Felde[1], Nancy Gratzke[1], Astrid Bingel[1], Sven Schröder[1], Edi Shaul[2], Shay Joseph[2]; *[1]Fraunhofer IOF, Germany; [2]Rafael Advanced Defense Systems Ltd., Israel.* Multifunctional saltwater-repellent coatings for optical ZnS components have been developed by optimizing nanorough structural properties. These coatings can open a path to sensor windows with improved durability and functionality in maritime and other challenging environments.

15:00 -- 16:15
Room: Presidio IV
ME • Laser Coatings I
Presider: Harro Hagedorn; Bühler Leybold Optics, Germany and Andrius Melninkaitis; Vilniaus Universitetas, Lithuania

ME.1 • 15:00 (Invited)
The Impact of Nano-Bubbles on Laser Damage Performance of IBS Fabricated MLD Coatings, Colin Harthcock[1]; *[1]Lawrence Livermore National Laboratory, USA.* We study the effects of 1nm bubbles in hafnia via coating process optimization on the laser damage performance at the first second and third harmonics of Nd:YAG.

ME.2 • 15:25
Novel LIDT Measurement Routine for Coating Optimization of Low Defect Density Optics in Nanosecond Pulse Regime, Alexander Weiß[1], Morten Steinecke[1], Kevin Kiedrowski[1], Heinrich Mädebach[1], Henrik Ehlers[2], Andreas Wienke[1,3], Marco Jupé[1,3]; *[1]Laser Zentrum Hannover e.V., Germany; [2]Laseroptik GmbH, Germany; [3]Cluster of Excellence PhoenixD, Germany.* A novel LIDT measurement routine suitable for coating optimization of low defect density optics in the nanosecond pulse regime is presented. Results of a high reflectance mirror irradiated according to this routine are discussed.

ME.3 • 15:30
Ultrafast Laser Stress Figuring (ULSF) for Compensation of High Energy Laser Dielectric Coatings, Carolyn Hokin[1], Kevin Laverty[1], Matthew Brophy[2], Dan Brooks[2], Pete Kupinski[2], Brandon Chalifoux[1]; *[1]Univ. of Arizona, USA; [2]Optimax, USA.* Ultrafast laser stress figuring (ULSF) can correct coating-induced figure deformation via stress fields patterned into bulk material. We investigate the stability of ULSF processed fused silica coated with an ion beam sputtered tantala/silica film.

ME.4 • 15:35
All-Alumina Quarter-Wave Plate Coating Fabricated by Glancing Angle Deposition for High Power Laser Application, Solene Bertet[1], Sara MacNally[2], Marine Chorel[1], Eric A. Lavastre[1], Daniel Sadowski[2], Corinne Marcel[3], Bruno Gallas[4], Marcela Mireles Ramirez[2]; *[1]CEA CESTA, France; [2]Laboratory for Laser Energetics, USA; [3]CEA Le Ripault, France; [4]Institut des*

NanoSciences de Paris, Sorbonne Université, France. An alumina quarter wave plate fabricated by glancing angle deposition is presented. It is a multilayer composed of 7 layer-pairs of isotropic and anisotropic layers deposited at ± 76° with an anti-reflective layer on top.

ME.5 • 15:40
Thermal Effects Induced by Nodular Defects in High-Reflection Film Under CW Laser Irradiation, Qian Ning[1,2], Hongfei Jiao[1,2], Xinshang Niu[1,2], Dongdong Li[1,2], Xiaochuan Ji[1,2], Jingjing Xia[1,2], Jinlong Zhang[1,2], Xinbin Cheng[1,2], Zhanshan Wang[1,2]; *[1]MOE Key Laboratory of Advanced Micro-Structured Materials, Tongji Univ., China; [2]Inst. of Precision Optical Engineering, School of Physics Science and Engineering, Tongji Univ., China.* The paper investigates the thermal effects caused by nodules in reflective coating under continuous-wave laser irradiation. Simulation calculations reveal how nodule morphology and material absorption influence thermal effects. A preliminary correlation between defects and thermal effects has been established.

ME.6 • 15:45
Nondestructive Characterization of Nano-Sized Absorbing Defects Within Laser Devices Using AFM-IR, Zhenyin Lu[1], Shenghuan Fang[1], Binbin Jiang[1], Hongfei Jiao[1], Xinbin Cheng[1], Zhanshan Wang[1], Jinlong Zhang[1]; *[1]Tongji Univ., China.* Fabrication-induced absorbing defects can significantly degrade device performance. In this study, AFM-IR was employed to successfully characterize defects as small as 50 nm and identify multiple substances within the same region.

ME.7 • 15:50
266nm Thermal Protection Window Based on Ultra-Thin Aluminum Layer, Yujie Liu[1], Chenying Yang[2], Yueguang Zhang[1], Weidong Shen[1]; *[1]State Key Laboratory of Modern Optical Instrumentation, Zhejiang Univ., China; [2]Hangzhou Inst. for Advanced Study, Univ. of Chinese Academy of Sciences, China.* We proposed a 266 nm thermal protective window based on the ultra-thin Aluminum layer with 67.7% transmittance at 266nm and >95% infrared reflectance, reducing thermal lensing effects by 99%.

ME.8 • 15:55
Laser Resistance of Low-Density SiO_2 Optical Thin Films by Sputtering and Electron Beam Deposition, Yuhang Yang[1], Taisei Wakamiya[2], Naoya Tajima[1], Takayuki Matsudaira[3], Hiroshi Murotani[1]; *[1]Tokai Univ., Japan; [2]the Japan Steel Works, Ltd., Japan; [3]Shincron Co., Ltd., Japan.* This study evaluates the 355 nm laser damage threshold of single-layer SiO_2 films with varying refractive indices, fabricated via simultaneous electron beam evaporation and direct current pulse sputtering deposition.

ME.9 • 16:00
Influence of Different Impurities on ion-Beam Sputtered UV-Coatings, Matthias Falmbigl[1], Antonio Checco[1], Jason George[1], Binyamin Rubin[1]; *[1]Veeco Instruments Inc, USA.* The influence of different impurities on ion beam sputtered thin film materials for optical coatings is investigated. Emphasis is given to materials that are typically used for the ion optics of gridded RF-sources.

ME.10 • 16:05
Transformer Neural Network-Based Algorithm for Manufacturing Error Inversion of Optical Coatings, Jianglin Dai[1], Xiaochuan Ji[1], Xinshang Niu[1], Hongfei Jiao[1], Xinbin Cheng[1], Zhanshan Wang[1], Jinlong Zhang[1]; *[1]Tongji Univ., China.* A Transformer-based deep learning algorithm is proposed to efficiently inverse thickness errors in optical coatings, achieving spectral differences under 1% with computations in milliseconds after training on simulated datasets.

ME.11 • 16:10
Optical Second Harmonic Generation From Three-Dimensional Graphene Films for non-Linear Optics, Emma Keel[1], Till Weickhardt[2], Giancarlo Soavi[2], Marco Caffio[3], Des Gibson[1], Carlos Garcia Nunez[4]; *[1]Univ. of the West of Scotland, UK; [2]Inst. of Solid State Physics, Germany; [3]Integrated Graphene, UK; [4]Univ. of Glasgow, UK.* In this work, optical and structural properties of three-dimensional graphene foam have been analysed to validate the potential use of this material for creating 2nd and 3rd harmonic waves from short laser pulses.

19:00 -- 20:00
Room: Presidio IV
MF • Evening Session
Presider: Lars Jensen; TRUMPF SE & Co.KG, Germany and Anna Sytchkova; ENEA, Italy

MF.1 • 19:00 Evening Speaker Submission
Unlocking the Potential of AR Glasses Through Novel Materials and Processes, Barry Silverstein[1]; *[1]Meta Platforms Inc., USA.* Augmented reality (AR) glasses are poised to become a mainstream consumer product driven by smart glass use cases such as image visualization and AI-assisted information. To achieve comfortable all-day wearability in a glasses form factor, novel optical materials, coatings, processes and resonant structures are necessary. This talk will discuss technical advances in materials and coatings that serve this objective.

Tuesday, 20 May

08:15 -- 09:30
Room: Presidio IV
TA • Applications II
Presider: Robert Sargent; Viavi Solutions Inc, USA and Myriam Zerrad; Fresnel Institut, France

TA.1 • 08:15 (Invited)
Lasing Mode Control of Fiber Lasers by Higher-Order Fiber Grating, Kazuo Hasegawa[1]; *[1]Grad Schl for Creation New Photonics Ind, Japan.* By inscribing a refractive index structure directly into the core with a femtosecond laser, forming a long period fiber Bragg grating, we were able to control the oscillation of a narrow linewidth fiber laser, which was not possible with conventional quarter-wave Bragg gratings.

TA.2 • 08:40
Achromatic Performance of Reflective Waveplates Fabricated via Glancing Angle Deposition, Angel Aquino[1], Sara MacNally[1], Christopher Smith[1], Amy L. Rigatti[1], Marcela

Mireles Ramirez[1]; [1]*Univ. of Rochester, USA.* High-power and broadband lasers require achromatic retarding optical elements able to work in reflection to avoid nonlinear effects. Here we evaluate the achromatic performance of reflective waveplates fabricated by glancing angle deposition.

TA.3 • 08:45
Fourier Analysis of Ultrafast Acoustic Waves in Thin Films, Karel Zidek[1], Martina Hlubučková[1], Vít Kanclír[1], Jan Václavík[1], Petra Veselá[1]; [1]*Research Center TOPTEC, Inst. of Plasma Physics of the Czech Academy of Sciences, Czechia.* We analyzed a picosecond sonar signal from strain wave reflections in a thin-film stack. Fourier analysis revealed attenuation of acoustic frequencies above 0.2 THz. We discuss implications for spatial resolution in the experiment.

