39th

ŞİŞECAM INTERNATIONAL GLASS CONFERENCE

UNITED TO INNOVATE

Inspire Future

9-11 APRIL | VENICE, ITALY

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Notice

Corresponding authors are responsible for the accuracy of their proceedings' content as well as the name, affiliation and address information of all their coauthors.

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Dear Colleagues and Esteemed Guests,

Şişecam's journey is one defined by progress, guided by the transformative power of science and technology since our founding.

In 1985, Şişecam pioneered the first Glass Conference to inspire innovation and strengthen the global glass ecosystem. Over the years, this event has become a cornerstone of knowledge, uniting industry leaders, scientists, and technologists to shape the future of glass.

Glass, a material with immense potential, transforms in remarkable ways when fused with creativity and intellect…

As a global leader in the glass and chemicals industries, we are proud to host this event first time in Italy, where we have made significant investments over the years. Our ambition is to foster collaboration across the entire ecosystem under the theme "United to Innovate: Inspire Future."

In a world marked by rapid change and increasing global challenges, collaboration is not just an opportunity, it is essential.

This Conference offers a unique platform to engage with the world's foremost scientists and visionaries, exploring the limitless possibilities and future applications of glass. Together, we can unlock its full potential and inspire the innovations that will define tomorrow.

We are honored to welcome you to this pivotal gathering and look forward to shaping the future together.

Görkem Elverici
Conference President
Chief Executive Officer
Şişecam

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	Özgür Gözler
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PROGRAM AT A GLANCE

April 9, 2025		
CET Time (Istanbul -02:00)		
18:00-20:00	REGISTRATION	MAIN ENTERANCE

April 10, 2025			
CET Time (Istanbul -02:00)			
08:00 - 08.30	REGISTRATION	MAIN ENTERANCE	
08:30 - 09:45	OPENING	HALL-1	
		Welcome / Opening Remarks	
09:45 - 10:15	COFFEE BREAK	FOYER	
10:15 - 12:15	PLENARY SESSION	UNITED TO INNOVATE: INSPIRE FUTURE	
12:15 - 13:15	LUNCH BREAK	Il MOLINO RESTAURANT	
13:15 - 15:15	PARALLEL SESSIONS	HALL-1	HALL-2
		DECARBONIZING THE GLASS INDUSTRY (I)	MATERIALS SCIENCE IN GLASS (I)
15:15 - 15:35	COFFEE BREAK	Il MOLINO RESTAURANT	
15:35 - 17:20	PARALLEL SESSIONS	HALL-1	HALL-2
		ENERGY EFFICIENCY IN GLASS PRODUCTION	ADVANCED COATING TECHNOLOGIES (I)
17:20 - 18:20	POSTER SESSIONS	FOYER	

April 11, 2025			
CET Time (Istanbul -02:00)			
08:00 - 08:30	REGISTRATION	MAIN ENTERANCE	
08:30 - 09:50	PLENARY SESSION	HALL-1	
		PANEL on DECARBONIZATION	
09:50 - 10:35	PARALLEL SESSIONS	HALL-1	HALL-2
		GLASS IN THE DIGITAL AGE	MATERIALS SCIENCE IN GLASS (II)
10:35 - 10:55	COFFEE BREAK	FOYER	
10:55 – 12:25	PARALLEL SESSIONS	HALL-1	HALL-2
		GLASS IN THE DIGITAL AGE	MATERIALS SCIENCE IN GLASS (II)
12:25 – 13:15	LUNCH BREAK	IL MOLINO RESTAURANT	
13:15 – 14:45	PARALLEL SESSIONS	HALL-1	HALL-2
		DECARBONIZING THE GLASS INDUSTRY (II)	ADVANCED COATING TECHNOLOGIES (II)
14:45 - 15:00	CLOSING	HALL-1	
		Closing Remarks	

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SCIENTIFIC PROGRAM

ŞİŞECAM 39TH INTERNATIONAL GLASS CONFERENCE
"United to Innovate: Inspire Future"
SCIENTIFIC PROGRAMME

CET Time (Istanbul -02:00)			April 10, 2025			
REGISTRATION	08:00	08:30	MAIN ENTERANCE			
COFFEE BREAK			FOYER			
OPENING	ROOM		HALL-1			
	08:30	08:35	**Burak Büyükfırat** Chief Research and Technological Development Officer, Şişecam, TR			
	08:35	08:50	**Görkem Elverici** Chief Executive Officer, Şişecam, TR			
	08:50	09:05	**Launch of the Project: "Plant of the Future"**			
	09:05	09:35	**Panel Discussion : "United to Innovate: Inspire Future"**			
	09:35	09:45	**ICG "Turner Award" Handover Ceremony** **Erik Muijsenberg** ICG Vice President - Commercial Director, Glass Service, CZ			
COFFEE BREAK	09:45	10:15	FOYER			
PLENARY SESSION	ROOM		HALL-1			
	CHAIR HALL		**Burak Büyükfırat** (Chief Research and Technological Development Officer, Şişecam, TR)			
	10:15	10:55	**Dr. Claudio Mazzali** VP Global Research, Corning Incorporated, US **"The Timeless and Transformative Impact of Glass Technologies in our Society"**			
	10:55	11:35	**Prof. Dr. Oğuzhan Aygören** Director, Institute for Business Innovation, University of California, Berkeley, US **"Vision, Inspiration, Connection: Exploring the path with Startup Orientation and Open Innovation"**			
	11:35	12:15	**Jeremy Lindley** Global Design Director, Diageo PLC, UK **"Beauty and Sustainability: How We Must Innovate to Achieve Sustainability and Design Excellence"**			
LUNCH BREAK	12:15	13:15	Il MOLINO RESTAURAN			
PARALLEL SESSIONS	ROOM		HALL-1	ROOM		HALL-2
	MAIN SESSION		DECARBONIZING THE GLASS INDUSTRY (I)	MAIN SESSION		MATERIALS SCIENCE IN GLASS (I)
	CHAIR		**Serkan Şahin** (Product Dev. & Production Tech. Senior Director, Şişecam, TR)	CHAIR		**Dr. İlkay Sökmen** (Innovation Director, Şişecam, TR)
	RESP. MEMBER		**Ömer Bayraktar** (Specialist, Şişecam R&TD, TR)	RESP. MEMBER		**Taygun Akar** (Specialist, Şişecam R&TD, TR)
	ONLINE RESP. MEMBER		**Murat Telli** (Specialist, Şişecam R&TD, TR)	ONLINE RESP. MEMBER		**Ateş Gösterişlioğlu** (Specialist, Şişecam R&TD, TR)
	13:15	13:45	**Simone Tiozzo** Head of R&D Dept. Stazione Sperimentale del Vetro (SSV), IT **"Horizon Europe project H2GLASS: Outcomes of the first campaigns of industrial scale H2 combustion trials performed in a container glass melting furnace of Steklarna Hrastnik"**	13:15	13:45	**Prof. Dr. Ashutosh Goel** Department of Materials Science and Engineering, Rutgers University, US **"Structural Design of a Scalable Glass with High Hardness and Crack Initiation Resistance"**
	13:45	14:00	**Elisa Gerali & Annick Lachance Nyiringango** R&D Engineer & R&D Engineer, Stara Glass, IT **"From Natural Gas to Hydrogen mixtures: Challenges and Opportunities in Combustion for Sustainable Glass Furnaces"**	13:45	14:00	**Dr. Serena Panighello** Senior Scientist, Stevanato Group, IT **"Advanced Surface Analysis Meets Chemical Functional Techniques to Study Glass in Pharmaceutical Packaging"**
	14:00	14:15	**Bruno Malphettes** Marketing and Sales Director, Fives, FR **"Progress in Lower Carbon Float Glass Melting: From Oxyfuel to Hybrid"**	14:00	14:15	**Prof. Dr. Christian Roos** Director of Institute, Glass and Glass Ceramic, RWTH Aachen University **"Glass to Metal Interaction during Forming"**
	14:15	14:30	**Galen Kutlubay** Global Account Manager, Clean Air, Topsoe, DK **"Revolutionizing Glass Manufacturing with Green Hydrogen and Catalytic Filtration"**	14:15	14:30	**Prof. Dr. Massimo Guglielmi** Head of the Department of Industrial Engineering at University of Padova, IT **"On the Surface Hydrolytic Resistance of Borosilicate Glass Vials under Extreme Depyrogenation Conditions"**

PARALLEL SESSIONS	ROOM		HALL-1	ROOM		HALL-2
	MAIN SESSION		DECARBONIZING THE GLASS INDUSTRY (I)	MAIN SESSION		MATERIALS SCIENCE IN GLASS (I)
	CHAIR		**Serkan Şahin** (Product Dev. & Production Tech. Senior Director, Şişecam, TR)	CHAIR		**Dr. İlkay Sökmen** (Innovation Director, Şişecam, TR)
	RESP. MEMBER		**Ömer Bayraktar** (Specialist, Şişecam R&TD, TR)	RESP. MEMBER		**Taygun Akar** (Specialist, Şişecam R&TD, TR)
	ONLINE RESP. MEMBER		**Murat Telli** (Specialist, Şişecam R&TD, TR)	ONLINE RESP. MEMBER		**Ateş Gösterişlioğlu** (Specialist, Şişecam R&TD, TR)
	14:30	14:45	**Sebastian Krogel** R&D Engineer, Nikolaus SORG GmbH & Co. KG, DE "SORG's Technology Portfolio to Support Glass Industry at Decarbonization"	14:30	14:45	**Dr. João Vitor Campos** Researcher, Materials Engineering, Federal University of Sao Carlos, BR **"Ultrafast and Energy-Efficient Crystallization of Glasses for All-Solid-State Battery Applications: A Case Study of Li1.5Al0.5Ge1.5(PO4)3"**
	14:45	15:00	**Dr. Thomas Bewer** Senior Director Forming Technology, Bucher Emhart Glass, CH **"CO2 Reduction and Strengthening Techniques for Lightweight Container Glass"**	14:45	15:00	**Asst. Prof. Mattia Biesuz** Department of Industrial Engineering, University of Trento, IT **"Structural characterization of the chemical tempering process of soda-lime silicate glasses"**
	15:00	15:15	**Dr. Michel Gaubil** Director Refractory Solution Engineering, SEFPRO, FR **"Hybrid Melting Technology: A Challenge for Glass Furnace Lifetime"**	15:00	15:15	**Dr. Levent Karacasulu** Researcher, Industrial Engineering, University of Trento, IT **"Structural and Property Modifications in Soda-Lime Silicate Glass via Hydrothermal Treatment"**
COFFEE BREAK	15:15	15:35	FOYER			
PARALLEL SESSIONS	ROOM		HALL-1	ROOM		HALL-2
	MAIN SESSION		ENERGY EFFICIENCY IN GLASS PRODUCTION	MAIN SESSION		ADVANCED COATING TECHNOLOGIES (I)
	CHAIR		**Tolga Uysal** (Melting Technologies Director, Şişecam, TR)	CHAIR		**Ozan Özer** (Product Development Director, Şişecam, TR)
	RESP. MEMBER		**Murat Telli** (Specialist, Şişecam R&TD, TR)	RESP. MEMBER		**Dr. Semin Canbazoğlu** (Specialist, Şişecam R&TD, TR)
	ONLINE RESP. MEMBER		**Ömer Bayraktar** (Specialist, Şişecam R&TD, TR)	ONLINE RESP. MEMBER		**Dr. Göksenin Kurt Çömlekçi** (Specialist, Şişecam R&TD, TR)
	15:35	16:05	**Erik Muijsenberg** Commercial Director, Glass Service, CZ **"Decarbonization through AI Batch Monitoring for Electric and Gas fired furnaces coupled with Model-Based Predictive Furnace Control"**	15:35	16:05	**Prof. Dr. Xusheng Qiao** School of Materials Science & Engineering, Zhejiang University, CN **"Hollow Silica Nanosphere Based Anti-reflective Coatings on Photovoltaic Glasses"**
	16:05	16:20	**Dr. Daniel Backhouse** Senior Glass Technologist, Glass Futures Ltd, UK **"Glass Futures: A Research and Collaboration Platform for Glass Industry Decarbonisation"**	16:05	16:20	**Dr. Dermot Monaghan** Managing Director, Gencoa Ltd, UK **"Better 'Understanding of the Vacuum' to Improve Film Quality and Process Control"**
	16:20	16:35	**Dr. Shrikar Chakravarti** Global Glass Strategic Account and Business Development Director, Linde GmbH, DE **"Step Change Reduction in Scope 1 CO2 Emissions by Converting Air-Regen Furnaces to Oxy-Fuel with OPTIMELT™ Heat Recovery Systems"**	16:20	16:35	**Marcus Klein** Managing Director, SURAGUS GmbH, DE **"Insights into Future Glass-Coating Monitoring Solutions by Inductive Inspection Methods"**
	16:35	16:50	**Dr. Daniela Messina** Technical Marketing Manager, RHI Magnesita, IT **"Regenerator Efficiency Optimization through new Checker Settings and Shape Design"**	16:35	17:20	**Dr. Wilmert De Bosscher** Chief Technology Officer, Soleras, BE **"Digitalization of Large Area Glass Coaters: Enabling Future Coating Expectations"**
	16:50	17:05	**Philippe Kerbois** Global Industry Manager, Ametek Land, FR **"Revolutionizing Glass Furnace Operations with AI-Enhanced AMETEK LAND Image Pro Software combined with NIRB- 2K Thermal Imaging"**	16:50	17:20	**Dr. Paweł Kwaśnicki** (ONLINE) Head of R&D Department, ML System S.A., PL Title/Affiliation **"Application of Atomic Layer Deposition Processes in Photovoltaic Systems"**
	17:05	17:20	**Neil Simpson** Managing Director, Simpson Combustion & Energy Ltd, UK **"Infra-Red does not Lie! We Have Just Never Seen It Before in Base of Regenerators"**			
POSTER SESSIONS	17:20	18:20	FOYER			

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SCIENTIFIC PROGRAMME

CET Time (Istanbul -02:00)	April 11, 2025					
REGISTRATION	08:00	08:30	MAIN ENTERANCE			
PLANERY SESSION	ROOM		HALL-1			
	08:30	09:10	**PANEL on DECARBONIZATION**: "Road for Decarbonization: Challenges and Urgencies" **Dr. Bassam Fattouh,** Director, OIES - Oxford Institute for Energy Studies, UK **Gözde Morkoç**, Sustainability Director, Şişecam, TR"			
	09:10	09:50	**PANEL on DECARBONIZATION:** "Challenges Faced by Industry and the Scientific Solutions" **Steve Whettingsteel,** CEO & Managing Director, Krysteline Technologies Ltd, UK **Dr. Malte Sander,** Business Development Manager, Glass Service A.S, CZ			
PARALLEL SESSIONS	ROOM		HALL-1	ROOM		HALL-2
	MAIN SESSION		GLASS IN THE DIGITAL AGE	MAIN SESSION		MATERIALS SCIENCE IN GLASS (II)
	CHAIR		**Seçil Erman** (Res.&Tech. Strategies Dev. Director, Şişecam, TR)	CHAIR		**Osman Burak Okan** (Adv. Surf/Coat. Tech Manager., Şişecam, TR)
	RESP. MEMBER		**Bahar Kuzu** (Specialist, Şişecam R&TD, TR)	RESP. MEMBER		**Ateş Gösterişlioğlu** (Specialist, Şişecam R&TD, TR)
	ONLINE RESP. MEMBER		**Dr. Utku Er** (Specialist, Şişecam R&TD, TR)	ONLINE RESP. MEMBER		**Taygun Akar** (Specialist, Şişecam R&TD, TR)
	09:50	10:20	**Johan van der Dennen** CTO, CelSian Glass & Solar B.V. **"Celfos: Simulation-Assisted AI Modeling for Glass Quality Prediction"**	09:50	10:20	**Prof. Dr. Reinhard Conradt** Consultant, UniglassAC GmbH, DE **"Properties of Pure Substances in Their Crystalline, Liquid and Glassy States Their Relevance for Industrial Glass Development"**
	10:20	10:35	**Dr. Yakup Bayram** CEO, PaneraTech, Inc., US **"Co-Working with AI: Lessons Learned From Steel Industry"**	10:20	10:35	**Ateş Gösterişlioğlu** Advanced Glass and Melting Technologies Specialist, Şişecam RT&D, TR **"Thin Glass Composition Design Study for Float Furnaces"**
COFFEE BREAK	10:35	10:55	FOYER			
PARALLEL SESSIONS	10:55	11:10	**Dr. Alexander Ruege** VP Data Analysis and Reporting, PaneraTech, Inc., US **"Transforming Glass Furnace Management with Continuous Refractory Wear Monitoring"**	10:55	11:10	**Asst. Prof. Dr. Jiri Schwarz** Department of General and Inorganic Chemistry, University of Pardubice, CZ **"Formation of Copper Nanoparticles in Oxide Glasses"**
	11:10	11:25	**Andries Habraken** Global Solution Consultant Green Glass, Schneider Electric, NL **"Digital Transformation in The Glass Industry"**	11:10	11:25	**Dr. Richard Krumpolec** Researcher, Plasma Physics and Technology, Masaryk University, CZ **"Atmospheric DCSBD Plasma Technology for Surface Treatment, Activation and Adhesion Improvement of Glass"**
	11:25	11:40	**Johannes Ertl** Head of Tin Bath Technology, HORN Glass Industries AG, DE **"HORN Tin Bath"**	11:25	11:40	**Zeynep Hoşgör** R&D Assistant Specialist, Akcoat Advanced Chemical Coating Materials Co. **"Synthesis and Characterization of SiO2-B2O3-Na2O-K2O-ZnO Glass System: The Effect of SnO2 on the Structural and Radiation Shielding Properties"**
	11:40	11:55	**Joep Veenbergen** Operational Intelligence Manager, Ardagh Group, NL **"AGP Data Strategy and the Power of Unlocking Data Silos"**	11:40	11:55	**Dr. Isabela Reis Lavagnini** Materials Engineering, Federal University of São Carlos, BR **"Ultrafast and Energy-Efficient Crystallization of Glasses with Low Thermal Expansion"**
	11:55	12:10	**Paul Schreuders** CEO, XPAR Vision, NL **"Future-Proof Container Glass Forming: Actionable Data!"**	11:55	12:10	**Chris Holcroft** (ONLINE) Principal Technologist , Glass Technology Services, UK **"Use of Controlled Dissolution Glasses for Marine Habitat Restoration"**
	12:10	12:25	**Sonia Debets** Area Sales Manager, IRIS Inspection Machines, FR **"Advanced Digitalisation in Inspection for Predictive Defect Detection"**	12:10	12:25	**Dr. Owen McGann** (ONLINE) Principal Technologist, Glass Technology Services Ltd, UK **"Vanadate Glass as an Alternative for Radiation Hard Photonics and Optics"**

LUNCH	12:25	13:15	II MOLINO RESTAURANT			
PARALLEL SESSIONS	ROOM		HALL-1	ROOM		HALL-2
	MAIN SESSION		DECARBONIZING THE GLASS INDUSTRY (II)	MAIN SESSION		ADVANCED COATING TECHNOLOGIES (II)
	CHAIR		**Değer Demircan Acılıoğlu** (Design Center Director, Şişecam, TR)	CHAIR		**Hasan İsmail** (Offline and Auxiliary Process Tech. Eng. Director, Şişecam, BG)
	RESP. MEMBER		**Can Özdemir** (Specialist, Şişecam R&TD, TR)	RESP. MEMBER		**Dr. Utku Er** (Specialist, Şişecam R&TD, TR)
	ONLINE RESP. MEMBER		**Bahar Kuzu** (Specialist, Şişecam R&TD, TR) & Levent Bozkurt (Mold Technology & Analysis Supervisor, Şişecam R&TD, TR)	ONLINE RESP. MEMBER		**Dr. Semin Canbazoğlu** (Specialist, Şişecam R&TD, TR)
	13:15	13:45	**Jeremy Lindley,** Global Design Director, Diageo PLC, UK Adi Raz, CEO, The Signatureglass Company, IL **"How & Why We Developed The World's Lightest 70cl Glass Scotch Whisky Bottle"**	13:15	13:45	**Prof. Dr. Alicia Duran** Instituto de Cerámica y Vidrio, CSIC ; Chair of the IYOG2023, SP **"Smart Multilayer System Based on PEO and Sol-Gel Process for AZ31B Mg Alloy"**
	13:45	14:00	**Steve Whettingsteel** CEO & Managing Director, Krysteline Technologies Ltd., UK **"The Decarbonisation Pathway for Used Glass"**	13:45	14:15	**Dr. Jörg Neidhardt** Head of S2S Technologies and Precision Coating, Fraunhofer FEP, DE **"Novel Processing Technologies and Substrates for Large Area Coating"**
	14:00	14:15	**Niels Schreuder** Director, Vlakglas Recycling Nederland, NL **"Together We Make Glass Infinite"**	14:15	14:30	**Prof. Dr. Juris Purans** Head of Laboratory, Institute of Solid State Physics, University of Latvia, LV **"Chromogenic Thin Films for Smart Windows"**
	14:15	14:30	**Stuart Hakes** Chief Executive, F.I.C.(UK) Limited, UK **"The Reality of Decarbonisation in the Glass Industry"**	14:30	14:45	**Dr. Robert Arndt** Director R&D, CTF SOLAR GmbH, DE **"Building Integrated Photovoltaic (BIPV)"**
	14:30	14:45	**Dr. Jozef Kraxner** Head of Glass Processing Department, Alexander Dubcek University of Trencin-FunGlass, SK **"Everglass – Innovative Glass Recycling Technology Process"**			
CLOSING	14:45	15:00	HALL-1			

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LOCATION OF ACTIVITIES

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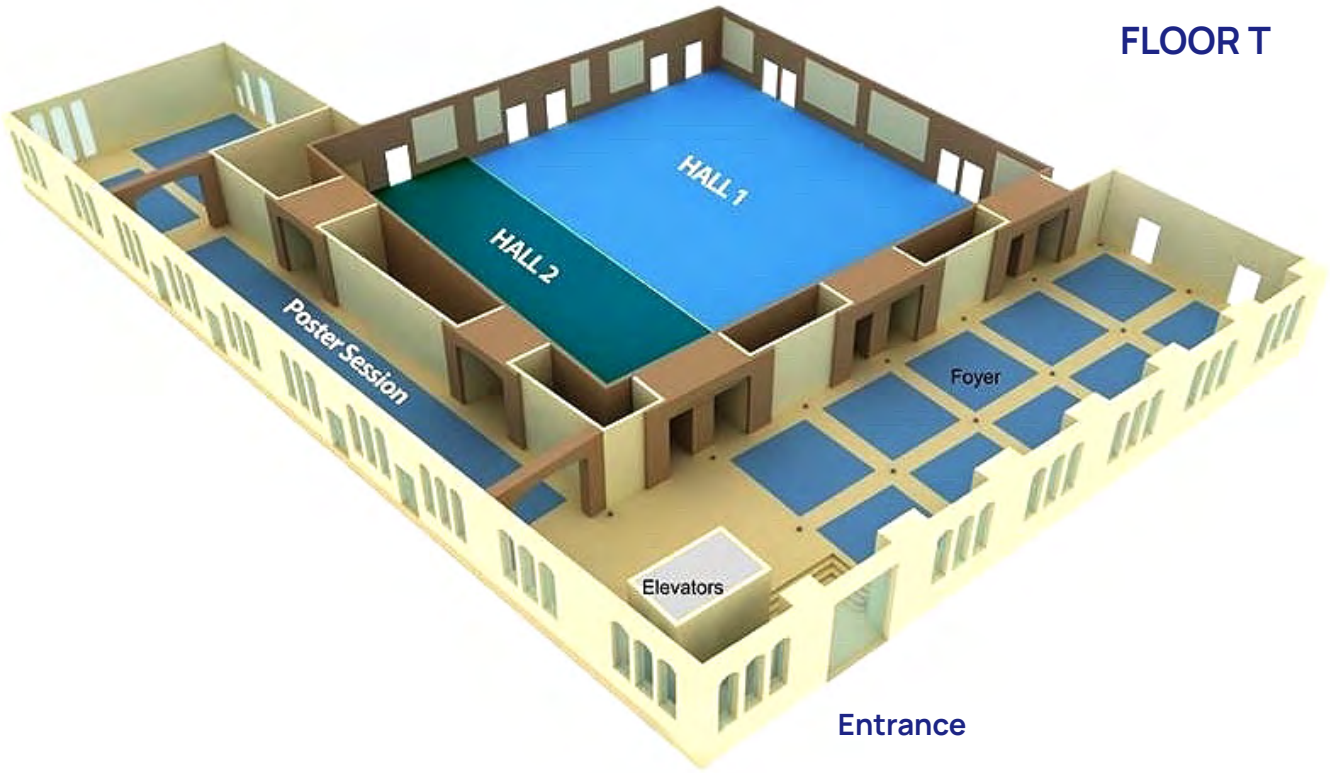

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KEYNOTE SPEAKERS

Dr. Claudio Mazzali (Keynote Speaker)
VP Global Research – **Corning Inc.**, Unites States

Session	United to Innovate: Inspire Future
Date	APRIL 10, 2025
Time (CET)	10:15 - 10:55
Chair	Burak Büyükfırat

The Timeless and Transformative Impact of Glass Technologies in our Society

Biography

Dr. Claudio Mazzali is the Vice President of Global Research at Corning Incorporated, a position he has held since June 2022. In this role, Dr. Mazzali leads the corporate research efforts at Corning's Sullivan Park R&D Center and across Corning's global research labs. His extensive career with Corning began in 1999 when he joined the Brazilian regional office as an Optical Communications Specialist. Over the years, Dr. Mazzali has held several key positions, including Senior Vice President and Chief Technology Officer for the Corning Optical Communications sector, Vice President of Technology for Optical Connectivity Solutions, and various roles in strategic alliances management, product line management, and new business development.

Dr. Mazzali's expertise has contributed to the development of components and solutions for optical fiber and optical communication systems across long haul, metro, access and hyperscale data centers. His leadership in early-stage development of integrated solutions has leveraged close connections with academia, and strategic industry partners.

A native of Brazil, Dr. Mazzali holds a Ph.D. in physics from the Gleb Wataghin Physics Institute at Unicamp. He is an esteemed member of the Optical Society of America (Optica) and was elected an OSA Fellow in 2019. Dr. Mazzali is also a member of the American Physical Society and an alumnus of the Global2020 program at Tuck School of Business. His passion for science and technology continues to drive his innovative contributions to optics and material science.