TA.4 • 08:50
Wideband Polarized Beam Combiner With Low Thermal Rise Property for High-Brightness Blue Laser, Muneo Sugiura[1], Takuro Yoshida[2], Hisayuki Oguchi[3], Hiroaki Suzuki[3], Chiaki Inoue[2], Keiji Nishimoto[2]; [1]*Tokai Optical Co., Ltd., Japan;* [2]*Tokai Optical Holdings Co., Ltd., Japan;* [3]*Panasonic Connect Co., Ltd., Japan.* We have developed wideband polarized beam combiners for blue lasers by magnetron sputtering and confirmed that its low thermal rise property allows to double the output energy from the laser while maintaining high beam quality.

TA.5 • 08:55
Simplified Fabrication of Optical Coatings for Folded Jamin Interferometers Used for Refractive Index Measurement of Gases and Aerosols, Daniel Poitras[1], Alireza Moallemi[1], Joel C. Corbin[1], Jalal Norooz Oliaee[1]; [1]*National Research Council Canada, Canada.* In this work, we present the design and fabrication of optical coatings for the main optical component of a Folded Jamin Interferometer, focusing on simplifying their fabrication.

TA.6 • 09:00
Thermally Tuneable Fabry-Perot Ultrasound Sensor With Integrated Heating Electrode for Camera-Based Photoacoustic Tomography, Claus Villringer[3,1], Jan Sievers[1], Leonid Goldenberg[3,2], Christian Dreyer[3,2], Sigurd Schrader[3], Martin Regehly[3], Jan Laufer[1]; [1]*Institut für Physik, Martin-Luther Universität Halle-Wittenberg, Germany;* [2]*Research Division Polymeric Materials and Composites PYCO, Fraunhofer-Inst. for Applied Polymer Research, Germany;* [3]*Technical Univ. of Applied Sciences Wildau, Germany.* This work presents the development of a planar Fabry-Perot ultrasound sensor with an integrated heating electrode, capable of tuning and fixing the fringe position to a setpoint with a deviation of ±0.4 pm using a PID controller.

TA.7 • 09:05
Active Multi-Dielectric Cavity With Bloch Modes for Optical Gas Sensing, Lionel Fliegans[1]; [1]*Institut Fresnel, France.* We are developing a compact gas sensor for 10 ppb–10 ppm detection of formaldehyde and acetaldehyde using electroluminescence, multi-dielectric microcavities, chemical functionalization, and microfluidic integration for enhanced sensitivity and molecular specificity in confined environments.

TA.8 • 09:10
Bragg-Reflector-Enhanced Electrochromic Devices With Adjustable Optical Performance, Martin Crouan[1], Bill Baloukas[1], Oleg Zabeida[1], Jolanta-Ewa Klemberg-Sapieha[1], Ludvik Martinu[1]; *[1]Polytechnique Montréal, Canada.* All-solid-state electrochromic devices typically exhibit a limited reflection increase during their coloration. By integrating WO_3/ITO bilayers, we achieve over twice the reflection modulation obtained using standard architectures, offering new opportunities for smart optics.

TA.9 • 09:15
Coating Essentials for Camera Design: Perspectives From Coating Graduate Students, Natalie Fullerman[1], Zachary B. Schuberg[1], Megan Fallon[1], Samuel T. Fujisawa-Phillips[1], Yifei Huang[1], Madeleine LaChance[1], Jennifer D. Kruschwitz[1]; *[1]Univ. of Rochester, USA.* This paper outlines the results of optical interference coating students establishing system requirements for lens design students working on a macro *butterfly* camera. The coating students optimized throughput and enabled an extra visualization filter.

TA.10 • 09:20
Plasmonic Distributed Bragg Reflectors for Volatile Organic Compounds Sensing, Zdeněk Krtouš[2,1], Oleksandr Polonskyi[3], Pavel Pleskunov[1], Bill Baloukas[1], Ludvik Martinu[1], Jaroslav Kousal[2]; *[1]Department of Engineering Physics, Polytechnique Montréal, Canada; [2]Department of Macromolecular Physics, Charles Univ., Czechia; [3]Department of Chemical Engineering, UC Santa Barbara, USA.* Polymer-based Distributed Bragg Reflectors (DBRs) are emerging as promising low-cost volatile organic compound sensors. Here, Ag nanoparticles-doped DBRs are prepared via plasma methods, while using precise optical modeling and exploring their sensing potential.

TA.11 • 09:25
Bandwidth Control of Mid-IR Bandpass Filters to Optimise Sensitivity of NDIR Methane Sensors, Lewis Fleming[1,2], Shigeng Song[1], David Hutson[2], Sam Ahmadzadeh[1], Ewan Waddell[2], Ian Brikley[2], Craig Michie[3], Ivan Andonovic[3], Emma Keel[1], Paul Hargreaves[4], Des Gibson[1,2]; *[1]The Univ. of The West of Scotland, UK; [2]Albasense Ltd, UK; [3]Strathclyde Univ., UK; [4]Scottish Rural College, UK.* Here, we discuss the application of a very-narrow bandpass mid-IR optical filter designed to capture the Q-branch of the methane v_3 absorption band, providing high-sensitivity requirements for NDIR sensing in Digital Dairy Farming applications.

10:00 -- 11:00
Room: Presidio IV
TB • Deposition Technologies II
Presider: Bill Baloukas; Polytechnique Montréal, Canada and Bin Fan; Optorun Co Ltd, Japan

TB.1 • 10:00 (Invited)
Recent Progress on Versatile Variable Filters Using HELIOS Reactive Magnetron Sputtering Technology, frederic lemarquis[1], Antonin moreau[1], Fabien Lemarchand[1], Cihan Koc[1], Detlef Arhilger[2], Harro Hagedorn[2], Julien H. Lumeau[1]; *[1]Fresnel Institut, France; [2]Bühler, Germany.* Gradient optical interference filters are a promising way to miniaturize imaging spectrophotometer. In this paper, we present a versatile method for the fabrication of variable filters with different spatial profiles based on magnetron sputtering (PARMS).

TB.2 • 10:25
Bandpass Filters Using Magnetron Sputtered SiO_2 and a-Si for mid-IR Wavelengths, Penghui Ma[1]; [1]*National Research Council Canada, Canada.* Bandpass filters based on magnetron sputtered SiO_2 and a-Si are investigated. The effort is not limited to the near-IR range, but also tested for the highest possible wavelength for these materials in the mid-IR. We report on the fabrication of a bandpass filter around 3.5 µm.

TB.3 • 10:30
Ultra-Narrowband Absorption Filters, William H. Southwell[1]; [1]*Table Mountain Optics, USA.* Ultra-narrowband, down to 1 Angstrom or lower, absorption filter designs are presented. These are optical interference coatings using standard coating materials, but no absorbing layers or metals are included in the stack.

TB.4 • 10:35
Optical Emission Spectroscopy of Plasmas in Pulsed DC Reactive Magnetron Sputtering, Estrella Teran-Hinojosa[2], Roberto Sangines[1], Noemi Abundiz-Cisneros[1], Juan Aguila-Muñoz[1], Roberto Machorro-Mejia[2]; [1]*Materiales Avanzados, CNyN, UNAM, SECIHTI, Mexico;* [2]*Materiales Avanzados, CNyN, UNAM, Mexico.* Reactive pulsed DC magnetron sputtering plasma was analyzed using optical emission spectroscopy. It was found that higher duty cycles required more oxygen for target poisoning, and enhanced silicon emission and film's deposition rate.

TB.5 • 10:40
Comparison of Optical and Antibacterial Behavior of Nb2O5 Coatings Prepared by Gas Impulse Magnetron Sputtering With Homogenous and Gradient Distribution of Bioactive Ions, Damian Wojcieszak[1], Agata Obstarczyk[1], Bogumila Szponar[2], Patrycja Pokora[1], Marcin Przadka[3], Paulina Kapuscik[1], Jaroslaw Domaradzki[1], Des Gibson[4]; [1]*Faculty of Electronics, Photonics and Microsystems, Wroclaw Univ. of Science and Technology, Poland;* [2]*Inst. of Immunology and Experimental Therapy, Polish Academy of Sciences, Poland;* [3]*Food4Future Technologies Sp. z o. o., Poland;* [4]*Inst. of Thin Films, Sensors and Imaging, Univ. of the West of Scotland, UK.* Transparent Nb2O5-based thin-film coatings prepared by Gas Impulse Magnetron Sputtering (GIMS) demonstrate excellent optical properties and selective antibacterial activity. Doping with bioactive metals, distributed uniformly or in a gradient, enhances biocidal activity.

TB.6 • 10:45
Direct Current and Radio Frequency Plasma Sources for Co-Sputtering of All-Solid-State Electrochromic Devices, Yu Wei Chang[1], Hsi-Chao Chen[1], Hong-Jie Lin[1], Ri-Jun Li[1], Yi-Jie Jiang[1], Shih-Hao Shao[1], Po-Hung Li[1]; [1]*NYUST, Taiwan.* This study mainly uses tungsten trioxide (WO_3) doped titanium dioxide (TiO_2) to prepare complementary all-solid-state electrochromic device, and direct current (DC) and radio frequency (RF) power is used to sputter TiO_2 doped to WO_3 film.

TB.7 • 10:50
Characterization of PARMS Produced 1-µm Thick Ta2O5 and SiO2 Monolayers in 0.35-5 µm Spectral Range, Tatiana Amotchkina[2], Aliaksandr Myslivets[3], Nadzeya Khinevich[3], Jordi Sancho-Parramon[4], Vesna Janicki[4], Michael K. Trubetskov[1,2]; [1]*Max Planck Inst. of Quantum Optics, Germany;* [2]*OTF Studio GmbH, Germany;* [3]*I-Photonics UAB, Lithuania;* [4]*Institut Ruder*

Boskovic, Croatia. Layer materials combination Ta2O5/SiO2 is widely used for production of optical coatings in the broadband spectral ranges. Optical properties of PARMS produced monolayers were characterized based on spectral and ellipsometric data using two software tools.