Abstract

From simple containers to complex devices, glass technologies have woven themselves into the very fabric of our world, shaping our past and continuously sculpting our future. Once confined to the roles of fluid containment and daylight admittance, glass has now evolved into a conduit for information and a window to global connectivity and intelligence.

This presentation aims to highlight the transformative prowess of glass technologies, demonstrating their crucial part in pushing boundaries and igniting unparalleled innovation. We will delve into their applications across diverse fields, highlighting the unique properties of different glass types that have positioned this material as a cornerstone of technological advancement. Furthermore, we will touch upon selected cutting-edge developments in glass technologies that are reshaping our reality and how these endeavors are continuing to unlock the boundless potential of this versatile material.

Keywords

glass technologies, innovation, connectivity, technological advancement

Prof. Dr. Oğuzhan Aygören (Keynote Speaker)
Director, Institute for Business Innovation
University of California, Berkeley, United States

Session	United to Innovate: Inspire Future
Date	APRIL 10, 2025
Time (CET)	10:55 - 11:35
Chair	Burak Büyükfırat

Vision, Inspiration, Connection: Exploring the path with Startup Orientation and Open Innovation

Biography

Oguzhan Aygoren is a Professor of marketing, entrepreneurship and innovation and currently serves as a Director at the Institute for Business Innovation at UC Berkeley Haas Business School. He is also a Faculty Innovation Fellow at Stanford University. He has education in Electrical and Electronics Engineering with an MBA, and a PhD in Marketing. He has a vast array of experience in the innovation field in the corporate, startup and academic worlds at prestigious institutions. He was previously a Visiting Professor at NYU Stern Business School and a long time full faculty member at Bogazici University where he founded Bright Center for Entrepreneurship. He is a cofounder of a new social club for entrepreneurs named Dotshub. He is also the founder of a new generation innovation consulting company, The X Way. Before joining academia, he started three startups and worked at Procter & Gamble as an innovation leader. He is also a board member, investor, venture partner and trusted advisor for investing in startups and working on corporate innovation and venturing working with leading firms.

Abstract

Through recent advances in technology and fundamental shifts in the world, the business environment is more uncertain and complex than ever. Startups are leading this change, and firms of all sizes are looking for ways to become more like a startup to thrive in this turbulent environment. Open innovation literature offers ways to solve this challenge originating from the idea that “Not all smart people work for us.” When things are fast moving, direction becomes the most important driver of change. With direction comes the need for people who build to move forward. And finally connecting the dots throughout the journey in a meaningful way paints the full picture in imagination. This paper presents the open innovation toolkit with successful examples of the past and offers a path forward for a world of unknowns with the emerging technologies fueled by AI and inspired by the startups.

Keywords

startup orientation, open innovation, emerging technologies, AI (artificial intelligence), business environment.

Jeremy Lindley
Global Design Director, Diageo,
United Kindgom

Session	United to Innovate: Inspire Future
Date	APRIL 10, 2025
Time (CET)	11:35 - 12:15
Chair	Burak Büyükfırat

Beauty and Sustainability: How We Must Innovate to Achieve Sustainability and Design Excellence

Biography

Jeremy is responsible for transforming the Design capability and output of Diageo's current brands and new products worldwide. Diageo is the world's leading premium drinks business. Standout projects include Johnnie Walker Blue Label Ultra, Guinness Harp dispense fount (winner of the DBA Design Effectiveness Grand Prix 2020) and the Johnnie Walker Princes Street Brand Home in Edinburgh.

Prior to joining Diageo, Jeremy was Head of Design for Tesco, responsible for the portfolio of 19,000 private label products and for leading the Store Formats and Design teams. His early career was as a Freelance Designer and University Lecturer.

Jeremy is a Cannes Lions and TEDx speaker. He is Chair of Trustees of the charity Achord, Former Chair of the Design Business Association and a visiting Lecturer at Omnes Business School.

Abstract

Beauty and desire are fundamental drivers of purchasing behaviors in the premium alcohol category. There appears to be an established principle that more premium the product, the heavier the packaging. We all face the carbon challenge, so how can we drive premiumization and lower carbon emissions?

In this talk, Jeremy defines the key drivers of purchase decisions in the premium alcohol category, the reasons humans behave as we do when making brand choices. We like to think of ourselves as logic-based creatures, in reality almost all of human decision making is driven by our emotions. This is especially the case when making brand choices, so visual cues and beauty are critical to ensuring a brand is chosen at the point of purchase or consumption. Packaging for the Premium Alcohol category is a critical component of the marketing mix, the silent communicator of brands provenance, heritage, character and quality. The talk outlines how the brain recognizes and decodes visual stimulus, the importance of distinctive design, the role of semiotics and beauty in driving premium cues.

Excellence in design and manufacturing glass continues to be critical, but we face the carbon challenge. How can glass continue to offer premium solutions and improve sustainability? Alternative materials are available, can we reduce weight and reinvent our manufacturing supply chain to ensure glass remains the material of choice for premium drinks?

"The best way to make sustainability work is to make it more desirable than the alternative."

Keywords

design, beauty, emotions, brand, semiotics

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PANELISTS

Dr. BASSAM FATTOUH

Director
Oxford Institute for Energy Studies,United Kingdom

Dr Bassam Fattouh is the Director of the Oxford Institute for Energy Studies (OIES) and Professor at the School of Oriental and African Studies (SOAS). He has published a variety of articles on energy policy, the international oil pricing system, OPEC behavior, the energy transition, and the economies of oil producing countries. Dr Fattouh served as a member of an independent expert group established to provide recommen-dations to the 12th International Energy Forum (IEF) Ministerial Meeting in Cancun (29-31 March 2010) for strengthening the architecture of the producer-consumer dialogue through the IEF and reducing energy market volatility. He is the recipient of the 2018 OPEC Award for Research. He acts as an advisor to a number of gov-ernments and companies. He is a regular speaker at international conferences.

MALTE SANDER

Business Development Manager
GLASS SERVICE, a.s., Czech Republic

Malte Sander studied materials engineering at the RWTH Aachen University in Germany, focusing on glass and process engineering. Fascinated by the material, Malte started a position as a doctoral candidate, in 2018, at the Chair of Glass and Glass-Ceramics in Aachen. During his time at the chair, Malte investigated the ef-fects of electric fields on the crystallization behavior of glass-ceramics and developed glasses for industrial applications.

Alarming reports about the climate crisis shook him up. So, Malte decided to move away from fundament al glass research and help decarbonizing the glass industry.

In 2023, he started his current position as business development manager at Glass Service. In his role, he supports the glass industry in solving problems, optimizing the glass melting process, and reducing carbon emissions.

STEVE WHETTINGSTEEL

Founder and CEO
Krysteline Technologies Ltd, United Kingdom

Steve Whettingsteel is the founder and CEO of Krysteline Technologies Ltd, developer of specialised engineered solutions for the waste management sector, particularly in the recovery and refinement of glass.

In the 1990s Steve was working as a marine engineer on cruise ships, there was an urgent need to change and develop the way glass recycling was being handled onboard. This led to him developing “glass implosion”, the unique, patented technology behind Krysteline’s machinery.

Since its formation in 1999 Krysteline has been exporting, with machines being sold around the world. Early customers including; the British Antarctic Survey, a laboratory in the Falkland Islands, super yachts, hotels and pharmaceutical companies.

Fast forward 20+ years and thanks to years of ongoing investment in research and development Krysteline has also developed an enviable reputation for high quality refined glass suitable for cullet, cement, foam glass, fertilizers, water filtration and expendable abrasives.

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INVITED SPEAKERS

Prof. Dr. REINHARD CONRADT

Consultant
Uniglassac GmbH, Germany

Reinhard Conradt is a retired professor from RWTH Aachen University.
1980 Ph.D. in Physical Chemistry;
1980-86 researcher at Fraunhofer Institute of Silicate Science, ISC Würzburg, Germany;
1987-96 lecturer and industry consultant at Chulalongkorn University, Thailand;
1997-2016 Chair of Glass & Ceramic Compo¬sites at RWTH Aachen University;
since 2017 consultant to glass industry through own company uniglassAC GmbH.
2015-2020; Chairman of the German Society of Glass Technology DGG;
2022-2024; 27th President of the International Commission on Glass ICG.
Most important recognitions and awards;
- International Otto Schott Research Award 2001,
- W.E.S. Turner Award of the International Commission on Glass ICG 2011,
- Fellow of The Society of Glass Technology (SGT, U.K.) 2017,
- L. David Pye Lifetime Achievement Award, The American Ceramic Society 2020,
- Otto Schott Memorial Coin of DGG 2021.

JOHAN VAN DER DENNEN

CTO
CelSian Glass & Solar B.V., Netherlands

Joining CelSian's predecessor TNO in 2011 as a CFD research engineer, Johan was one of the founding members of CelSian. Prior to joining TNO/CelSian, Johan finalized his master's in physics at the Twente University and has worked as a product engineer for Bosch.

After many years of being operationally responsible, he moved from the beginning of 2023 to the position of CTO. Making him responsible for new product developments, product improvements, the introduction/integration of new technologies like AI and GPU calculation, and the introduction of CelSian's products to other industries.

Prof. Dr. ALICIA DURAN

Instituto de Cerámica y Vidrio, CSIC
Chair of the IYOG2023, Spain

Prof. Dr. Alicia Durán is degree in Physics by UNC (Argentina) and PhD in Physical Sciences from UAM (Spain), developing her professional career at the Institute of Ceramics and Glass (CSIC).

She is Research Professor of CSIC and responsible of the research group GlaSS, a group of excellence, in the higher 10% among the 1600 research groups of CSIC (http://glass.icv.csic.es). The Glass group is the Spanish reference in Glass science and technology, with close relation with national and international glass field centres and industries, in particular with Spanish glass companies and their associations, ANFEVI and VIDRIO ESPAÑA.

Alicia has more than 295 publications in WOK. She was Treasurer of ICG from 2002 to 2016 and President of the International Commission on Glass (ICG) on 2018-2021. From this position she nominated 2022 as Interna-tional Year of Glass 2022 at United Nations, being the chair of the IYOG. Among the prizes she received the Gottardi Prize in 1988. In the last years she received the Phoenix Award, being named Glass Person of the Year 2019 and bestowed with the Otto-Schott Award in 2022 as well as the ICG President's Award in 2022.

Prof. Dr. ASHUTOSH GOEL

Materials Science and Engineering
Rutgers University, United States

Dr. Goel is a Professor in Materials Science and Engineering at Rutgers University, New Jersey, USA. Before joining Rutgers, Dr. Goel worked as a Materials Scientist at Pacific Northwest National Laboratory in Richland, WA, and as a Senior Research Scientist specializing in Optical Fibers at Sterlite Technologies Ltd. in Aurangabad, India.

Dr. Goel has authored or co-authored over 100 research articles in leading international journals and holds several U.S. patents. He serves as an Associate Editor for both the Journal of the American Ceramic Society and the International Journal of Applied Glass Science. He is also on the editorial board of the Journal of Non-Crystalline Solids and actively reviews for numerous scientific journals.

Additionally, Dr. Goel is actively involved in the International Commission on Glass (ICG) and the American Ceramic Society. He served as the Chair of the technical Committee on Hazardous Waste Vitrification (TC05) from 2019-2025, and in the leadership committee of Bioceramics Division of the American Ceramic Society from 2018-2022. His impactful contributions to glass science and engineering have been recognized with prestigious honors, including the 2017 Vittorio Gottardi Prize (ICG), the 2021 W.H. Zachariasen Prize (Journal of Non-Crystalline Solids), and the 2023 Tadashi Kokubo Award (American Ceramic Society).

Dr. PAWEŁ KWAŚNICKI

Head of R&D Department
ML System S.A., Poland

Since 2018, he has served as the Director of Research and Development at ML System S.A. Prior to this, from 2017, he held the position of Deputy Director for Research and Technology Transfer, and since July 1, 2015, he has been employed as a Nanotechnology Specialist at ML System. Since 2016, he has also been a faculty member, and since 2018, an Assistant Professor at the Institute of Environmental Engineering at the Catholic University of Lublin. From 2011 to 2015, he was a Research Scientist at the National Center for Scientific Research (CNRS). He obtained his PhD in Physical Sciences in 2014 from the University of Montpellier (France), with his dissertation focused on the non-destructive evaluation of doping in SiC ("Evaluation of doping in 4H-SiC by optical spectroscopies").

Between 2011 and 2014, he was a Research Scientist at CNRS, working at Université Montpellier 2 in the Charles Coulomb Laboratory, within the Semiconductor Materials and Sensors group. He is a specialist in optical spectroscopy (LTPL, Raman, IR, ellipsometry), structural measurements (SIMS, SEM, TEM), and electrical measurements (Hall effect, C-V, DC). He has extensive experience in characterizing the optical, transport, and electrical properties of semiconductors, with a particular focus on wide-bandgap semiconductors and low-dimensional materials, including quantum dots.

He was a member of the international NETFiSiC program (2011-2014) dedicated to the production, research, and application of SiC. He has participated in numerous international conferences and workshops focused on SiC and semiconductor characterization methodology, including ICSCRM 2013 (The International Conference on Silicon Carbide and Related Materials, Miyazaki, Japan), HeteroSiC-WSMPE 2013 (Nice, France), and ECSCRM 2012 (St. Petersburg, Russia). As part of the NETFiSiC project, he completed several international research internships aimed at gaining knowledge in the production, characterization, and application of semiconductor thin films, including at NOVQSIC SA (growth and polishing of semiconductor thin films via CVD), Vilnius University (measurement of optical properties of thin films using DT and LITG methods), and the University of Thessaloniki ("Summer School: Micro- and Nano-structural Characterization of Materials").

Currently, he is focused on material growth processes using physical and chemical techniques dedicated to energy conversion processes. In his work on the implementation of third-generation printed cells, he supervised and conducted research utilizing screen printing, spray deposition, rollblade, and n-fog techniques. He has been both the leader and a participant in numerous international and national projects dedicated to the implementation of innovative energy conversion and storage technologies.

ERIK MUIJSENBERG

Commercial Director
Glass Service, Czech Republic

Erik Muijsenberg is a Mechanical Engineering graduate from the University of Eindhoven, Class of 1990. In the eight years following his graduation, he was employed by TNO Glass group in Eindhoven, where he focused on furnace modeling and glass melt technology. In 1997, he assumed the role of TNO Glass Department leader.

In 1998, he took on the position of Managing Director at GLASS SERVICE B.V., marking the establishment of the first GLASS SERVICE subsidiary office in Maastricht, the Netherlands. After eleven years, he relocated to GLASS SERVICE headquarters in the Czech Republic, where he assumed the role of group Vice President. GLASS SERVICE boasts a global presence with over 110 engineers and offices in Czechia, Slovakia, Nether-lands, Germany, UK, France, USA, China, and Japan. Notable subsidiaries include FlammaTec, recognized worldwide for combustion systems, and FIC UK, specializing in Electric melting solutions.

As of April 2024, Glass Service Group has become part of SEFPRO and Erik was appointed as the Commer-cial Director.

During the ICG Annual Conference in Korea in August 2024, Erik was elected as the new Vice President of the International Commission on Glass.

Erik has been a fervent advocate for Industry 4.0, promoting smarter model-based predictive furnace and fore-hearth control, as well as Carbon emission reductions in the Glass Industry for over two decades.

JÖRG NEIDHARDT

Head of S2S Technologies and Precision Coating
Fraunhofer FEP, Germany

Jörg Neidhardt is heading the Department of Sheet-to-Sheet and Precision Coating at the Fraunhofer Institute for Electron Beam and Plasma Technologies in Dresden, Germany. His main focus is on application inspired research and development turning lab-scale ideas into pilot-scale surface engineering solutions. He dwells on more than 25 years experience both in academia as well as industry holding positions in the hard coating, semi conductor, photovoltaic and equipment/component manufacturing industry. Before his current role at Fraunhofer he was the Head of Innovation and Technology Application with VON ARDENNE.

He holds a PhD in “Thin Film Physics” from the University Linköping, Sweden and has been educated at the West Saxonian University (Germany), Sheffield Hallam University (UK) as well as the University of Leoben (Austria).

Prof. Dr. XUSHENG QIAO

State Key Laboratory of Silicon and Advance Semiconductor Materials & School of Materials Science and Engineering
Zhejiang University, China

Xusheng Qiao, an associate professor at Zhejiang University, vice dean of Institute of the inorganic and non-metallic materials, and director of Zhejiang University – Assure Joint Research Center. He has led over ten national research projects and published over 100 scientific papers on journals such as Nature Communication, ACS Nano and Adv. Science. He teaches the courses of "Fundamentals of Materials Science" and "Solid-state Chemistry" and is collaborating with international groups on glass and glass-ceramics.

SIMONE TIOZZO

Head of R&D Department
Stazione Sperimentale del Vetro (SSV), Italy

Simone Tiozzo is the Head of the Research and Development department of Stazione Sperimentale del Vetro (SSV), the Italian glass science and technology research institute (Venice), where he has been working for 13 years. SSV provides since 1956 analytical and technical support to the whole glass industry chain and to most industry sectors, offering services such as chemical analysis and micro-analysis, defects identification and interpretation, mechanical testing and fracture analysis, on-site emission measurements, energy audits, prod-uct certification.

The main focus of His applied research activity is glass sustainability, with projects dedicated to, for example: reduction of pollutant and GHG emissions of glass melting furnaces, implementation and testing of innovative solutions for Hydrogen combustion, steam methane reforming and CO2 capture and storage in glass furnaces, Design for Recycling of glass based packaging items, etc.

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ADVANCED COATING TECHNOLOGIES

Prof. Dr. Xusheng Qiao (Invited Speaker)
Zhejiang University, China

Session	Advanced Coating Technologies (I)
Date	APRIL 10, 2025
Time (CET)	15:35 - 16:05
Chair	Ozan Özer

Hollow Silica Nanosphere Based Anti-Reflective Coatings on Photovoltaic Glasses

Abstract

Anti-reflection (AR) coatings can suppress the reflection of light on the surfaces or interfaces so as to enhance light harvest efficiencies as well as photovoltaic efficiencies of solar cells. It usually requires an increment of the optical transmittance in the front panel surface of solar cells. Among various anti-reflection coatings, it has been considered as one of the most promising methods to fabricate porous AR coatings with the sol-gel method. How to control the stability of coating sol and improve the mechanical properties of AR films is the key issue for mass production. In our study, high performance hierarchical nanoporous AR films were developed through dip coating hollow silica nanospheres (HSNs) and block copolymer F127 containing inorganic/organic composite sol onto solar cell cover glasses. With the introduced steric effect and surface modification, it suppressed the aggregation of nanospheres so that the sol showed better stability. After annealing, the transmittance of AR coated glass still held the transmittance of 96 % at 550nm. The nano-scale surface embossments due to the addition of HSNs was also contributory to the AR effect of the films. The mechanical performance of the AR film was further strengthened to 6H through compositing SiO2, Al2O3 or TiO2 sol as binders. The composite sol can keep stable at least one month at ambient temperature without any visible precipitation. Therefore, the proposed method is promising to effectively and economically fabricate high performance AR films.

Co-authors

Jiannan Jia, Yao Xiao, Wangchen Hao, Zhiyu Wang, Xianping Fan and Guodong Qian

State Key Laboratory of Silicon and Advance Semiconductor Materials & School of Materials Science and Engineering, Zhejiang University, Hangzhou 310027, China

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Keywords

antireflective coatings of photovoltaic glasses; solar cells; hollow silica nanosphere (HSNs); surface modification; sol-gel method

Dermot Monaghan
Gencoa Ltd, United Kingdom

Session	Advanced Coating Technologies (I)
Date	APRIL 10, 2025
Time (CET)	16:05 - 16:20
Chair	Ozan Özer

Better “Understanding of the Vacuum” to Improve Film Quality and Process Control

Abstract

A wide range of glass is coated and processed in a vacuum environment. The nature of a vacuum is inherently problematic especially when enacted on a very large scale. There is no such thing as a ‘leak’ or contamination free vacuum chamber, just the levels and the effect on production quality and speed. The standard approach to assessing the vacuum quality is the pressure reading and helium leak checking. To a lesser extent, analysis of the trace gases in the vacuum is used to provide more definitive analysis. Gas analysis is a powerful tool as it provides a total picture of species present, and this can be used to track production quality and unwanted variations. It can provide on-line chamber atmospheric leak rates, leak rates of chamber components, substrate and chamber moisture outgassing rates, as well as the quality and ratio of process gases. All this information can be used to good effect to improve product quality and productivity as well for AI based optimisation. The method of remote plasma optical emission spectroscopy (RPOES) has been shown as a very important tool to track gas species in an industrial vacuum environment as it combines sensitivity with robustness.

Keywords

vacuum, quality, coating, productivity, rga

Marcus Klein
Suragus GmbH, Germany

Session	Advanced Coating Technologies (I)
Date	APRIL 10, 2025
Time (CET)	16:20 - 16:35
Chair	Ozan Özer

Insights into Future Glass-Coating Monitoring Solutions by Inductive Inspection Methods

Abstract

Functionalization of glass is being used in several applications for decades and new or improved functions and application are added constantly. Innovations are achieved by the application of thin-films in architectural glass, smart glass, display glass, solar glass, heatable glass, mobile friendly glass or bird friendly glass. Also ultra-thin glass with integrated touch sensors or displays are develop for the achievement reactive surfaces. Aspects for innovation are thin-film deposition, thin-film modification, and thin-film removal or structuring. Along with new materials, new layer stacks and advanced processes its process control is crucial for cost efficient production of advances layer stacks. Here individual monitoring solutions and process control strategies are required. The presentation describes monitoring strategies for glass processing based on inductive layer characterization by eddy current sensing. Many existing limitations are reduced and new innovations are being achieved. The focus of this talk is the depiction of new opportunities for process monitoring achieved by new sensor capabilities that allow to address process requirements, in terms of the measurement task itself and the specific process environments. Requirements such as minimized installation space, high-vacuum at high-temperature conditions up to 600°C require new innovations. New innovations such as miniaturized sensor solutions, high temperature resistant sensors, sensor lines for inline imaging are shown. The talk also addresses new monitoring strategies which are enabled by this. German-based SURAGUS company provides process and quality control solutions by means of high frequency eddy current technology, for applications such as architectural glass, smart glass, display glass, solar glass, heatable glass, mobile friendly glass or bird friendly glass and further automotive glass applications

Keywords

emissivity, metrology, eddy current monitoring, process control

Wilmert De Bosscher
Soleras, Belgium

Session	Advanced Coating Technologies (I)
Date	APRIL 10, 2025
Time (CET)	16:35 - 16:50
Chair	Ozan Özer

Digitalization of Large Area Glass Coaters: Enabling Future Coating Expectations

Abstract

Digitalization has come a long way and adoption into industry is happening at an ever-increasing pace. The revolution in high volume large area glass coating applications is happening today.

This presentation tries capturing various activities of digital transformation in industrial vacuum deposition processes and how these may significantly impact our expectations and way of working in the near-future coating businesses.

Although most recent sputter coaters have plenty of possibilities for logging process parameters in real time, data mining and correlation analysis is often insufficiently explored. Limited integration into overall coater data management systems may limit the potential of those advanced tools. Having an appropriate IT framework and data gateways can link all settings and sensor data to the final performance of coated products. A new and flexible control and monitor interface is presented, allowing flexibility in dashboards and user specific configuration tools.

Incorporating machine learning into coater operation and coating processes while using aggregated data from prior operations will be discussed. By linking historical metrology data with real-time sensor and process data, performance of the coated product may be predicted during the coating process. These capabilities allow implementing an operator controlled or automated feedback loop system for providing long-term stable high quality and high yield output even for more complex coated products. In addition, component performance and the potential need for preventive maintenance on coating equipment may be monitored and allowing optimal functionality of the system.

A combination of the presented enablers will allow achieving the desired production efficiency at minimized costs and thus reducing CO2 emission and carbon footprint. Finally, innovative glass products with advanced coating functionalities and energy saving performance contribute significantly to our greener and sustainable future.

Keywords

vacuum coater, sputter equipment, control software, machine learning

Dr. Paweł Kwaśnicki (Invited Speaker)
John Paul II Catholic University of Lublin
ML System S.A., Poland

Session	Advanced Coating Technologies (I)
Date	APRIL 10, 2025
Time (CET)	16:50 - 17:20
Chair	Ozan Özer

Application of Atomic Layer Deposition Processes in Photovoltaic Systems

Abstract

Atomic Layer Deposition (ALD), a gas-phase thin-film deposition technique based on self-limiting surface reactions, offers unparalleled control over film thickness and conformality, rendering it highly advantageous for photovoltaic (PV) device fabrication. ALD enables the deposition of ultrathin, pinhole-free passivation layers, such as Al_2O_3 and SiO_2, on semiconductor absorber surfaces, effectively suppressing surface recombination velocities and consequently enhancing minority carrier lifetimes. Furthermore, ALD plays a critical role in the synthesis of transparent conductive oxides (TCOs) with optimized electrical and optical properties, as well as the engineering of functional interlayers and buffer layers at critical interfaces to minimize interfacial defects and optimize charge carrier transport. ALD plays a crucial role in the advancement of quantum dot solar cell (QDSC) technology by addressing several key challenges associated with these devices such as improving stability by passivation, improving carrier transport for both electron and hole, enhancing the interfaces in order to optimize energy level alignment. By enabling the deposition of conformal coatings on complex nanostructured substrates and facilitating precise compositional control within multi-layered structures ALD is leading technology in QDSC manufacture process. Despite its significant advantages, the application of Atomic Layer Deposition (ALD) in the production of quantum dot solar cells (QDSCs) also presents several disadvantages and challenges such as: relatively slow deposition rate and cost, precursor availability and handling, material constraints and one of the biggest challenge scalability. Still scaling up the process to deposit uniform films over large areas remains a significant challenge. Maintaining uniform precursor distribution and reaction rates across large substrates in ALD reactors is difficult. In this work we present the scaling up process of ALD layer deposited on glass surface of 1000 x 2000 mm. The key parameters such as process temperature and homogeneity as well as pulse time of selected precursor and puree time were optimized in order to obtained conformal layer.

Keywords

thin film deposition, photovoltaic systems, quantum dots, solar cell

Prof. Dr. Alicia Duran (Invited Speaker)
Instituto de Cerámica y Vidrio, CSIC, Spain

Session	Advanced Coating Technologies (II)
Date	APRIL 11, 2025
Time (CET)	13:15 - 13:45
Chair	Hasan İsmail

Smart Multilayer System Based on PEO and Sol-Gel Process for AZ31B Mg Alloy

Abstract

Magnesium alloys have become promising materials for different applications due to their light weight. The use of lightweight materials is a viable and suitable option to reduce the overall weight of vehicle bodies and therefore their energy consumption. Nevertheless, the high chemical reactivity of Mg alloys makes them very susceptible to corrosion, limiting their widespread use.