TB.8 • 10:55
Optical and Durability Properties of Microwave Plasma Assisted Sputter Deposited Stoichiometric Silicon Nitride, Connor Lindsay[1], Carlos Garcia Nunez[2], Lewis Fleming[1], Ian Brikley[1], Stuart Reid[4], Iain Martin[3], Des Gibson[1]; *[1]Univ. of the West of Scotland, UK; [2]Electronics and Nanoscale Engineering, Univ. of Glasgow, UK; [3]Physics Department, Univ. of Glasgow, UK; [4]Department of Biomedical Engineering, Univ. of Strathclyde, UK.* A study of the optical and mechanical properties of stoichiometric Silicon Nitride deposited using microwave plasma assisted sputtering. A coating stress of -317MPa, hardness of 1.3GPa was obtained with a transmittance range of 300nm-5µm.

13:15 -- 14:30
Room: Presidio IV
TC • Manufacturing and Process Control
Presider: Silvia Schwyn Thöny; Evatec Ltd, Switzerland and Christoph Zaczek; Carl Zeiss SMT GmbH, Germany

TC.1 • 13:15 (Invited)
OIC 2025 Manufacturing Challenge, Daniel Poitras[1], Amy L. Rigatti[2], Michael R. Jacobson[3], Catherine C. Cooksey[4], Luke J. Sandilands[1], John J. Gilmore[5]; *[1]National Research Council Canada, Canada; [2]Univ. of Rochester, USA; [3]Optical Data Associates, USA; [4]USA, National Inst. of Standards and Technology, USA; [5]Optimax, USA.* The 2025 Optical Interference Coatings (OIC) Manufacturing Challenge consists in designing, fabricating and measuring a filter with transmittance and front and back reflectance spectra matching a predetermined profile as closely as possible.

TC.2 • 13:45 (Invited)
From Measurement to Control: Synergizing Advanced in Situ Metrology and Smart Data Analysis in Thin Film Deposition, Florian Carstens[1]; *[1]Laser Zentrum Hannover e.V., Germany.* Developed in-situ coating-process measurement techniques and concepts for structured central data aggregation are presented. The talk highlights how these enable advanced approaches to precise control and process optimization in designing and manufacturing optical interference coatings.

TC.3 • 14:10
Monitoring in Situ the Thermal Annealing of TiO_2-GeO_2 Coatings for High-Performance Distributed Bragg Reflectors, Michele Magnozzi[1,2], Stefano Colace[1], Shima Samandari[1], Michael Caminale[1], Valentina Venturino[1], Christophe Michel[3], Julien Teillon[3], Maurizio Canepa[1]; [1]*Università degli Studi di Genova, Italy;* [2]*Istituto Nazionale di Fisica Nucleare, Sezione di Genova, Italy;* [3]*Laboratoire des Matériaux Avancés, France.* The refractive index and thickness of amorphous mixed TiO_2-GeO_2 coatings are tracked in real time during the thermal annealing of the coatings. Results shed light on the relation between the annealing temperature and coatings properties.

TC.4 • 14:15
Direct Intermittent Monitoring in the DUV Range, Detlef Arhilger[1], Harro Hagedorn[1], Alfons Zoeller[1]; [1]*R&D, Buhler Alzenau GmbH, Germany.* The wavelength range for direct monitoring in box coaters was extended to the DUV range. An optical path with deuterium lamp, a special designed achromatic lens system and a PMT detector was used.

TC.5 • 14:20
Determination of Layer Thickness During Double-Side Coating, Thomas Melzig[1], Stefan Bruns[1], Philipp Farr[1], Bernd Galonska[2], Michael Schneider[2], Michael Vergoehl[1]; [1]*Fraunhofer IST, Germany;* [2]*VON ARDENNE, Germany.* Optical interference coatings are often applied on both sides of a substrate. We show an adaption of broad band monitoring of layer thickness for coating machines that allow simultaneous stack deposition.

TC.6 • 14:25
In-Situ Optical Monitoring for Linear Variable Filters (LVFs) Deposited Using Microwave Plasma Assisted Reactive Sputtering, James A. Rogers[1], Simon Hicks[2], Matthew Neeves[2], Frank Placido[1], Shigeng Song[1]; [1]*Univ. of the West of Scotland, UK;* [2]*Intellemetrics Global Ltd., UK.* This work presents the deposition of linear variable filters with a wavelength range of 450-800nm, control of the filters was achieved using a monochromatic optical monitor, demonstrating superior controllability when compared to quartz crystal monitoring.

14:50 -- 15:35
Room: Presidio IV
TD • Structured and Metaoptics
Presider: Jessica DeGroote Nelson; Edmund Optics Inc., USA and Michel Lequime; Fresnel Institut, France

TD.1 • 14:50 (Invited)
Metaoptics, From Lenses to Optical Module Solutions, Theodor Nielsen[1], Ram Narayanswamy[1]; [1]*NIL Technology, Denmark.* In the paper we present the value chain from design to prototyping and manufacturing of meta-optical element (MOEs) and how they can fully replace refractive optics, to create cameras for eye-tracking, gesture recognition, and more.

TD.2 • 15:15
Nano-Imprint Lithography of Metal Oxides: Materials and Nano-Fabrication Methods for Photonic Metasurfaces, Marco Abbarchi[1]; [1]*SOLNIL, France.* Sol-gel coatings and nano-imprint lithography are employed to directly frame 3D nano-structures composed of hard ceramics (e.g. SiO2, TiO2) over large surfaces. Photonic metasurfaces can be produced with high throughput

at low cost for applications in structural colour, anti-reflection coatings for high power lasers, AR/VR, and light emission.

TD.3 • 15:20
Architecting Periodic Columnar-Thin-Film Bilayer with a Central Layer Defect as Spectral Reflection-Hole Filter, Abdul Rehman[1], Akhlesh Lakhtakia[1]; *[1]Department of Engineering Science and Mechanics, The Pennsylvania State Univ., USA.* Periodic bilayers of columnar thin films with central layer defects were fabricated and optically characterized. Experimental analysis indicates that an optimal number of unit cells will deliver the best performance as a spectral reflection-hole filter.

TD.4 • 15:25
Enhancing Stability of the Optical Properties of Nanostructured All-Silica Coatings, Marcela Mireles Ramirez[1], Sara MacNally[1], Christopher Smith[1], Amy L. Rigatti[1]; *[1]Univ. of Rochester, USA.* We present the use of hexamethyldisilazane as a passivation treatment for nanostructured silica waveplates. Our results show the successful passivation of the silica matrix, preventing interaction with moisture, and overall stabilizing the optical properties.

TD.5 • 15:30
Emerging Fabrication Technologies for all-Dielectric Periodic Metastructures in Coatings, Lina Grineviciute[1,2], Julianija Nikitina[1], Tomas Tolenis[1,4], Mindaugas Andrulevicius[3], Simonas Indrisiunas[1]; *[1]Ctr for Physical Sciences & Technology, Lithuania; [2]Vilnius Univ., Lithuania; [3]Kaunas Univ. of Technology, Lithuania; [4]ELI Beamlines Facility ERIC, Czechia.* The method to structure and oxidize metallic layers on glass, creating transparent oxide surfaces with periodic patterns, is presented. Sub-micrometer gratings are formed using laser interference patterning of tantalum layers, followed by thermal oxidation.

Wednesday, 21 May

08:15 -- 09:30
Room: Presidio IV
WA • Ultrafast Coatings
Presider: Peter Fuqua; The Aerospace Corporation, USA and Vladimir Pervak; Ludwig-Maximillians-Universität Munchen, Germany

WA.1 • 08:15 (Invited)
Thin Film as Ultrashort Laser Pulse Shaper, Jing Meng[1]; *[1]Optimax Systems Inc, USA.* Shaped ultrashort pulse is essential to highly efficient laser-matter interactions. Beyond the SLM, this study investigates the potential of thin film as Femtosecond pulse shaper due to its compact size, user friendly and low cost.

WA.2 • 08:40 (Invited)
Development of Refractive Index Control Technology for Optical Thin Films by a Combination of Sputtering and Electron Beam Evaporation, Naoya Tajima[1], Takayuki Matsudaira[2], Hiroshi Murotani[1]; *[1]Tokai Univ., Japan; [2]Shincron Co., Ltd., Japan.* By controlling the refractive index of SiO_2 optical thin films using a deposition system that combines sputtering

and EB evaporation, 51-layer SiO_2 mono-material multilayer coatings, comprising the same deposition material as the substrate, were fabricated.

WA.3 • 09:05
Investigation of sub-ps LIDT of Various Dielectric Coatings Deposited by PVD Techniques With the Same Laser Damage set-up, Marine Chorel[1], Océane Aubard[1], Nadja Roquin[1], Laurent Lamaignère[1], Eric A. Lavastre[1]; *[1]CEA, France.* During the last few years, in the search of increasing the LIDT of Petal mirrors, various materials and coatings techniques have been evaluated on the same damage set-up. This gives insights for manufacturing.

WA.4 • 09:10
Impact of Intermediate States on Nonlinear Absorption, Joshua R. McCauley[1], Sebastian Balendat[1,3], Andreas Wienke[1,2], Detlev Ristau[1,2], Marco Jupé[1,2]; *[1]Laser Zentrum Hannover, Germany; [2]Cluster of Excellence PhoenixD, Leibniz Univ. Hannover, Germany; [3]Inst. for Quantum optics, Leibniz Univ. Hannover, Germany.* During deposition of hafnia thin films, defects such as oxygen vacancies or super-stoichiometry can lead to the formation of intermediate states between the valance and conduction bands. These were investigated for nonlinear absorption.

WA.5 • 09:15
High-Power Laser-Interface Interactions and Fundamental Mechanisms of Laser Damage of High-Quality Multilayer Coatings by Femtosecond Laser Pulses, Vitaly Gruzdev[1]; *[1]Univ. of New Mexico, USA.* Analysis of interactions of high-power femtosecond laser pulses with dielectric-dielectric interfaces of multilayer optical coatings suggests feasibility of dynamic absorption enhancement within few-nanometer-thick layers at the interfaces. Novel mechanisms of ultrafast laser-induced damage are discussed.