Under this perspective, the aim of this work was to develop a smart integrated protective system to provide long-term protection to Mg alloys. The smart system was performed by depositing a first oxide layer using the Flash-plasma electrolytic oxidation process (F-PEO) followed by the sealing of the F-PEO coating using a glass-like CexOY sol and finally, the deposition of an inorganic-organic hybrid SiO_2 coating. The F-PEO coating was obtained using an environmentally friendly electrolyte using phosphate and carbonate salts. The glass-like CexOY coating was developed using cerium acetate as precursor and the SiO_2 hybrid coating was obtained by hydrolysis and condensation reactions of tetraethoxysilane (TEOS) and 3-(glycidyloxypropyl) trimethoxysilane (GPTMS), SiO_2 nanoparticles.

Different techniques were used to characterize the smart integrated protective system such as SEM, optical microscopy, etc. Finally, Electrochemical Impedance Spectroscopy (EIS) and Scanning Kelvin Probe Microscopy (SKPFM) were performed to characterize the corrosion resistance of the smart coatings using a highly concentrated 3.5% wt. NaCl. EIS and SKPFM measurements confirmed that the integrated multilayer coating provides long-term corrosion protection to Mg alloys (more than 20 days) through a mechanism that involves the migration and precipitation of cerium ions (Ce_3+/Ce_4+) into CeO_2 crystalline species.

Co-authors

E. Merino, Y. Castro
Instituto de Cerámica y Vidrio, CSIC, Spain

Notes

This item is a part of the dissemination activities of MICINN project TED2021-131258B-I00, and FunGlass project. This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreement No 739566..

Keywords

AZ31B Mg alloy, PEO, sol-gel, self-healing, Glass-like CexOy coating

Dr. Jörg Neidhardt (Invited Speaker)
Fraunhofer Institute for Electron Beam and Plasma Technology, Germany

Session	Advanced Coating Technologies (II)
Date	APRIL 11, 2025
Time (CET)	13:45 - 14:15
Chair	Hasan İsmail

Novel Processing Technologies and Substrates for Large Area Coating

Abstract

The ever-growing demands on innovative technologies as well as increasing environmental concerns drive the development of surface engineering solutions. These technologies play an increasing role especially within the glass coating industry, where improved performance, new functionalities as well as higher productivity / reduced costs of glass products are of vital importance.

Fraunhofer FEP is hereby a technology service provider turning lab-scale ideas (TRL 3) into pilot-scale surface engineering solutions (TRL 7). These collaborative approaches with partners and clients encompass technology development, coating stack design, feasibility and scaling studies as well as hardware and components design. During this talk 3 innovative approaches alongside with the respective use cases will be presented:

Technologies and pilot equipment for coating and surface engineering of ultra-thin flexible glass

- Innovative substrate down to 30 µm thickness
- R2R (300mm width) and S2S (600x1200mm2) inline processing capabilities
- incl. inline cleaning, handling, inspection and full-face vertical coating
- mechanical characterization of the surface and edge strength
- Application examples: transparent contact layers and thermochromic materials for smart glazing

Energy-efficient inline flash lamp annealing of large areas

- Surface selective annealing method
- Inline processing of up to 600mm width
- In vacuum or controllable atmosphere
- Application examples: cost effective highly transparent conductive oxides and lowE coatings, recrystallization of self-cleaning TiOx, dewetting of color selective plasmonic structures, chemical surface activation for antipathogenic and anti-fingerprint functionality

Optical coating stacks on large precurved 2.5D substrates

- Inline coating of substrates with a thickness or curvature of up to 120mm and 150kg
- Inline sputter deposition of high/low layer stacks with optical precision
- Compensation of curvature by adapted machine and component design
- Special emphasis on particle control during in-line processing
- Application examples: holographic full-face head-up-displays in car windscreens, large laser-optical components

Co-authors

Kerstin Täschner, Thomas Preußner, Daniel Glöß
S2S Technologies and Precision Coating, Fraunhofer FEP, Dresden, Germany

Keywords

surface engineering, smart glazing, coating technology development, flexible glass, flash lamp annealing

Juris Purans
University of Latvia, Latvia

Session	Advanced Coating Technologies (II)
Date	APRIL 11, 2025
Time (CET)	14:15 - 14:30
Chair	Hasan İsmail

Chromogenic Thin Films for Smart Windows

Abstract

Chromogenic thin films (electrochromic, thermochromic, and photochromic) are at the forefront of smart window development, which is anticipated to play a pivotal role in energy conservation for the buildings of the future. Within the EU HORIZON project Smart Windows for Zero Energy Buildings, innovative single and multi-layered transition metal oxide (TMO) thin films have been designed and fabricated. These include ReO_3-WO_3, MeO-IrO_2, WO_3/Cu/WO_3, and rare-earth metal oxy-hydrides (REHO) such as Y-H-O, utilizing advanced Reactive High-Power Impulse Magnetron Sputtering (R-HiPIMS) and industrially scalable roll-to-roll (R2R) deposition techniques.

Building on pioneering work initiated in the 1990s, synchrotron radiation studies have been extensively applied to investigate cathodic electrochromic oxides such as WO_3, MoO_3, and ReO_3-WO_3, as well as anodic oxides including NiOx, IrOx, and NiO-IrOx. Among these materials, REHO thin films represent a groundbreaking class of inorganic mixed-anion compounds with exceptional photochromic properties, including pronounced light-induced resistivity changes. Recent advancements extend these investigations to photochromic Y-O-H systems and antibacterial coatings like WO_3/Cu/WO_3, highlighting their potential for multifunctional applications.

Additionally, large-area roll-to-roll deposition of YHO and WO_3/Cu/WO_3 has been explored to enable scalable production for smart windows and other optoelectronic devices. This work underscores the potential of advanced chromogenic materials to transform energy-efficient building technologies, offering a significant contribution to achieving zero-energy goals.

Notes

Financial support was provided by the Project "Smart Windows for Zero Energy Buildings" (SWEB) GA nr. 101087367.

Keywords

chromogenic, smart windows, thin films, HIPIMS deposition

Robert Arndt
CTF-Solar, Germany

Session	Advanced Coating Technologies (II)
Date	APRIL 11, 2025
Time (CET)	14:30 - 14:45
Chair	Hasan İsmail

Building Integrated Photovoltaic (BIPV)

Abstract

In the effort to reverse climate change and phase out the consumption of fossil fuels, solar energy is indispensable. While representing far less installed capacity than utility-scale systems, building-integrated photovoltaics (BIPV) is nevertheless an important and significant component of the increased adoption of photovoltaics necessary for the transition to a sustainable energy supply, and the segment has been rapidly growing along with the solar energy market as a whole. BIPV can be divided into three main categories: rooftop, facade, and windows (semi-transparent). Rooftop accounts for a little more than half of the total share, and based on previous trends, the relative ratios of these three categories is fairly constant over time. Trends in market growth indicate that by 2029, European demand for solar windows will exceed 1 gigawatt.

In terms of price and performance, crystalline silicon historically and presently is the dominant PV technology with 95% market share overall, particularly in utility and residential applications. However, for building facade and especially for semi-transparent applications, thin-film technologies are strongly favoured.

CdTe is the most well-established thin-film technology worldwide with almost exclusive thin-film market share, currently delivering module conversion efficiencies in the range of 18-20%. As a polycrystalline thin-film technology, CdTe offers a significant degree of configuration flexibility which is particularly relevant for BIPV. Semi-transparency of nearly any degree is achievable by multiple methods. Module fabrication is largely unconstrained by module size and aspect ratio – modules can be easily designed to accommodate any size and rectangular shape with minimal loss in performance. A number of CdTe BIPV products will be shown in the presentation to demonstrate the potential range of applications, from transparent windows and fences to colorful exterior components.

Keywords

BIPV, thin film on glass, solar window

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DECARBONIZING THE GLASS INDUSTRY

Simone Tiozzo (Invited Speaker)
Stazione Sperimentale del Vetro scpa, Italy

Session	Decarbonizing the Glass Industry (I)
Date	APRIL 10, 2025
Time (CET)	13:15 - 13:45
Chair	Serkan Şahin

Horizon Europe project H_2GLASS: Outcomes of the First Campaigns of Industrial Scale H_2 Combustion Trials Performed in a Container Glass Melting Furnace of Steklarna Hrastnik

Abstract

Within the framework of the Horizon Europe H_2GLASS Project, from the 20th November to the 1st December 2023, several days of experimental campaigns of preliminary H_2 combustion trials took place in the industrial demonstrator site of Steklarna Hrastnik. The tests were carried out on an oxy-fuel fired furnace producing high quality flint glass for the manufacture of premium beverage containers, and were aimed at assessing the impact of the combustion of various H_2/Natural Gas blends on the gaseous emissions, on glass quality and on the energy transfer by flames to the melt and raw materials.

The trials involved feeding different couples of burners (out of 6 total) at a time with fuel mixtures ranging from 0% to 100%, H_2, that is experimenting combustion configurations where H_2 accounted for up to the 60% in volume of the total fuel input, thus contributing up to 33% of the total power required for glass melting, which translates into an equivalent up to 33% reduction in direct combustion CO_2 emissions.

During the trials, SSV carried out simultaneous multi-parametric measurements in several points of the furnace system, deploying its MCM – Multipoint Continuous Monitoring approach for glass furnace behavior characterization. This presentation will highlight the main results and evidences gathered from these on-site measurements, providing a first assessment of the impact of increasing H_2 concentrations in fuel on combustion, emissions and production of the studied furnace.

Co-Authors

Damiano Marchese, Stazione Sperimentale del Vetro scpa, Italy
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Keywords

decarbonization, hydrogen, furnace, emissions, oxy-combustion

Elisa Gerali, Annick Lachance Nyiringango
Stara Glass, Italy

Session	Decarbonizing the Glass Industry (I)
Date	APRIL 10, 2025
Time (CET)	13:45 - 14:00
Chair	Serkan Şahin

From Natural Gas to Hydrogen mixtures: Challenges and Opportunities in Combustion for Sustainable Glass Furnaces

Abstract

The shift from traditional NG combustion to the use of hydrogen mixtures represents a pivotal transition in the pursuit of sustainable industrial processes. This presentation explores the advantages and challenges posed by new fuel sources, particularly in glass furnace applications, where reducing CO_2 emissions is a priority. While hydrogen and syngas offer a low carbon footprint that can enhance a better environmental impact, their adoption is hindered by evolving regulatory frameworks and safety concerns. A focus will be placed on the diverse production pathways for hydrogen and syngas and the need for consolidated international standards to support their integration into industrial practice.

Keywords

glass, decarbonization, hydrogen, syngas, new challenges

Bruno Malphettes , Wolf Kuhn, Syntia Metchueng Kamdem
Fives, France

Session	Decarbonizing the Glass Industry (I)
Date	APRIL 10, 2025
Time (CET)	14:00 - 14:15
Chair	Serkan Şahin

Progress in Lower Carbon Float Glass Melting: From Oxyfuel to Hybrid

Abstract

Glass melting is a demanding process that faces unique challenges related to energy consumption, efficiency, cost, and productivity. Float Glass makers are requested to make drastic changes to their furnaces and processes to follow a long term decarbonization path, while maintaining quality and total cost of ownership of their assets with minimal industrial risk. While most of the changes glassmakers make are usually incremental, Fives is developing a specific roadmap for Float Glass melting decarbonization, ready to bring change for good.

As an example, the paper will discuss Fives recent industrial success in float glass melting using preheated oxygen and natural gas as a primary melting energy. Combining this technology brick with advanced furnace design features, a unique L.E.M® technology solution was applied by Fives on a float glass furnace, yielding undeniable results in terms of energy consumption, furnace productivity, and NOx and SOx primary emissions.

As a second step, we will dive into Fives roadmap for melter electrification applied to Float Glass. While electrification is already well underway in most glass sectors, from fibers to container, especially with Fives new Ecoflex design, Float Glass electrification requires a dedicated approach to tackle specific issues. We will discuss the challenges of optical quality, fining, furnace durability and energy saving concerns and how to solve them to reach high levels of electrification with high tonnage and no compromise on glass quality.

Keywords

oxygen, preheating, boosting, float, melting

Galen Kutlubay
TOPSOE, Denmark

Session	Decarbonizing the Glass Industry (I)
Date	APRIL 10, 2025
Time (CET)	14:15 - 14:30
Chair	Serkan Şahin

Revolutionizing Glass Manufacturing with Green Hydrogen and Catalytic Filtration

Abstract

Topsoe is a global leader in decarbonization technologies, committed to creating a sustainable future for industries worldwide. We deliver innovative solutions like Solid Oxide Electrolysis Cells (SOECs) to produce e-fuels, enabling companies to transition to low-carbon operations. Our catalytic filtration technologies also support compliance with air emission regulations, addressing key environmental challenges.

The glass industry is under pressure to advance existing technologies and adopt innovative solutions such as green hydrogen (H_2) to reduce emissions affordably. Projections indicate the sector could achieve full decarbonization by 2050 through advanced technologies enhancing energy and environmental efficiency.

For over 20 years, Topsoe has partnered with glass manufacturers, delivering catalytic filtration technologies to support emission reductions. Our innovations advance De-NOx processes, ammonia (NH_3) control, CO and VOC removal, and dioxin (PCDD/F) destruction.