WA.6 • 09:20
Broadband Scattering Loss of Dispersive Mirrors, Xiaochuan Ji[1], Jinlong Zhang[1], Hongfei Jiao[1], Jianglin Dai[1], Xinshang Niu[1], Jingjing Xia[1], Xinbin Cheng[1], Zhanshan Wang[1]; *[1]Tongji Univ., China.* In the resonance region of dispersive mirrors, may cause significant scattering. This study discussed broadband scattering in dispersive mirrors and validates through scattering measurements. And shows that optimizing the design may reduce broadband scattering.

WA.7 • 09:25
The Effect of Coating Thickness Error on Broadband Pulse Compression Gratings, Zachary B. Schuberg[1], Douglas Smith[1], Dale Smith[1], Turan Erdogan[1]; *[1]Plymouth Grating Laboratory Inc., USA.* Coating thickness variation affects the diffraction efficiency of MLD pulse compression gratings. Experimental coating data is examined. Simulations compare the sensitivity of different grating designs with narrow and broad bandwidths.

10:00 -- 10:40
Room: Presidio IV
WB • Keynote Session II
Presider: Jennifer Kruschwitz; Univ. of Rochester, USA and Ric Shimshock; MLD Technologies, LLC, USA

WB.1 • 10:00 Keynote Submission
How Laser Fusion Power Generation Could Impact the Coating Industry, Christopher J. Stolz[1]; [1]*Lawrence Livermore National Laboratory, USA.* Achieving laser fusion ignition in 2022 has been a catalyst for the creation of multiple startup power companies. Commercialization of laser fusion will have a significant impact on the precision optics coating industry.

10:40 -- 11:00
Room: Presidio IV
WC • Laser Coatings II
Presider: Jennifer Kruschwitz; Univ. of Rochester, USA and Ric Shimshock; MLD Technologies, LLC, USA

WC.1 • 10:40
Survey of Oxide Mixtures for Multilayer Dielectric Coatings for λ ≤ 355 nm, Carmen S. Menoni[1,2], Ramon Rodriguez Lopez[1], Maxwell Weiss[1], Aaron Davenport[1], Francois Schiettekatte[3], Martin Chicoine[3]; [1]*Colorado State Univ., USA;* [2]*XUV Lasers, USA;* [3]*Univ. of Montreal, Canada.* Oxide mixtures are used to engineer ultraviolet coatings for fusion energy lasers operating at wavelengths λ <355 nm. It is shown that oxide mixtures of HfO_2-SiO_2 and HfO_2-Al_2O_3 allow extension of the optical bandgap to energies of 6.25 eV (wavelengths as short as λ=190 nm).

WC.2 • 10:45
Distributed Light Absorption in a Biocompatible Film for High Energy Laser Pulses, Christopher Harrison[1], Isaac Degani[1], Alex Stange[1], Matthew Sullivan[1], Jean Serrano[1], Matthias Wagner[1], Chris Cook[2]; [1]*Cellino Biotech, USA;* [2]*Edmund Optics, USA.* To support an all-optical bioprocessing strategy for adherent stem cells, Cellino Biotech is developing a robust, light absorbing film stack that interacts with a pulsed laser.

WC.3 • 10:50
Influence of Oxygen Flow and Sub-Stoichiometry on the Optical and Damage Resistance Properties of Hafnium Oxide Thin Films, Amira Guediche[1], Saaxewer Diop[1], Raluca Negres[1], Leonardus B. Bayu Aji[1], Colin Harthcock[1]; [1]*Lawrence Livermore National Laboratory, USA.* This study examines how oxygen flow during hafnia coating deposition by ion beam sputtering affects optical properties, film structure, and laser damage performance under nanosecond laser exposure.

WC.4 • 10:55
Preparation of Anti-Reflection Periodic Nanostructure Devices With 3ω High Laser Damage Threshold, Lidi Zhang[1], Hongfei Jiao[1], Xinshang Niu[1], Dongdong Li[1], Xiaochuan Ji[1], Jingjing Xia[1], Jinlong Zhang[1], Xinbin Cheng[1], Zhanshan Wang[1]; [1]*Tongji Univ., China.* Large-area 3ω anti-reflection periodic nanostructure devices have been prepared on the surface of

fused quartz by HF etching, EBL, step-and-flash Nanoimprint and ICP etching. It exhibits excellent transmissivity, environmental stability and Laser-induced Damage Threshold.

13:15 -- 14:30
Room: Presidio IV
WD • Metrology and Coating Properties I
Presider: Garrett Cole; Thorlabs Inc, USA and Sven Schröder; Fraunhofer IOF, Germany

WD.1 • 13:15 (Invited)
Towards Renewed ISO 21254-1 and -2 Standards: Addressing Industry Needs in Laser Damage Threshold Testing, Andrius Melninkaitis[1]; [1]*Vilniaus Universitetas, Lithuania.* This presentation outlines recent efforts to revise ISO 21254-1 and -2 standards, addressing industry needs in laser damage threshold testing. Focus areas include improving testing accuracy, damage criteria, and analysis methods to meet evolving laser technology challenges.

WD.2 • 13:40
Fabrication and Characterizations of an Aerogel All-Silica Mirror, Phyo P. Lin[1], Joseph Talghader[1]; [1]*Univ. of Minnesota, USA.* Two different techniques to fabricate all-silica mirrors using dense silica and silica aerogel films were investigated. An all-silica mirror with near 100% reflectivity was built with 23 layers of PECVD dense silica and silica aerogel.

WD.3 • 13:45
Metrology of low Absorption and Photo-Induced Effects at 1.1 and 1.5 µm With Lock-in Thermography and Phase Imaging Techniques, Mathias Soulier[1], Hélène krol[2], Julien H. Lumeau[1], Laurent Gallais[1]; [1]*Institut Fresnel, France;* [2]*CILAS, France.* This study quantifies absorption and wavefront deformations in optical thin films using Lock-in Thermography (LIT) and phase imaging techniques. A finite element model simulates thermo-mechanical effects, providing insights to optimize high-power laser system performance and reliability.

WD.4 • 13:50
Thin Film Interface and Bulk Characterization via Second Harmonic Generation, Jakub Lukes[1,2], Vít Kanclír[1,2], Karel Zidek[1]; [1]*TOPTEC, Inst. of Plasma Physics of the Czech Academy of Sciences, Czechia;* [2]*Technical Univ. of Liberec, Czechia.* We present a method based on SHG phenomena for thin centrosymmetric film characterization. We show measurements and consequent data fitting and their comparison to simulated data. Problems and benefits of this method are discussed.

WD.5 • 13:55
Effect of Surface Modification on Properties of Porous SiO_2 High Reflection Coating, Wenyun Du[1], Tianbao Liu[1], Jianda Shao[1], Meiping Zhu[1]; [1]*Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China.* Porous silica coatings are prepared using plasma ion-assisted electron beam co-evaporation and chemical etching to investigate the effect of surface modification, showing that will reduce the laser resistance of high reflection coatings.

WD.6 • 14:00
Multi-Angle Photometric Measurements of Specular and Diffuse Samples, Scott Melis[1]; [1]*Agilent Technologies, USA.* Automated, angle-dependent spectroscopic measurements of large wafers or multiple smaller optical components provide more data for controlling product quality. Reflectance data for specular and/or diffuse samples using the Cary Spectrophotometer's UMA are presented.

WD.7 • 14:05
Phase-Shift Interferometer Measurement of Anisotropic Stress in Wide Bandgap Zirconium Oxide Thin Films, Hong-Jie Lin[1], Hsi-Chao Chen[1], Yu Wei Chang[1], Kun-Hong Chen[1], Guan-Yi Su[1], Zheng-Zhan Hong[1], Tan-Jung Li[1]; [1]*NYUST, Taiwan.* A self-made phase-shift interferometer with the 3% measured error was used to measure the anisotropic stresses of zirconium oxide (ZrO_2) film. The minimum principle and shearing stresses at are -82.98 and 26.79 MPa, respectively.

WD.8 • 14:10
Phase Coating Metrology of a Roof Prism Using Standard RT Spectrophotometer, Chris Cook[1], Gary Pajer[1]; [1]*Edmund Optics Inc., USA.* We present on a simple technique developed to measure a phase coating using a standard RT spectrophotometer. We show results of measurements broadband phase correction coating on a (solitary) roof prism used in binoculars.

WD.9 • 14:15
Nonuniformity Metrics for Coated Circular Substrates, Eric Nybank[1], Adam Preuss[1], Jim C. Switzer[1], Markus K. Tilsch[1]; [1]*Viavi Solutions Inc, USA.* We define total, radial, and azimuthal nonuniformity to describe coating nonuniformity on circular substrates. The calculations prove sensitive to details of potentially necessary interpolation. We apply the metrics on a planetary motion simulation example.

WD.10 • 14:20
Controlling Stress of Sputtered Hydrogenated Amorphous Carbon (a-C:H) for Infrared Durable Optical Coating of Chalcogenide Glass, Jonathan Pomfret[1,2], Sam Ahmadzadeh[2], Lewis Fleming[2], Greig Oliver[2], Peter Mackay[1], Des Gibson[2]; [1]*G&H, UK;* [2]*Inst. of Thin Films, Sensors and Imaging, Univ. of the West of Scotland, UK.* Infrared optical coatings using hydrogenated amorphous carbon were deposited on chalcogenide glass. Control of the coating stress using variable hydrogen flow resulted in a durable coating with good adhesion which passes TS1888 wiper test.

15:00 -- 16:15
Room: Presidio IV
WE • Deposition Technologies III
Presider: Christian Mühlig; Fraunhofer IOF, Germany and Christopher Stolz; Retired, USA

WE.1 • 15:00 (Invited)
Development of Large Area Optical Coatings for Ultra-High Intensity Laser Systems in ELI, Tomas Tolenis[1]; [1]*ELI Beamlines Facility ERIC, Czechia.* Abstract not available.

WE.2 • 15:25
Gallium Oxide Nanostructures Film Synthesized via Ultra-Short Laser Pulse in-Situ Nanostructure Generation (ULPING): A Novel Approach for Optoelectronic Applications, Nishant S. Jamwal[1], Amirkianoosh Kiani[1]; *[1]Ontario Tech Univ., Canada.* Abstract: Gallium oxide, an emerging optoelectronic material was synthesized into nanostructures on a gallium phosphide substrate via ULPING technique. Characterization through SEM, EDX, and XPS confirmed nanostructure formation, while REELS determined the band gap as 4.8 eV.

WE.3 • 15:30
Efficient Manufacturing of Quantized Nanolaminate Multilayer Coatings, Stephan Waldner[2], Manuel Baertschi[1], Silvia Schwyn Thöny[2], Fabian Steger[1], Daniel Schachtler[1], Christoph Sturzenegger[1], Thomas Frei[2], Xavier Mäder[3]; *[1]RhySearch, Switzerland; [2]Evatec AG, Switzerland; [3]Laboratory for Mechanics and Nanostructures, EMPA, Switzerland.* Quantized nanolaminates (QNL) are efficiently manufactured and incorporated in multilayer designs using magnetron sputtering. In a comparison, fs-LIDT testing shows excellent performance of mirrors containing QNL, exceeding the values of designs composed of standard materials.

WE.4 • 15:35
PARMS-Based Nanolaminates for UV-Applications, Julien H. Lumeau[1], Fabien Lemarchand[1], Supratik Dasgupta[2]; *[1]Fresnel Institut, France; [2]Bühler, USA.* We present a comparative study of Ta_2O_5/SiO_2 and Nb_2O_5/SiO_2 nanolaminates. They were fabricated using Plasma-Assisted Reactive Magnetron Sputtering. We show that these nanolaminates present an interesting alternative to classical high-refractive-index materials for UV applications.

WE.5 • 15:40
Optical Characterization of Si-SiO_2 Quantizing Nanolaminates, Joerg Terhuerne[1], Tatiana Amotchkina[3], Stefan Bruns[2], Philipp Farr[2], Thomas Melzig[2], Michael Trubetskov[3,4], Michael Vergoehl[2]; *[1]Bte Bedampfungstechnik GmbH, Germany; [2]Fraunhofer Inst. for Surface Engineering and Thin Films IST, Germany; [3]OTF Studio GmbH, Germany; [4]Max-Planck Inst. of Quantum Optics, Germany.* Quantizing nanolaminates are under development for use as materials with optimized properties for optical interference coatings. The optical dispersion needs another description than simply mixing the basic materials because of the bandgap shift.

WE.6 • 15:45
Quantizing Nanolaminates and Suboxides of Germanium, Cassian Bergmann[1], Morten Steinecke[1], Andreas Wienke[1,2], Marco Jupé[1,2]; *[1]Laser Zentrum Hannover e.V., Germany; [2]Cluster of Excellence PhoenixD, Germany.* Using a new coating procedure in the IBS process, hybrid quantizing nanolaminates based on Ge and TiO_2 were prepared. A refractive index of over 3.4 was measured for 1550 nm and the band gap was shifted to a wavelength of 1377 nm.

WE.7 • 15:50
Antireflection Coatings Using Nanolaminate Layers with Intermediate Refractive Index, Silvia Schwyn Thöny[1], Stephan Waldner[1], Manuel Baertschi[2], Thomas Frei[1]; *[1]Evatec Ltd, Switzerland; [2]Rhysearch, Switzerland.* We revisit antireflection coating designs with intermediate refractive index using nanolaminate layers and show in design and experiment that lower average reflection and sensitivity against thickness error can be reached compared to standard two material designs.

WE.8 • 15:55
Quantitative Scatterometry: Mapping Defects and Contamination on Optical Surfaces, Adrien Bolliand[1], Michel Lequime[1], Claude Amra[1], Myriam Zerrad[1]; *[1]Fresnel Institut, France.* A new spatially resolved scatterometer designed for the recording of up to 400\,000 elementary BRDF for a single optical component is presented. It allows quantifying the weight of defects and contamination in the scattering losses.

WE.9 • 16:00
Submicrometer Defect Detection and Classification by Angle Resolved Light Scattering, Sven Schröder[1], Anne-Sophie Munser[1], Siyao Ma[1], Tobias Herffurth[1], Thomas Gischkat[1], Christian Mühlig[1,2], Andreas Tünnermann[1,2]; *[1]Fraunhofer IOF, Germany; [2]Inst. of Applied Physics, Friedrich-Schiller Univ., Germany.* Angle resolved light scattering is used to analyze sub-micron defects in coatings to improve performance and stability of optical components for high power laser applications.

WE.10 • 16:05
Effect of Transition Metal (Fe, Co) ion Doping on TiO2 Nano Particles and its Photonic Applications for Spintronics., kirit kumar S. Siddhapara[1]; *[1]Research and development, Chemight India Chemicals, India.* we report the growth of [Fe, Co]xTiO2 (x=0.01,0.02&0.04) particles prepared by Sol-Gel technique. The results obtained in this research contribute to the understanding of binary doped transition metal in TiO2 nanoparticles can lead the efforts of enhancing their application in Photonic and spintronics.

Thursday, 22 May

08:15 -- 09:30
Room: Presidio IV
ThA • Applications III and Coatings for Space
Presider: James Barrie; The Aerospace Corporation, USA and Laurent Pinard; CNRS-IN2P3, France

ThA.1 • 08:15 (Invited)
Unique Optical Bench Able to Measure Spectrally the WFE of the EUCLID Dichoic Optic, Benoit Sassolas[1], Maël Baron[1], Laurent Pinard[1], Anne Ealet[1], Guillaume Dovillaire[2], Patrick Grand-Chavin[2], Rémy Juvenal[2], Jérôme Legrand[2], Fabrice Sanson[2], Pierre-Antoine Frugier[3], Luis M Gaspar Venancio[4]; *[1]Univ Claude Bernard Lyon 1, CNRS/IN2P3, IP2I Lyon - LMA, France; [2]Imagine Optic SA, France; [3]Université Paris-Saclay, Université Paris Cité, CEA, CNRS, AIM, France; [4]European Space Agency-ESTEC, Netherlands.* The performance of the *Euclid*'s dichroic mirror is impacted by its chromatic wavefront error (WFE). A bench has

been developed to measure the WFE according to the wavelength, the angle of incidence and the polarization.

ThA.2 • 08:40 (Invited)
Advanced Antireflective Solutions for Quantum Computing Applications Based on Transparent Conductive Nanostructures, Astrid Bingel[1], Friedrich Rickelt[1], Ulrike Schulz[1], Sven Schröder[1]; *[1]Fraunhofer IOF, Germany.* Transparent conductive oxides face reflection losses due to high refractive index. ITO nanostructures prepared via vacuum deposition and plasma-etching, achieving low effective refractive indices and therefore excellent antireflective properties for quantum computing applications are presented.

ThA.3 • 09:05
On the Impact of Low-Energy Protons on the Optical Performance of Coated Optical Devices for Oblique Incidence Implementation, Anna Sytchkova[1], Emilio Corte[2], Sabereh Taghdisi Rastkar[1,3], Elena Nieto Hernández[2]; *[1]ENEA Optical Coatings Group, Italy; [2]Physics, Univ. of Turin, Italy; [3]Information Electronics and Telecommunication Engineering, La Sapienza Univ. of Rome, Italy.* R.f.-sputtered hafnia thin films were exposed to low energy protons. Good stability of the films was confirmed, while a dramatic change induced in the performance of coated optics was evidenced at certain incidence angles.

ThA.4 • 09:10
Dielectric Broadband Mirrors for Space Applications, Morten Steinecke[1], Michael Hunnekuhl[1], Marc Neufert[1], Simon Strotmann[2], Volker Kirschner[2], Andreas Wienke[1]; *[1]Laser Zentrum Hannover e.V., Germany; [2]ESTEC, European Space Agency, Netherlands.* The paper investigates purely dielectric broadband mirrors as an alternative to metallic optics for space applications. Designs, materials, and production for different space missions are presented, as well as results and advantages over metallic coatings.

ThA.5 • 09:15
Design and Development of Dichroic With Suppression of Harmonics Stopbands for Future Mars Missions, Hélène Krol[1], Xavier Buet[1], Grégory Chauveau[1], Didier Torricini[1]; *[1]CILAS, France.* This paper presents the design and development of a new dichroic component for Mars missions, with a specific design that includes harmonic suppression, to improve Laser Induced Breakdown Spectroscopy (LIBS) analysis of Mars surface materials.

ThA.6 • 09:20
Fabrication of the Film with Low-Refractive Index and Lowscattering for Anti-Reflective Coating, Ryoko Suzuki[1]; *[1]Nikon Corporation, Japan.* Porous silica thin film bearing low refractive index was successfully prepared using the sol-gel method. By careful selection of raw materials, thin films with both a low refractive index and low scattering can be fabricated.

ThA.7 • 09:25
Coronographs for Laser-Guide Star Adaptive Optics at the Starfire Optical Range, Lirong Sun[1,2], Lauren Schatz[3], Nathan Episcopo[4], Tod Laurvick[3], Jeremiah Gaulding[3], Maggie E. Lankford[1,5], Amy Morren[1,2], Mala Mateen[3], Robert L. Johnson[3], Michael Carter[1], Peter R. Stevenson[1], Lirong Sun[2]; *[1]Materials and Manufacturing Directorate, Air Force Research Laboratory, USA; [2]Azimuth Corporation, USA; [3]Directed Energy Directorate, Air Force Research Laboratory, USA; [4]Center for Advanced Materials Research, Univ. of Texas El Paso,*

USA; [5]UES, a BlueHalo Company, USA. We present the fabrication and characterization of coronographs for testbed evaluation at the Air Force Research Laboratory Starfire Optical Range. These coronagraphs represent photolithographically patterned fused silica substrates with anti-reflection, reflective, and absorptive multilayer coatings.