SOEC technology is central to our strategy, using high-temperature electrolysis to produce green hydrogen, syngas, and other sustainable products from renewable energy. Green hydrogen offers a viable, sustainable alternative for high-temperature processes, reducing reliance on fossil fuels. While electrification will dominate future glass production, hydrogen is expected to account for 21% of the fuel mix, making it crucial for decarbonization.

SOEC also supports e-fuel production, such as methanol and ammonia, when integrated with carbon capture systems, ensuring significant CO_2 reductions without compromising efficiency. Trials have demonstrated green hydrogen's transformative potential in reducing CO_2 emissions and improving energy efficiency.

Topsoe empowers the glass industry to adopt green hydrogen, e-fuels, and catalytic filtration technologies to meet sustainability goals and remain competitive globally. Our innovations are driving the transition to a cleaner, net-zero future.

Keywords

decarbonization, emission control, green hydrogen, catalyst, electrolysis

Sebastian Krogel
Nikolaus SORG GmbH & Co. KG, Germany

Session	Decarbonizing the Glass Industry (I)
Date	APRIL 10, 2025
Time (CET)	14:30 - 14:45
Chair	Serkan Şahin

SORG's Technology Portfolio to Support Glass Industry at Decarbonization

Abstract

Company Nikolaus SORG is a supplier of high-end glass-melting furnaces.

Most of our customers are facing huge challenges in regard of the decarbonization of their industry facilities. There are multiple ways meeting this challenge. SORG is supporting its customers in all potential directions, considering their wishes and local boundary conditions.

The presentation wants to give an overview over the innovative technical solution possibilities provided by SORG. Apart from our well known all-electric VSM® furnace series and the CleanMelter® hybrid, we also have experience with heavy-boosted end fired furnaces as well as with hydrogen combustion equipment. With a broad portfolio of solutions SORG is the right partner in challenging times.

Keywords

furnaces, heavy-boosted, hybrid, all-electric, hydrogen

Thomas Bewer
Bucher Emhart Glass, Switzerland

Session	Decarbonizing the Glass Industry (I)
Date	APRIL 10, 2025
Time (CET)	14:45 - 15:00
Chair	Serkan Şahin

CO_2 Reduction and Strengthening Techniques for Lightweight Container Glass

Abstract

As the packaging industry continues to focus on sustainability, lightweight container glass presents a significant opportunity for reducing CO_2 emissions and advancing eco-friendly production practices. This talk provides an overview of the CO_2 reduction potential associated with lightweight container glass, emphasizing the environmental benefits of reducing glass weight without compromising container performance. Key challenge is to stabilize the container forming process. Innovative approaches will be presented that ensure process stability and thus allowing the production of lightweight containers.

The discussion will also delve into cutting-edge methods for inline strengthening of container glass, which enhances durability and resistance to breakage, even with reduced material usage. First results from these methods will be presented, demonstrating the viability and effectiveness of these techniques in real-world production settings. By exploring these advancements, this session will highlight how the glass industry can achieve both sustainability goals and improved product performance through the adoption of lightweight glass technologies.

Keywords

lightweighting, glass strengthening, process control, process stability

Michel Gaubil[1] Gautier Herbouze[1], Stéphane Schaller[1], Damien Bolore[2], Isabell Gross[2]
[1]SEFPRO, France, [2]SGR Provence, France

Session	Decarbonizing the Glass Industry (I)
Date	APRIL 10, 2025
Time (CET)	15:00 - 15:15
Chair	Serkan Şahin

Hybrid Melting Technology: A Challenge for Glass Furnace Lifetime

Abstract

The first key challenge of the glass industry for the years to come is to Achieve low carbon glass production. Glass companies have announced clear targets to reach carbon-neutrality in the coming decades. This challenge is facing many obstacles. The most significant one being the switch to renewable energy sources. Among them, glass furnace electrification will play a significant role for many players in the industry. Switching from fuels to electrical power on glass furnace involves high impact on refractories material lifetime. We will discuss, with CFD and corrosion simulation data support from SEFPRO, what could be the evolution of soldier block corrosion profile and bottom paving. We will analyze the contribution of numerical simulation to compare different situation. Moreover, in order to limit the impact on glass furnace lifetime we will propose different refractory solution including Fused Cast AZS such as ER 2010 RIC, ER 1699RS, Xeebost. Finally, we will address how monitoring solutions can support hybrid furnace management.

Keywords

Refractory Corrosion Numerical Simulation Monitoring

Jeremy Lindley
Diageo, United Kingdom

Session	Decarbonizing the Glass Industry (II)
Date	APRIL 11, 2025
Time (CET)	13:15 - 13:45
Chair	Değer Demircan Acılıoğlu

How & Why We Developed The World's Lightest 70cl Glass Scotch Whisky Bottle

Abstract

Johnnie Walker and Sisecam recently unveiled a first-of-its kind, boundary-breaking innovation. Johnnie Walker Blue Label Ultra, the world's lightest 70cl Scotch whisky glass bottle; a design that takes bold strides and dares to experiment with a recognised paradigm of luxury. With the luxury world heading in a new direction – one where 'understated' is the new 'overstated' and 'delicacy' the new 'heavy' – we sought to experiment with luxury whisky to see what might be possible in lightweighting glass.

At just 180g – half the weight of the brand's next-lightest whisky glass bottle – Johnnie Walker Blue Label Ultra has been created by adopting the 'concept car' approach and designing without limitation. Johnnie Walker, SignatureGlass and Sisecam rethought all aspects of how the bottle is designed, made and transported: from hand-blowing the glass, to using a teardrop shape which, for the first time ever, meant rethinking the iconic Johnnie Walker square bottle.

The result is an industry-first that, as well as achieving exquisite beauty, has a lower impact upon the planet in terms of carbon. The knowledge garnered over these five years is already being applied to lightweighting projects across the Diageo range. The brand's findings have been granted a patent and in order to encourage further progress in the industry – and in a first for Diageo – the license will be offered royalty-free to anyone in the world who wishes to share in these discoveries.

In celebration of this technological breakthrough 888 limited-edition bottles will be on sale, starting in the UK in February 2025 and then in the US, Singapore and Northern Europe, RRP £1000.

Johnnie Walker Blue Label Ultra was born out of a vision for the future of luxury. The technical challenges that lightweighting presents led us to incorporate design and production specifications that we could not have envisaged at the start of our journey

Notes

Diageo is a global leader in beverage alcohol with an outstanding collection of brands across spirits and beer categories. These brands include Johnnie Walker, Crown Royal, J&B and Buchanan's whiskies, Smirnoff, Cîroc and Ketel One vodkas, Captain Morgan, Baileys, Don Julio, Tanqueray and Guinness.

Following extensive research, to the best of our knowledge, Johnnie Walker Blue Label Ultra is the world's lightest 70cl Scotch whisky glass bottle.

In general, independent studies show that, all else equal, for every gramme of glass reduced that means over half a gramme less carbon emissions in production.

- Source: British Glass UK glass manufacturing sector decarbonisation roadmap to 2050 page 6.

Keywords

lightweight, glass, innovation, luxury, world's-lightest

Steve Whettingsteel
Krysteline Technologies Ltd, United Kingdom

Session	Decarbonizing the Glass Industry (II)
Date	APRIL 11, 2025
Time (CET)	13:45 - 14:00
Chair	Değer Demircan Acılıoğlu

The Decarbonisation Pathway for Used Glass

Abstract

Glass recycling must evolve to support a more viable low carbon approach. One motivated to change, by setting ambitious carbon reduction targets which mostly revolve around key cornerstones of fuels, lightweighting and efficiency. Can there be significant short-term gains by revisiting our cullet and recycled glass strategy? How can the industry prepare for a positive future, where all glass products have a low or negative CO_2 footprint?

A great challenge for glass recycling is the understanding of CO_2 expenditure in the creation and delivery of cullet to a furnace, in many cases the true cost of CO_2 in its recycling is greater than its claimed benefit.

Sustainable low CO_2 solutions for all glass entering a recycling facility are required for the long-term viability of the glass industry, respecting and monetising all glass equally. Innovation and progressive thinking are developing a clearer strategy for glass recycling, one focused on low CO_2 and the recycling of all types of glass including containers, automotive, flat glass, pharmaceutical and photovoltaic (PV) cells.

We consider how a more inclusive CO_2 strategy with cooperation with academic research facilities and small businesses will impact the recycling landscape by facilitating the discovery and development of ultra-low CO_2 products for current and emerging markets. We will review how the location of glass and facilities affects the viability of use and look at the complexities and market dynamics required to establish a fair and logical national and international approach of glass decarbonization. Resolving to determine a strategy based on CO_2 instead of tonnage and considering CO_2 at every stage from conception along its journey through distribution, filling, packaging, distribution, waste collection, processing at an MRF, transport to beneficiation. To be legislated in a logical way, to mandate change, and motivate policies based on location, available markets, and of course CO_2.

Keywords

glass recycling, decarbonisation, carbon strategy, scope 3

Niels Schreuder, Cor Wittekoek
Vlakglas Recycling Nederland (VRN), Netherlands

Session	Decarbonizing the Glass Industry (II)
Date	APRIL 11, 2025
Time (CET)	14:00 - 14:15
Chair	Değer Demircan Acılıoğlu

Together We Make Glass Infinite

Abstract

Recycling is not a choice, but a necessity. After all, the depletion of the earth's raw materials has been a growing problem for many years. Our supplies of oil, gas, minerals and metals are being depleted so fast that it is uncertain how much more we can extract from the earth. Recycling is part of the solution to this issue. It is worth separating and collecting any materials that we can in order to recycle them. The same applies to waste sheet glass.

This non-profit organization coordinates all the activities associated with recycling and collecting waste glass in an efficient, environmentally friendly manner and at the lowest possible cost. Furthermore, the foundation promotes awareness of and enthusiasm for recycling glass. The government has also demonstrated its commitment to this process by legislating for the sheet glass recycling levy (financial fee) for double glazing.

The glass cycle...

After collection, the waste sheet glass is transported by boat or truck to specialist recycling plants. There, the dirt is removed from the glass and it is processed into a material called cullet, which is made up of small pieces of cleaned recycled glass. This cullet can then be re-used in the glass industry.

Circular; the next step

But as recycling means melting, still a lot of energy is used resulting in emission of CO2 and NoX. Therefore we started with the collection of unbroken double glazing from renovation projects. This glazing will be dismantled in to separate glass panes. The uncoated pane can be used for the production of of new double glazing. The other pane can be used for the production of new float glass, instead of packaging glass or glass wool. By doing this we close the loop of flat glass (flat-to-flat) and we create real circular glass.

Notes

Acknowledgment

This work has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101129967". Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Union or European Innovation Council. Neither the European Union nor the granting authority can be held responsible for them.

Keywords

glass waste, glass recycling, additive manufacturing, gmorph-glass laser morphing.

Stuart Hakes
FIC UK Limited, United Kingdom

Session	Decarbonizing the Glass Industry (II)
Date	APRIL 11, 2025
Time (CET)	14:15 - 14:30
Chair	Değer Demircan Acılıoğlu

The Reality of Decarbonisation in The Glass Industry

Abstract

The paper will examine the various options for decarbonisation of furnaces and forehearths and discuss how far we are from achieving them and the specific barriers to overcome.

Keywords

decarbonisation, furnaces, forehearths, hydrogen, electricity

Jozef Kraxner[1], Hana Kaňková[1], Rafael Comesana[2], Giulio Gorni[3], María Jesús Pascual[3], Juan Pou[3], Dušan Galusek[4]
[1]FunGlass, Alexander Dubcek University of Trenčín, Slovakia [2]CINTECX, School of Engineering, University of Vigo, Spain
[3]Ceramics and Glass Institute (CSIC), Spain [4]Joint Glass Centre of the IIC SAS, Slovakia

Session	Decarbonizing the Glass Industry (II)
Date	APRIL 11, 2025
Time (CET)	14:30 - 14:45
Chair	Değer Demircan Acılıoğlu

Everglass – Innovative Glass Recycling Technology Process

Abstract

Glass as a material plays an important role in the carbon-neutral future, but current technology does not allow full recycling. While Europe has efficient processes for recycling soda-lime glass, recycling of many other types, for example, optical glass, electronic screens, and glass wool, is often neglected. With the increasing amount of this glass waste, much is either landfilled. This problem also applies to waste from the medical and digital technologies sectors, which produce waste glass from X-ray tube glass, pharmaceutical vials, and LCD screens. Given the rapid expansion of these industries, it is imperative to address the increasing volume of this polluting glass waste. The current model, which recycles only a small fraction of glass, must evolve into a comprehensive recovery strategy capable of processing all glass types, which can be recycled indefinitely.

This study focuses on developing a laboratory-scale prototype Everglass recycling process, employing Gmorph-Glass Laser Morphing to process various waste glasses into novel 3D objects. This innovative approach seeks to unveil sustainable pathways for efficient recycling of various glass systems, thereby tackling critical environmental and industrial challenges.

Notes

Acknowledgment

This work has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101129967". Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Union or European Innovation Council. Neither the European Union nor the granting authority can be held responsible for them.

Keywords

glass wastes, glass recycling, additive manufacturing, gmorph-glass laser morphing

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GLASS IN THE DIGITAL AGE

Johan van der Dennen (Invited Speaker)
CelSian Glass & Solar B.V., Netherlands

Session	Glass in The Digital Age
Date	APRIL 11, 2025
Time (CET)	09:50 - 10:20
Chair	Seçil Erman

Celfos: Simulation-Assisted AI Modeling for Glass Quality Prediction

Abstract

The glass industry operates in an increasingly complex environment, with rising demands for quality, energy efficiency, and cost optimization. Furnace operators play a critical role in navigating these challenges, yet they face an overwhelming volume of process variables and data points to analyze in real time. This raises the following question: How can we provide operators with actionable insights, reducing guesswork and improving confidence?