10:00 -- 11:00
Room: Presidio IV
ThB • Coating Design
Presider: Ludvik Martinu; Ecole Polytechnique, Canada

ThB.1 • 10:00 (Invited)
OIC Design Challenge Results, Jennifer D. Kruschwitz[1], Michael K. Trubetskov[2,3], Jason Keck[4]; *[1]Univ. of Rochester, USA; [2]Max Planck Inst. of Quantum Physics, Germany; [3]OTF Studio GmbH, Germany; [4]G5 Infrared, USA.* The design problems for OIC 2025 involve a Design for Production challenge (Problem A) and an Immersed, Polarizing Notch Filter challenge (Problem B).

ThB.2 • 10:30
Reverse Engineering of Optical Coatings with a Machine Learning Algorithm, Diana Tonova[1], Michael Sundermann[1], Florent Martin[2], Joseph O'Leary[2]; *[1]Carl Zeiss Jena GmbH, Germany; [2]Carl Zeiss AG, Germany.* In this study, a machine learning algorithm (Partial Least Squares) is successfully applied for the reverse engineering of manufactured multilayered coatings. The algorithm retrieves the coating layers thicknesses without a need of specialized expert knowledge.

ThB.3 • 10:35
Broadband Enhancement of a Vanadium Oxide Variable Emissive Multilayer, Samuel L. Dunscombe[1,2], Peter D. Fuqua[1], David Abraham[2], James Barrie[1], Aaswath Raman[2]; *[1]The Aerospace Corporation, USA; [2]Materials Science and Engineering, UCLA, USA.* Vanadium dioxide based variable emissive designs demonstrated improved change of emittance through the introduction of enhancement layers. Based on this success, an optimized simulated emittance of 0.81 was achieved for future fabrication.

ThB.4 • 10:40
Advanced Multi-Objective and Robust Design Method for Optical Coatings, Jinlong Zhang[1], Ailing Pan[1], Jianglin Dai[1], Xiaochuan Ji[1], Xinshang Niu[1], Hongfei Jiao[1], Xinbin Cheng[1], Zhanshan Wang[1]; *[1]Tongji Univ., China.* Two advanced optical coating design methods have been proposed and validated, including multi-objective optimization algorithms for simultaneously optimizing multiple physical properties, and robust design method for correlation manufacturing errors appear in optical monitoring.

ThB.5 • 10:40
Stopband Spacing and Count for Sawtooth Thickness Modulated Thin-Film Designs, Bruce E. Perilloux[1]; *[1]BP Scientific LLC, USA.* Analytical design of multilayer thin-films and stopband positions was previously investigated for sinusoidal thickness modulation. Here, the relationship of stopband spectral positions and number versus modulation period are determined for select sawtooth thickness modulation schemes.

ThB.6 • 10:45
***Ab Initio* Modeling of Thin-Film TiN: Implications for Machine Learning Optical Metasurface Design,** Eric Suter[1,2], Lirong Sun[2,1], Nathan Episcopo[3], Amy Morren[1,2], John G. Jones[1], Peter R. Stevenson[1], Eric S. Harper[1]; *[1]Air Force Research Laboratory, USA; [2]Azimuth Corporation, USA; [3]Center for Advanced Materials Research, Univ. of Texas, USA.* We show that special quasi-random cells can be used within density functional theory to predict the optical properties of TiN think films and that metasurface inverse design via machine learning depends sensitively on these optical properties.

ThB.7 • 10:50
Unified Framework for Modeling Parameter-Dependent Optical Constants in Thin-Film Coating Design, Joseph Peeples[1,2], Lirong Sun[1,2], Angelica Drees[1,2], Maggie E. Lankford[1,4], William H. Southwell[3], Peter R. Stevenson[1]; *[1]Materials and Manufacturing Directorate, Air Force Research Laboratory, USA; [2]Azimuth Corporation, USA; [3]Table Mountain Optics, USA; [4]UES, USA.* A modeling design framework is presented for variable optical property materials beyond wavelength (i.e., thickness, composition, and temperature). Our approach integrates such parameter-dependent variations within the design optimization to further advance optical thin-film engineering.

13:30 -- 14:45
Room: Presidio IV
ThC • Deposition Technologies IV
Presider: Hsi-Chao Chen; National Yunlin Univ of Science and Tech, Taiwan and Daniel Poitras; National Research Council Canada, Canada

ThC.1 • 13:30 (Invited)
Realizing Nanophotonic Effects Through Thin-Film Optical Coatings, Chunlei Guo[1]; *[1]Univ. of Rochester, USA.* Abstract not available.

ThC.2 • 13:55 (Invited)
Development of Neutron Film Elements and Optics in IPOE, Tongji Univ., Wentao Song[1], Zhong Zhang[1], Jun Yu[1], Jialian He[1], Qiushi Huang[1], Runze Qi[1], Shengzhen Yi[1], Kun Wang[1], Xiaoqiang Wang[1], Qiya Zhang[1], Weihang Hong[2], Xuewu Wang[2], Zheng Qu[3], Zhanshan Wang[1], Xiaochuan Ji[1]; *[1]Tongji Univ., China; [2]Tsinghua Univ., China; [3]Institude of Nuclear Physics and Chemistry, China.* High-reflectivity Ni/Ti supermirrors, guiders, multi-shell nested and multi-channel focusing systems have been successfully designed and fabricated to achieve the transmission, focusing and collimation of neutron beam using direct-current magnetron sputtering and integrated assembly technology.

ThC.3 • 14:20
High Speed Atomic Layer Deposition of Broadband Antireflection Coatings Based on Nanoporous Alumina, Jani Holopainen[1], Abhishekkumar Thakur[1], Adriana V. Szeghalmi[2], Stephan Mingels[1], Harro Hagedorn[1]; *[1]Bühler Leypold Optics, Germany; [2]Fraunhofer Inst. for Applied Optics and Precision Engineering IOF, Germany.* Spatial ALD and hot water treatment to nanoporous alumina were used to prepare a broadband antireflection coating. High deposition rate and low average reflection below 0.01% in the visible range were achieved.

ThC.4 • 14:25
Two-Stage Thermal Chemical Vapor Deposition Preparation of 2D MoS_2 Modified ZnO/Cu_2O Sensing Electrode, Rong-Ling Ni[1], Hsi-Chao Chen[1], An-Hsiung Cheng[1], Kun-Zu Yin[1], Zhoun-Qing Wang[1]; [1]*NYUST, Taiwan.* Two-dimensional layered molybdenum disulfide (MoS_2) was fabricated with two-step thermal chemical vapor deposition (CVD) modified Cu_2O/ZnO NRs composite electrodes on Ex-ITO. This energy gap of n-MoS_2 can match n-Zn NRs to increase the sensing intensity.

ThC.5 • 14:30
Spatial Atomic Layer Deposition: a new Revolution in Ultra-Fast Production of Conformal Optical Interference Coatings, John Rönn[1], Sauli Virtanen[1], Emmanuele Sortino[1], Philipp Maydannik[1], Sami Sneck[1]; [1]*Beneq, Finland.* We present conformal, stress-neutral, low-loss, and durable optical interference coatings fabricated with a novel spatial atomic layer deposition that enables thin film deposition up to two orders of magnitude faster than traditional atomic layer deposition.

ThC.6 • 14:35
Plasmonic Nanoparticles for Optical Coatings, Bill Baloukas[1], Pavel Pleskunov[1], Artem Shelemin[1], Oleg Zabeida[1], Ludvik Martinu[1]; [1]*Polytechnique Montréal, Canada.* The integration of plasmonic absorption in optical coatings is of interest, but far from trivial. We explore the use of a gas aggregation cluster source for the generation of silver nanoparticles and deposition of nanocomposites.

ThC.7 • 14:40
The Influence of Substrate Material and Surface Morphology on the Layer Growth via Plasma-Enhanced Atomic Layer Deposition, Jingjing Xia[1], Jinlong Zhang[1], Hongfei Jiao[1], Xinshang Niu[1], Xiaochuan Ji[1], Jingyuan Zhu[1], Siyu Dong[1], Xinbin Cheng[1], Zhanshan Wang[1]; [1]*Tongji Univ., China.* Here, we discuss the influence of substrate material and its microscopic surface morphology on the optical properties and surface evolution deposited via plasma-enhanced atomic layer deposition (PEALD).

15:15 -- 16:15
Room: Presidio IV
ThD • Metal Coatings
Presider: Julien Lumeau; Fresnel Institut, France and Michael Trubetskov; Max-Planck-Institut fur Quantenoptik, Germany

ThD.1 • 15:15 (Invited)
Improvement of the Stability of Silver Thin Films by the Introduction of Nanolayers, Midori Kawamura[1]; [1]*Kitami Inst. of Technology, Japan.* We have achieved high stability of a silver thin film that can withstand environmental test in high-humidity atmospheres by introducing organic monolayers or metal nanolayers on the film surface.

ThD.2 • 15:40
Low Humidity Mixed Flowing Gas Exposure of Various Silver Mirrors, Diana Alaan[1], Frank Pan[2], Kelsey Folgner[1], James Barrie[1]; [1]*The Aerospace Corporation, USA;* [2]*Lawrence Livermore, USA.* Different types of protected silver mirror samples were exposed to 220 hours

Mixed Flowing Gas at varying humidity levels of 30%, 40%, 50%, and 70% RH to determine the effects of humidity in corrosion attack.

ThD.3 • 15:45
Design Optimization of Metal-Dielectric Bandpass Filters Using Experimentally Derived Thickness-Dependent Optical Dispersions, Maggie E. Lankford[3,1], Lirong Sun[3,2], Joseph Peeples[3,2], John G. Jones[3], Peter R. Stevenson[3]; *[1]BlueHalo, USA; [2]Azimuth Corporation, USA; [3]Materials and Manufacturing Directorate, Air Force Research Laboratory, USA.* Optical bandpass filters are designed using layer thickness-dependent optimization with experimentally derived optical disperion data from complex index ultrathin metal films (≤20 nm). Improvement in passband transmission is presented while maintaining low blocking band transmission.