Traditionally, furnace control systems have focused on stabilizing temperatures, yet temperature stability alone does not guarantee optimal glass quality. Aligning operational performance, reliability, and glass quality requires a deep understanding of the dynamic, time-transient behavior of glass furnaces. The challenge lies in the broad residence time distribution, influenced by multiple variables, and the difficulty of identifying key process parameters that impact glass quality. Moreover, conventional systems struggle to adapt to sensor deterioration or replacement, leading to data inconsistencies and reduced reliability.

This presentation introduces Celfos, an AI-powered system that enhances operational decision-making by linking process settings to glass quality. By combining advanced neural network models with time-transient CFD analysis (GTM-X), Celfos provides insights into complex furnace dynamics and delivers precise quality predictions.

Celfos combines historical furnace data and real-time process parameters with qualitative GTM-X models. It works for all common glass and furnace types and is control system independent The neural network is trained to correlate these inputs with glass quality metrics, enabling predictive quality control and adaptive decision-making, even when sensors degrade or are replaced.

Celfos is a dynamic, adaptive system that brings the glass industry closer to a future of precision and efficiency designed to support operator expertise.

Co-Authors

Oscar Verheijen, Arnab Ghosh, Luuk Thielen

CelSian Glass & Solar B.V., Eindhoven, The Netherlands

Keywords

self-powered facades, media glass, BIPV, transparent photovoltaics, sustainable architecture

Yakup Bayram
PaneraTech, Inc. United States

Session	Glass in The Digital Age
Date	APRIL 11, 2025
Time (CET)	10:20 - 10:35
Chair	Seçil Erman

Co-working with AI: Lessons Learned from Steel Industry

Biography

Dr. Yakup Bayram is CEO of PaneraTech. PaneraTech helps glass and steel manufacturers reliably make more products with their critical assets, even with a less-experienced workforce. PaneraTech's digital transformation of assets enables managers to make data-driven decisions by providing threefold support of technology, data, and expertise. Prior to PaneraTech, Dr. Bayram has been the Principal Investigator and leading scientist on various radar-based sensors for asset health monitoring at The Ohio State University. Dr. Bayram and his team have been working with manufacturers for over two decades, developing innovative solutions for effective critical asset management. Dr. Bayram received his PhD in Electrical Engineering from The Ohio State University, specializing in advanced sensor solutions.

Abstract

Efficiency is the top priority in heavy manufacturing industries, requiring stable processes. Experienced operators are crucial for maintaining stability, as they know how to handle unexpected situations. However, many experienced managers are retiring, leaving a less-experienced workforce that often does not stay long enough to gain sufficient experience.

Digital transformation and data-driven decision-making, using Artificial Intelligence (AI), offer a solution. However, about 75% of AI solutions that need to work alongside humans never reach production.

This presentation will discuss the challenges of AI adoption in manufacturing, steps to address the reasons behind adoption failures, and lessons learned from our experience with AI in the steel industry.

Alexander Ruege
VP Data Analysis and Reporting, PaneraTech, Inc., US

Session	Glass in The Digital Age
Date	APRIL 11, 2025
Time (CET)	10:55 - 11:10
Chair	Seçil Erman

Transforming Glass Furnace Management with Continuous Refractory Wear Monitoring

Abstract

Glasses play a crucial role in modern technology due to their versatile optical and mechanical properties. Enhancing these properties remains a key focus for advancing both scientific understanding of the glasses and practical usability. In this study, hydrothermal treatments were applied to soda-lime silicate glass at different temperatures to investigate their potential in tailoring the glass' structure and properties. The surfaces of the glasses were chemically, structurally, and thermally characterized by various techniques such as differential scanning calorimetry (DSC), positron annihilation spectroscopy (PALS), and spectroscopic analyses. The mechanical properties were also determined using nano-indentation, and the crack formation probability was evaluated. The results showed that soda–lime silicate glass treated in hydrothermal conditions led to notable modifications in the structure, which was vigorously associated with enhanced optical and mechanical properties.

Keywords

soda-lime silicate glasses, hydrothermal treatment, optical properties

Andrea Codazzi
Schneider Electric, Netherlands

Session	Glass in The Digital Age
Date	APRIL 11, 2025
Time (CET)	11:10 - 11:25
Chair	Seçil Erman

Digital Transformation in The Glass Industry

Abstract

The glass industry is undergoing a major transformation. Glass production is an energy-intensive and, in many cases, emissions-intense process. The estimated contribution of the glass industry is about 95 million tons of carbon dioxide per year. 80% of those emissions are from the melting furnace. Converting the industry from its traditional furnaces to digitized hybrid and full-electric versions is essential. However, the real power of digitization lies in more than one piece of equipment. Digitization allows us to visualize and understand the entire value chain-every process connected to the glass produced. It also enables all stakeholders along the value chain to take a data-driven approach to their work. Let's delve into the glass industry's transformative journey, mainly focusing on digitization's role along the value chain and how it helps decarbonization efforts.

Digital twins allow for the simulation and optimization of furnace operations, offering previously unattainable insights. More sophisticated control systems now provide higher precision, efficiency, and sustainability levels. There are numerous benefits: 1. Streamlining operations; Automating and optimizing processes. 2. Improved quality control; Using sensors and data analytics. 3. Energy management; Implementing power and energy management. 4. Predictive maintenance; Machine learning algorithms predict equipment failures. 5. Supply chain transparency; Visibility across the entire chain. 6. Data-driven decisions; Analyzing data trends.

Digitization opportunities in the glass industry underscore the need for expert guidance and collaboration. These tools must be safe, cybersecure, and resilient. With its expertise in electrification and energy management solutions, Schneider Electric can assist glass companies in navigating this transition.

Keywords

digital twin, process optimization, digital factory, digital transformation

Johannes Ertl
Head of Tin Bath Technology, HORN Glass Industries AG, DE

Session	Glass in The Digital Age
Date	APRIL 11, 2025
Time (CET)	11:25 - 11:40
Chair	Seçil Erman

HORN Tin Bath

Abstract

Summary HORN Tin Bath Presentation

1.Introduction HORN

- HORN's capacities in Float Glass Production

2. HORN's Tin Bath

- Tin Bath engineered by HORN
- Capacities from 250 TPD till 1000TPD
- Complete design done by HORN
- All Equipment engineering and produced by HORN

3. HORN's Top Innovative Tin Bath Equipment

- New Tweel
- Equipment for Atmosphere Analysing
- Horn Top Roller
- Drossbox
- New De-Drossing Pocket Design

4. Future development Tin Bath

- Horn's view to the future float glass forming – Tin Bath – Industry 4.0
- Current status of development in HORN

Keywords

tin bath - industry 4.0

Joep Veenbergen[1], Hans-Peter Mueller2

[1]Ardagh Group, Netherlands
[2]Heye International, Germany

Session	Glass in The Digital Age
Date	APRIL 11, 2025
Time (CET)	11:40 - 11:55
Chair	Seçil Erman

AGP Data Strategy and the Power of Unlocking Data Silos

Abstract

In the current market environment, the glass industry faces significant challenges from legislators and alternative packaging materials. Digitalization plays an important role to face these challenges. 'Ardagh's' digitalization transformation is built around 5 specific pillars. As part of this strategy hot end performance remains a critical topic not only for Ardagh but for the container glassmaking industry as a whole. Connectivity to our data silos is an important initial step to deliver on this strategy. Through the collaboration with Heye and the development of SmartLink, we have established flexible 2-way communication between our IS-machines and any 3rd party supplier, unlocked one of our core data silos and set the stage for further automation, centralized monitoring, and efficiency increases.

Keywords

Ardagh, Heye, data, connectivity, SmartLink

Paul Schreuders
XPAR Vision, Netherlands

Session	Glass in The Digital Age
Date	APRIL 11, 2025
Time (CET)	11:55 - 12:10
Chair	Seçil Erman

Future-Proof Container Glass Forming: Actionable Data!

Abstract

With hot end sensing and robotics new possibilities for glass making are within reach. In addition, with Data Science and AI more new opportunities are unlocked. XPAR Vision continues to invest in these technologies.

During the presentation learnings will be shared and examples given. Based on these learnings it is concluded that combining AI and data driven KPI's allow for setting new standards for glass manufacturing, defined by actionable data leading to improved forming process control and optimization. As such allowing for future-proofing glass making.

Keywords

actionable, data, glass, forming, future

Sonia Debets
Iris Inspection Machines, France

Session	Glass in The Digital Age
Date	APRIL 11, 2025
Time (CET)	12:10 - 12:25
Chair	Seçil Erman

Advanced Digitalisation in Inspection for Predictive Defect Detection

Abstract

We live in a world undergoing unparalleled technological transformation even in traditional industries such as glass production. In addition, the challenge of decarbonisation is increasing the need to adapt even faster and to achieve better quality assurance and production efficiency.

Thanks to advanced digitalization in glass inspection, it is possible to meet these modern challenges. At IRIS Inspection Machines, we identified two axes which allow to be more data-driven and sustainable:

1) Real Time Monitoring by an intelligent assistant

2) Integration of AI and Machine Learning

The perception of inspection machines as tools that destroy production is now outdated. Today, the intelligent inspection machines have a role of connected sensors, that collect precious data from glass production in real-time: the size and number of defects, their values and dimensions, the amount of inspected and rejected articles and many more... The AI-based reprocessing of this data uncovers trends and correlations that are imperceptible to a human being.

IRIS Inspection Machines' R&D team has created an AI-based assistant monitoring all its inspection machines 24/7. The concept of collective intelligence developed by IRIS goes far beyond interconnecting machines. Data collected by each machine from the entire furnace are analyzed and refined with the goal of optimizing and fine-tuning the settings of your inspection machines, supervising production, highlighting process drift and detecting early defects.

Understanding the origin and the criticality level of the produced defects, correlating them with mould numbers, and recognizing the trends in their evolution, allows us to identify process variations before they affect your pack-to-melt.

In conclusion, advanced digitalization, including real-time monitoring and AI integration, is transforming glass production. IRIS Inspection Machines enables data-driven insights, optimizing processes, detecting defects early, all while answering decarbonization and inspection challenges in a sustainable way.

Keywords

artificial intelligence, digitalisation, defects prediction, real-time monitoring, sustainability

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ENERGY EFFICIENCY IN GLASS PRODUCTION

Erik H.P.H. Muijsenberg
Glass Service a.s., Czech Republic

Session	Energy Efficiency in Glass Production
Date	APRIL 10, 2025
Time (CET)	15:35 - 16:05
Chair	Tolga Uysal

Decarbonization Through AI Batch Monitoring for Electric and Gas Fired Furnaces Coupled with Model-Based Predictive Furnace Control

Abstract

Batch and cullet melting represent the initial stages of the glass melting process. The stability of this process, influenced by factors such as pull, cullet level, glass color, raw material variations, rheological behavior, and the batch charger, is crucial for ensuring optimal glass quality in gas-fired furnaces. The potential instability necessitates continuous 24-hour monitoring and potential corrective control to minimize quality issues. Additionally, the increasing electric boosting levels resulting from the decarbonization process have the capacity to alter glass convection loops, displacing batch downstream in the process.

In cold top melting furnaces, the thickness of the batch plays a pivotal role in insulating the hot glass melt and minimizing heat loss. However, variations in pull and cullet can significantly impact batch thickness. Until now, there has been a lack of systems capable of measuring the actual batch thickness or height and incorporating this parameter into automatic model-based predictive furnace control.

This paper will present the latest developments and results for both gas-fired and cold top electric melters.

Keywords

decarbonization, batch & cullet glass melting, furnace control & monitoring, batch thickness

Daniel Backhouse
Glass Futures Ltd, United Kingdom

Session	Energy Efficiency in Glass Production
Date	APRIL 10, 2025
Time (CET)	16:05 - 16:20
Chair	Tolga Uysal

Glass Futures: A Research and Collaboration Platform for Glass Industry Decarbonisation

Abstract

The glass industry needs a step-change in technology if it is to achieve net-zero. This involves high risk R&D at a large/industrially-relevant scale. Glass Futures is a not-for-profit research organisation, built by its members from across the global glass industry to do exactly this, at a Centre of Excellence being built in St Helens, UK. The remit of the organisation is to enable its members from across the glass supply chain and beyond to collaborate in areas which affect all parties, with a particular focus on decarbonisation of the glass-making process and its upstream and downstream activities.

At the heart of the new Glass Futures' facility is a 30 tonnes/day pilot-scale glass furnace, due to be commissioned in spring 2025. The facility has been designed to enable the industry to develop and trial new technologies at an industrially relevant scale, without risk to their commercial manufacturing assets, thus providing increased confidence for manufacturers looking to invest in low-carbon technologies such as alternative fuels, CCUS technologies and new raw materials.

In this presentation, the authors will provide an overview of the new Glass Futures facility. The initial programme of pilot-scale trials focusing around low-carbon energy sources (biofuels, electric boost, hydrogen) will be highlighted. In addition, some of the key research work conducted by Glass Futures and partners in this area will be discussed.

Keywords

decarbonisation, sustainability, R&D, innovation, low-carbon.