ThD.4 • 15:50
Smart Color Designs with Ag and Au Metal-Island Films, Tatiana Amotchkina[2], Michael K. Trubetskov[1,2], Petar Pervan[3], Vesna Janicki[3]; *[1]Max Planck Inst. of Quantum Optics, Germany; [2]OTF Studio GmbH, Germany; [3]Ruder Boskovic Inst., Croatia.* Multilayer structures incorporating silver and gold metal-island films in two different embedding materials are designed to achieve the reflectance of three distinct colors. The designs are specially adjusted for micro and nanoarray fabrication.

ThD.5 • 15:55
Ag- Based Interference Filter by Plasma Assisted Reactive Magnetron Sputtering, Navas Kutty[1], Stephan Mingels[1], Harro Hagedorn[1]; *[1]Buhler Alzeanu GmbH, Germany.* Dielectric/Ag/dielectric based interference color filters are deposited by plasma assisted reactive magnetron sputtering (PARMS). A peak transmission of 50-55 % in RGB regions and a high optical density of 4.5 in the NIR was achieved without compromising the environmental stability criteria.

ThD.6 • 16:00
Relationship Between Synthesis Parameters, in-Situ Stress, and Optical Surface Quality of AgAl Thick Films, Vania Jiao[1], Chelsea D. Appleget[1], Scott Sitzman[1], In-Tae Bae[1], Christopher Panetta[1], James D. Barrie[1], Kelsey Folgner[1]; *[1]The Aerospace Corporation, USA.* AgAl alloys were magnetron sputtered at various working pressures while monitoring in-situ residual stress. Using cross-sectional TKD and surface optical measurements, the deposition parameters yielding the best optical and stress performance are identified and discussed.

ThD.7 • 16:05
Spectrally and Time Resolved Measurements of Photo-Induced Thermal Radiation of Metallic Thin-Film Coatings, François Thullier[2,1], Claude Amra[1], Paul Rouquette[1], Myriam Zerrad[1], Hélène KROL[2]; *[1]Institut Fresnel, France; [2]CILAS, France.* We present the instrument that has been developed to perform spectrally and time resolved measurements of photo-induced thermal radiation in optical thin films. The first step was dedicated to wide band measurements in the MIR, then, narrowband filters have been implemented to obtain a calibrated instrument.

ThD.8 • 16:10
Induced Transmission Filters with Complex Index Hydrogenated Al-Doped ZnO and Ultra-Thin Ag Films, Lirong Sun[2,1], John G. Jones[2], Peter R. Stevenson[2]; [1]*Azimuth Corporation, USA;* [2]*Air Force Research Laboratory, USA.* Hydrogenated Al-doped ZnO (HAZO) and ultra-thin bulk-like Ag films were prepared using pulsed DC magnetron sputtering and RF etching techniques. Induced transmission filters were designed and deposited using derived optical properties.

16:30 -- 17:50
Room: Presidio IV
ThE • Metrology and Coating Properties II
Presider: Colin Harthcock; Lawrence Livermore National Laboratory, USA and Amy Rigatti; Univ. of Rochester, USA

ThE.1 • 16:30 (Invited)
OIC Measurement Challenge, Christian Mühlig[1], Florian Carstens[2], Thomas Gischkat[1], Andreas Wienke[2], Sven Schröder[1]; [1]*Fraunhofer IOF, Germany;* [2]*Laser Zentrum Hannover, Germany.* For the OIC Measurement Challenge, as always, a special task is given, which is challenging but at the same time also meaningful. Moreover, the problem should be accessible to a broad range of potential participants with both, standard equipment and specialized tools. This time, the goal of the Measurement Challenge (MC) is the sensitive and precise measurement of the optical losses of high-reflecting (HR) mirrors at a wavelength of 1064 nm and/or 355 nm, and an AOI of 0°.

ThE.2 • 17:00
Characterization of Laser Damage Using Cutting Edge Microstructure Analysis, Rene Feder[1], Christian Patzig[1], Christoph Sturzenegger[2], Daniel Schachtler[2], Thomas Höche[1]; [1]*Fraunhofer IMWS, Germany;* [2]*RhySearch, Switzerland.* Optical components for laser applications face increasing requirements on long-term and high-power stability. Understanding the root causes of damage is crucial for further improvements. The benefits of in-depth microstructure analysis are illustrated using selected results.

ThE.3 • 17:05
Aging Changes in Dynamics of ps Sonar Experiment in Thin Optical Films: Possible Sources and Consequences, Petra Veselá[1], Martina Hlubučková[1], Vít Kanclír[1], Jan Václavík[1], Karel Zidek[1]; [1]*toptec, IPP CAS, Czechia.* We used the experimental pump&probe method of picosecond acoustics to show that the signal is prone to sample aging, partially reversible in vacuum. The aging can be eliminated by deposition of an Si_3N_4 passivation layer.

ThE.4 • 17:10
How to Accurately Measure the Performance of Optical Filters With Spatially Varying Spectral Features?, Alexandra Carrez[1], Michel Lequime[1], Myriam Zerrad[1]; [1]*Institut Fresnel, France.* We present the design of an opto-mechanical tool that allows the performance of optical filters with spatially varying spectral features to be accurately measured in both their pass and stop bands.

ThE.5 • 17:15
Characterization Method Determining Thermo-Optical Properties of Optical Thin-Films, Jonas N. Matthes[1], Marco Jupé[1,2], Gerd -. Hoffmann[1,2], Andreas Wienke[1,2]; *[1]Laser Zentrum Hannover e.V., Germany; [2]Cluster of Excellence PhoenixD, Germany.* A method of determining the thermal properties of thin-film filter materials from spectrophotometric measurements is proposed. Its feasibility is shown by extracting the material properties from simulated transmission spectra imprinted with real world measurement errors.

ThE.6 • 17:20
Coherent Detection of Light Backscattered From Optical Components, Michel Lequime[1], Paul Rouquette[1], Alexandra Carrez[1], Adrien Bolliand[1], Claude Amra[1], Myriam Zerrad[1]; *[1]Fresnel Institut, France.* We describe an improved version of an optical bench that can characterize the amount of light backscattered by an optical component when illuminated by a single-mode Gaussian beam and that interacts coherently with this incident beam.

ThE.7 • 17:25
Sensitivity of Experimental Conditions on Inhomogeneous Tthin Film Growth, Ramon Rodriguez Lopez[3], Emmanuel Villa[3], Noemi Abundiz Cisneros[1], Roberto Sangines[1], Juan Aguila-Muñoz[1], Estrella Teran-Hinojosa[1], Lorena C. Cruz Gabarain[3], Roberto Machorro-Mejia[2]; *[1]CONAHCyT, Centro de Nanociencias y Nanotecnología, UNAM, Mexico; [2]Centro de Nanociencias y Nanotecnología, UNAM, Mexico; [3]PhD student, CICESE, Mexico.* The Fourier transform approximation is employed to synthesize filters with a continuously variable refractive index on a substrate. In this work, we investigate the deposition parameters involved through both numerical simulations and experimental measurements.

ThE.8 • 17:30
IR-TAMS: A New Automated Goniometer Accessory for Variable Angle Spectroscopy in Infra-red Range, Dr Aniket[1]; *[1]PerkinElmer Inc., USA.* IR-TAMS is a new commercially available metrology tool for measurement of angular optical properties across the infra-red range. It offers fully automated, absolute reflectance and transmittance measurements, aiding R&D in optoelectronics and sensor design.

ThE.9 • 17:35
Anti-Reflection Coatings for Diamond Windows for Extreme Temperatures, Shay Joseph[1], Edi Shaul[1]; *[1]Rafael, Israel.* Diamond is gaining increasing attention as a potential window material for optical systems set to operate under extremely high temperatures and harsh environmental conditions. This presents a tremendous challenge to develop durable anti-reflection coatings.

ThE.10 • 17:40
Reliable Characterization of SK-1300, MgF2, ZnSe, and Si Substrates in 0.2-4.2 µm Spectral Range, Tatiana Amotchkina[1], Vladislav Matusevich[3], Jordi Sancho-Parramon[4], Michael K. Trubetskov[1,2]; *[1]OTF Studio, Germany; [2]Max-Planck-Inst. of Quantum Optics, Germany; [3]VM-TIM GmbH, Germany; [4]Rudjer Bošković Inst., Croatia.* Reliable substrate characterization approach is proposed. Four widely used substrates SK-1300, MgF2, ZnSe, and Si were characterized in a broadband spectral range from 250-4200 nm based on multi-angle measurements. Refractive index accuracy was estimated.

ThE.11 • 17:45
Effect of Dimethyl Phthalate Contamination on Wave Plates Fabricated by Glancing Angle Deposition, Solene Bertet[1], Marcela Mireles Ramirez[2], Marine Chorel[1], Eric A. Lavastre[1], Daniel Sadowski[2], Sara MacNally[2], Bruno Gallas[3], Corinne Marcel[4]; *[1]CEA CESTA, France; [2]Laboratory for Laser Energetics, USA; [3]Institut des NanoSciences de Paris, Sorbonne Université, France; [4]CEA Le Ripault, France.* The effect of dimethyl phthalate (DMP) contamination on the optical properties of wave plates fabricated by Glancing Angle Deposition are investigated. A long-term reduction of transmission and retardance is observed associated with DMP sorption.

Friday, 23 May

08:15 -- 09:30
Room: Presidio IV
FA • Coatings for Gravitational Wave Detectors
Presider: Carmen Menoni; Colorado State Univ., USA and Robert Sargent; Viavi Solutions Inc, USA

FA.1 • 08:15 (Invited)
Mirror Coatings for Interferometric Gravitational Wave Detectors, Martin M. Fejer[1]; *[1]Stanford Univ., USA.* Abstract not available.

FA.2 • 08:40
Characterization and Comparison of Thin Film Stress for a Variety of Oxide Materials, Chambers, and Deposition Techniques, Ian C. Stevenson[1], Mathias Mende[1], Michael Middleton[1], Nick Smith[1], Chris Infante[1], David Ahlstrand[1], Nathan Carlie[1], Olivia Wheeler-Williams[1]; *[1]Edmund Optics Inc., USA.* Stress has been evaluated in a variety of thin film materials, across multiple chambers, using different deposition processes. A database has been constructed that allows the prediction of stress induced figure changes for various coating and substrate combinations. The design approach can then be modified accordingly.

FA.3 • 08:45
Reduction of the Absorption Coefficient in Hydrogenated Amorphous Silicon for Gravitational Wave Interferometric Mirrors, Frances Hellman[1], Manel Molina-Ruiz[1], Ruinan Zhou[1], Ashot Markosyan[2], Martin M. Fejer[2], Aaron Davenport[3], Carmen S. Menoni[3]; *[1]UC Berkeley, USA; [2]Stanford Univ., USA; [3]Department of Electrical and Computer Engineering, Colorado State Univ., USA.* The absorption coefficient of vapor-deposited amorphous silicon is reduced orders of magnitude at near-infrared wavelengths when hydrogenated despite low H incorporation.
Raman and ESR measurements suggest H catalyzes structural relaxation of weak Si–Si bonds.

FA.4 • 08:50
Minimization of Coating Thermal Noise in TiO_2:GeO_2 and SiO_2 High Reflector Stacks for Gravitational Wave Detectors, Aaron J. Davenport[1], Gabriele Vajente[2], Nicholas Demos[3], Ashot Markosyan[4], Simon Tait[2], Martin M. Fejer[4], Slawek Gras[3], Matthew Evans[3], Carmen S. Menoni[1]; *[1]Colorado State Univ., USA; [2]LIGO Laboratory, California Inst. of Technology,*

USA; [3]LIGO Laboratory, Massachusetts Inst. of Technology, USA; [4]E. L. Ginzton Laboratory, Stanford Univ., USA. Combining multilayer stack design, ion beam sputtered deposition process and annealing steps we demonstrate high reflectors for gravitational wave detectors operating at λ=1064 nm with low coating thermal noise and excellent optical properties.

FA.5 • 08:55
The Influence of Ti Doping and Post-Deposition Annealing on the Network Properties of Ti-Doped GeO_2 Coatings for Gravitational-Wave Detectors, Carmen S. Menoni[1], Ruth Osovsky[1,2], Sangita Bhowmick[1], Samuel Castro Lucas[1], Ashot Markosyan[3], Martin M. Fejer[3], Francois Schiettekatte[4], Martin Chicoine[4]; *[1]Colorado State Univ., USA; [2]Physical Chemistry, Israel Inst. for Biological Research, Israel; [3]E. L. Ginzton Laboratory, Stanford Univ., USA; [4]Univ. of Montreal, Canada.* Fourier Transformed Infrared and X-ray Photoelectron spectroscopies of amorphous GeO_2 doped with Ti reveal the evolution of the atomic network formed by Ge-O-Ge, Ti-O-Ti and Ti-O-Ge linkages in mixtures with different Ti content and with annealing. It is shown the atomic network configuration affects the onset of crystallization.

FA.6 • 09:00
GaAs/$Al_{0.92}Ga_{0.08}$as Crystalline Coatings in Gravitational Wave Detectors, Elizabeth G. Gretarsson[1], Andri Gretarsson[1], Ambroise Juston[1], Garrett D. Cole[5], Gregory Harry[2], Steve Penn[3,4], Breck Meagher[3]; *[1]Physics and Astronomy, Embry-Riddle Aeronautical Univ., USA; [2]Physics, American Univ., USA; [3]Electrical Engineering and Computer Science, Syracuse Univ., USA; [4]Physics, Hobart & William Smith College, USA; [5]Thorlabs Crystalline Solutions, USA.* We present defect imaging and birefringence measurements of low thermal-noise GaAs/Al0:92Ga0:08As mirror coatings. We also describe nitrogen/phosophorus alloying for strain compensation and growth on offcut germanium to facilitate the use of these coatings in future gravitational wave detectors.

FA.7 • 09:05
Optical Properties of VO_2 Film Encapsulated by High- and Low-Index Oxide Layer Materials, Angelica M. Drees[1], Lirong Sun[2], Peter R. Stevenson[2], Andrew Sarangan[2]; *[1]Univ. of Dayton, USA; [2]Air Force Research Laboratory, USA.* This study aims to characterize the refractive index of VO_2 phase change thin films grown on different dielectric materials and substrates, using spectroscopic ellipsometry.

FA.8 • 09:10
The Atomic Network of Ti-Doped Germania From Modeling and Experiments, Rui Zhang[1], Ruth Osovsky[2,3], Jun Jiang[1], James N. Fry[1], Martin M. Fejer[4], Carmen S. Menoni[3], Hai-Ping Cheng[1]; *[1]Department of Physics, Northeastern Univ., USA; [2]Department of Physical Chemistry, Inst. for Biological Research, Israel; [3]Department of Electrical and Computer Engineering, Colorado State Univ., USA; [4]E. L. Ginzton Laboratory, Stanford Univ., USA.* Atomic modeling and Raman spectroscopy of amorphous TiO_2-doped GeO_2, a LIGO mirror coating material, revealing the structure of the atomic network and the effects of density, doping, and strain.

FA.9 • 09:15
Study of Optical Losses in SiN_x and SiO_xN_y Coatings Deposited by Plasma-Enhanced Chemical Vapour Deposition for Gravitational Wave Detection, Kirstin Saunders[1], Tobias Herffurth[2], Simon Bublitz[2], Christian Mühlig[2], Anne-Sophie Munser[2], Des Gibson[3,4], Caspar Clark[5,3], Carlos Garcia Nunez[1], Sven Schröder[2]; *[1]Univ. of Glasgow, UK; [2]Fraunhofer Inst. of*

Applied Optics, Germany; [3]Inst. of Thin Films Sensors and Imaging, Univ. of the West of Scotland, UK; [4]Albasense Ltd, UK; [5]Helia Photonics Ltd, UK. Gravitational wave detectors rely on low mechanical and optical loss mirror coatings. This work discusses optical losses through absorption and light scattering mechanisms in SiN_x and SiO_xN_y coatings deposited by plasma-enhanced chemical vapour deposition.

10:10 -- 11:05
Room: Presidio IV
FB • Coatings for AR/VR and Applications
Presider: Martin Bischoff; Qioptiq Photonics GmbH & Co KG, Germany and Markus Tilsch; Viavi Solutions Inc, USA

FB.1 • 10:10 (Invited)
Coatings for AR and VR Applications, Igor Landau[1]; *[1]Opticsworks Inc., USA.* Abstract not available.

FB.2 • 10:35
Ultra-Antireflective Optical Coating With Atomic Layer Deposition, Xiangru Guo[1], Leevi Pesonen[1], John Rönn[1], Lassi Leppilahti[1], Mikael Saarniheimo[1], Sami Sneck[1]; *[1]Advanced ALD, Beneq, Finland.* Ultra-antireflective Beneq AtomGrass™ coatings were fabricated with Beneq P800 large batch ALD system achieving ultra-low average reflectance < 0.1% in wavelength range 400 - 700 nm at wide angles of incidence 7° - 40°.

FB.3 • 10:40
Hard Antireflection Coatings for Consumer Electronics, Yu-Si Wang[1], Weidong Shen[1]; *[1]Zhejiang Univ., China.* This paper proposes a hard AR coating design using a "fence" optical approach to meet the growing demand for durable coatings in consumer electronics.

FB.4 • 10:45
Liquid Crystal and Two-Dimensional Material Optical Nanocomposite Thin Films, Urice Tohgha[1,2], Michael A. Susner[1], Michael Mcconney[1], Peter R. Stevenson[1]; *[1]Materials and Manufacturing directorate, USA; [2]Azimuth corporation, USA.* We present the facile preparation of uniform nanocomposites of 2D nanomaterials in cholesteric liquid crystals using compatible materials. Here, we illustrate films with tunable and fixed optical properties that can be optimized to realize desired characteristics.

FB.5 • 10:50
Gasochromic Properties of Tungsten Oxide Thin Films Prepared by Glancing Angle Deposition With Electron Beam Evaporation, Wiktoria Wichbrodt[1], Jaroslaw Domaradzki[1], Des Gibson[2], Michal Mazur[1]; *[1]Faculty of Electronics, Photonics and Microsystems, Wroclaw Univ. of Science and Technology, Poland; [2]Inst. of Thin Films, Sensors and Imaging, Univ. of the West of Scotland, UK.* This work presents gasochromic properties of WO_3 thin films deposited by GLAD technique using EBE and shows the influence of the deposition angle on the change of transmission coefficient upon exposure to hydrogen.

FB.6 • 10:55
Study of Deposition Parameters of Silicon Oxide and Silicon Nitride Thin Films Synthesized by Pulsed-Direct Current Reactive Magnetron Sputtering, Lorena C. Cruz Gabarain[1], Roberto Sangines[2], Noemi Abundiz Cisneros[2], Estrella Teran-Hinojosa[3], Roberto Machorro[2]; *[1]CICESE, Mexico; [2]UNAM, Mexico; [3]CONAHCYT, Mexico.* This work shows the results of a characterization protocol to synthesize silicon dioxide and nitride films by Pulsed sputtering using optical emission spectroscopy to monitor plasma and correlate to the thin films optical properties.

FB.7 • 11:00
Functionalized Hybrid POSS-Based Films for Optical Applications, Oleg Zabeida[1], Pedro Avila[1], Jolanta Klemberg-Sapieha[1], Ludvik Martinu[1]; *[1]Polytechnique Montréal, Canada.* Ion-assisted thermal evaporation was used to deposit polyhedral oligomeric silsesquioxane (POSS) films using different precursors containing specific functional groups. Their optical, mechanical, and functional properties have been fine-tuned by adjusting the ion assistance.