Shrikar Chakravarti, Hisashi Kobayashi, Chao Liang, Matthias Görisch, Davide Razzari, Herbert Groiss

Linde GmbH, Germany

Session	Energy Efficiency in Glass Production
Date	APRIL 10, 2025
Time (CET)	16:20 - 16:35
Chair	Tolga Uysal

Step Change Reduction in Scope 1 CO_2 Emissions by Converting Air-Regen Furnaces to Oxy-Fuel with OPTIMELT™ Heat Recovery Systems

Abstract

Due to increased emphasis on sustainability, glass companies are looking for ways to substantially reduce CO_2 emissions from their operations. Several glass companies have made definitive commitments for CO_2 reduction as part of the Science Based Targets Initiative.

One approach to economically achieving reduction in CO_2 emissions is by converting traditional air-regen furnaces to oxy-fuel furnaces with OPTIMELT™ Thermo-Chemical Regenerator (TCR) systems. Flue gases typically exit an oxy-fuel glass furnace at 1400 – 1500ºC. Linde's novel OPTIMELT™ technology recovers energy from the flue gas to preheat and reform natural gas. This results in a reduction of 25 – 30% in fuel-based Scope 1 CO_2 emissions.

The first commercial OPTIMELT™ system has been successfully operating for over seven years at a high-quality tableware furnace in the Netherlands. Two other OPTIMELT™ projects are underway with startup scheduled for 2H'25. This presentation will provide a summary of the experience from the field and share preliminary information related to the ongoing projects.

Flue gas typically exits the OPTIMELT system at 600 – 750ºC, a temperature high enough to allow for further heat recovery. Also to be considered are schemes for using the flue gas leaving the OPTIMELT™ system for secondary heat recovery, e.g. preheat batch & cullet / oxygen. This could further decrease the fuel-based CO_2 emissions by 6 – 10%; reducing fuel-based Scope 1 CO_2 emissions by 30 – 40% versus the traditional air-regen case.

The combination of OPTIMELT™ heat recovery and secondary heat recovery could provide glass companies an economical and low risk pathway to achieving their 2030 CO_2 reduction targets. Also, OPTIMELT™ & secondary heat recovery technologies are compatible with low carbon fuels like green / blue hydrogen, bio-ethanol, and ammonia. Furnaces that convert to oxy-fuel with OPTIMELT™ and secondary heat recovery systems achieve an immediate reduction of 30 – 40% in CO_2 emissions while being ready to achieve complete carbon neutrality when low carbon fuels become economically viable.

Notes

This presentation is suitable for the topic "Decarbonizing the Glass Industry" as well as for the topic "Energy efficiency in Glass Production"

Keywords

CO2 reduction, carbon neutrality, fuel reduction, secondary heat recovery, Thermo-Chemical-Regenerator

Daniela Messina
RHI Magnesita, Italy

Session	Energy Efficiency in Glass Production
Date	APRIL 10, 2025
Time (CET)	16:35 - 16:50
Chair	Tolga Uysal

Regenerator Efficiency Optimization through new Checker Settings and Shape Design

Abstract

Regenerators play a critical role in thermal efficiency and energy recovery in industrial processes, particularly in high-temperature applications like glass production. The performance of regenerators depends significantly on the configuration and shape of their internal checker bricks, which impact heat exchange efficiency and operational reliability. This presentation investigates the influence of different checker brick settings and geometries on regenerator performance, focusing on heat transfer efficiency and durability along the regenerators campaign.

Checker bricks, arranged in various patterns and fabricated in diverse shapes, are responsible for maximizing the surface area available for heat exchange while maintaining structural integrity. This research evaluates and compares standard configurations, such as arrangements with TG and TL shapes alongside shape variants like TLW. By employing our internally developed software called R21, it is possible to simulate the efficiency of different checker settings under given operating conditions and finally the study quantifies the effects of these variables on regenerator efficiency.

Results demonstrate that the application of advanced checker settings, involving the new developments in terms of shapes and in terms of applications, in combination with a proper material selection, offer superior heat transfer efficiency due to their high surface area-to-volume ratio, to the promotion of turbulence of the combustion air and waste gases flow and to the promotion of the flows homogeneous distribution. However, these designs necessitate optimization for specific operational contexts. Conversely, the application of straight settings in the lower checker area, like the LCP shapes show lower thermal efficiency but are advantageous in scenarios where high risk of clogging and reduced maintenance are needed.

Keywords

efficiency, regenerators, energy saving, chimney blocks

Philippe Kerbois
AMETEK LAND, France

Session	Energy Efficiency in Glass Production
Date	APRIL 10, 2025
Time (CET)	16:50 - 17:05
Chair	Tolga Uysal

Revolutionizing Glass Furnace Operations with AI-Enhanced AMETEK LAND Image Pro Software combined with NIRB- 2K Thermal Imaging

Abstract

Glass furnace operations demand precise temperature control, efficient energy utilization, and rigorous quality assurance to maintain production efficiency and meet environmental standards.

This paper introduces an innovative AI module integrated with AMETEK LAND Image Pro software, enhancing its thermal imaging capabilities with advanced analytics and manual decision support. The proposed module leverages machine learning and computer vision to optimize furnace performance, improve glass quality, and enable predictive maintenance. Through real-world data and simulations, we demonstrate how the AI module achieves energy efficiency, defect reduction, and operational cost savings. This advancement represents a paradigm shift in glass manufacturing, aligning with Industry 4.0 principles.

Keywords

Machine Learning, batch coverage with AI, Furnace operations with AI, ImagePro Glass

Neil Simpson
Simpson Combustion & Energy Ltd, United Kingdom

Session	Energy Efficiency in Glass Production
Date	APRIL 10, 2025
Time (CET)	17:05 - 17:20
Chair	Tolga Uysal

Infra-Red Does Not Lie! We Have Just Never Seen It Before in Base of Regenerators

Abstract

For decades the regenerator checker shadow pack has been the visual way to check the condition of the regenerator pack. A bright floor with well-defined pack has been the traditional sign of clear regenerators. Less bright areas and less well-defined checker shadow suggests the start of some blockages. Visible dark areas suggest a blockage. Clearly the use of a water-cooled endoscope can provide a clearer image of the blockage of light but does it show that the pack is blocked? A controlled burn-out to help clear may cause greater damage if there is still a path for the air and exhaust gases.

At the 2023 Şişecam Conference the IPA concept for automatic reversal control for end fired furnaces was introduced. As part of the IPA technology a Long Wave Infra Red [LWIR] instrument was used for the first time to look at the rider arches and measure the change in temperature. The logical next step was to look at the impact on cross-fired furnaces. Three cross fired furnaces of different sizes, ages and condition were inspected. The first furnace was a furnace which had some challenges which were not obvious by conventional trouble-shooting. As an experiment the LWIR was positioned in the gable end of the common regenerator. The initial results suggested that there was more than sulphates on the regenerator floor. Use of a different LWIR with a wider angle and different temperature ranges provided a view of the floor and the rider arches. Subsequent measurements can be used to establish if the condition has stabilised or degrading.

Unlike an in-furnace thermal imaging camera which is permanently installed in a water cooled lance on a retraction mechanism the LWIR instrument is around the size of a refractory brick and in the examples shown was installed for 40-60 minutes survey per side to catch both the firing and exhaust side.

Keywords

regenerator, heat-recovery, infra-red, energy-optimisation, infra-red inspection

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MATERIALS SCIENCE IN GLASS

Prof. Dr. Ashutosh Goel (Invited Speaker)
Rutgers University, United States

Session	Materials Science in Glass (I)
Date	APRIL 10, 2025
Time (CET)	13:15 - 13:45
Chair	Dr. İlkay Sökmen

Structural Design of a Scalable Glass with High Hardness and Crack Initiation Resistance

Abstract

The industry has long sought to develop glass that is both "hard" and "crack resistant." However, achieving these properties simultaneously in oxide glasses has proven to be exceptionally challenging. While Al_2O_3-rich oxide glasses with both hardness and crack resistance have been reported in recent years, their industrial application faces two major obstacles: (1) high processing temperatures exceeding 2000°C and (2) limited glass-forming regions near the eutectic point. Our study introduces a structurally engineered high-modulus, hard and crack resistant glass designed within the peraluminous region of the $MgO–Al_2O_3–B_2O_3–SiO_2$ system containing rare earth oxides. This glass can be processed at temperatures ≤1650°C, demonstrates a Vickers hardness (Hv) greater than 7 GPa (under a 1.96 N load), crack resistance (CR) of 26.5 N, and optical transmittance of 90 ± 2%. This presentation will explore the development process behind this glass, as well as ongoing efforts to address challenges related to its scale-up and commercialization.

Co-Authors

Anjali Yadav, Anne Rebecca, Saurabh Kapoor, Brian Wang, Yueh-Ting Shih, Liping Huang

Keywords

glass; hardness; crack resistance; structure

Serena Panighello
Stevanato Group, Italy

Session	Materials Science in Glass (I)
Date	APRIL 10, 2025
Time (CET)	13:45 - 14:00
Chair	Dr. İlkay Sökmen

Advanced Surface Analysis Meets Chemical Functional Techniques to Study Glass in Pharmaceutical Packaging

Abstract

The pharmaceutical industry relies heavily on secure and effective packaging to ensure the integrity, safety, and efficacy of its products. Glass containers have long been a staple in pharmaceutical packaging, thanks to their unique attributes, such as transparency and chemical resistance. Nevertheless, there have been reports glass quality issues, such as corrosion/delamination.

In this study, advanced glass surface analysis techniques, namely, dynamic secondary ion mass spectrometry (D-SIMS) and X-ray photoelectron spectroscopy (XPS), were used in tandem with more consolidated chemical functional techniques for pharmaceutical products. The aim is to characterize the inner vial surface after the converting process and under stress conditions. Different vials obtained from distinct converting process parameters have been investigated by XPS and SIMS to evaluate at nanoscale level the surface composition that may be difficult to assess by other methods. Afterward, the evaluation of vial quality attributes was performed using chemical durability testing platform: pH shift, hydrolytic and corrosion resistance. The purpose is to correlate chemical and physical properties to better define the risk evaluation in assessing common failure modes of pharmaceutical containers.

In conclusion, this work provides a novel overview of the outlook of surface analysis techniques for glass containers in pharmaceutical packaging. By embracing these innovations, the pharmaceutical industry can continue to deliver safe and efficacious products and meet the evolving needs of patients and healthcare providers.

Keywords

borosilicate, glass manufacturing, glass surface, surface analysis, pharmaceutical packaging

Christian Roos
RWTH Aachen University, Germany

Session	Materials Science in Glass (I)
Date	APRIL 10, 2025
Time (CET)	14:00 - 14:15
Chair	Dr. İlkay Sökmen

Glass to Metal Interaction During Forming

Abstract

Forming glass usually requires materials that can withstand direct contact with molten glass. Such materials often must be protected by the application of lubricants from erosion, glass adhesion and overheating. And consequently, such lubricants often cause adjacent problems such as enhanced corrosion or contamination. These limitations can hardly be overcome without a better understanding of the glass contact behavior. The interaction of glass-melts at viscosities of 10^2 Pa·s and higher with the respective contact material is very crucial for a successful glass forming process. One key interaction between glass-melt and its contact material is sticking. At a certain point, no smooth, low-friction at e.g. sliding of a glass-gob into a mould occurs and the glass sticks to the respective forming material. The corresponding theory of this behaviour is nowadays mostly accepted and has later been refined leading to a hypothesis for sticking which has been introduced by a number of scientists.

The presented investigation aims to establish a new approach for determining glass to contact-material interaction during glass-forming, and it uses this approach to explain, why the sticking theory of glass-metal interaction at elevated temperatures needs to be revisited. We first explain the motion of a molten soda-lime glass at elevated temperatures on various materials. We then compare the measured contact angles and capillary numbers with physical theories originally developed for liquids at room temperature. These theories include, in particular, the molecular kinetic spreading model and the model of Mahadevan and Pomeau for droplet dynamics. Furthermore, it is also discussed how the contact behavior of a glass to another material is related to the sticking of glass to the respective material and a new model for glass-metal interaction is proposed.

Notes

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Keywords

kinetic model, glass contact, glass to metal interaction

Massimo Guglielmi
University of Padova, Italy

Session	Materials Science in Glass (I)
Date	APRIL 10, 2025
Time (CET)	14:15 - 14:30
Chair	Dr. İlkay Sökmen

On the Surface Hydrolytic Resistance of Borosilicate Glass Vials under Extreme Depyrogenation Conditions

Abstract

ICG TC12 "Pharma Packaging" started to operate in 2013. Thirteen members from glass and pharma companies, and from research laboratories, started to work addressing the problem of identifying an analytical protocol for determining the delamination propensity of borosilicate vials through specifically designed round robin activities. A short resume of this work, which che ha impegnato will be given at the beginning, devoting the rest of the presentation to the last effort of TC12, which was devoted to check the effect of extreme depyrogenation conditions might affect the chemical properties of borosilicate containers. The study was motivated by a concern about the risk that the depyrogenation treatment of glass vials, when performed in an abnormal way that deviates from the usual procedure, may have a negative impact on the hydrolytic resistance of the container inner surface after filling with the drug product, The study was executed by using 10 ml clear type I Borosilicate glass vials representing four different compositions. For the applied depyrogenation process extreme parameters were chosen with maximum temperature up to 400°C, exposure times up to 72 hours and different amounts of residual water inside vials as starting conditions. Those treated samples were tested in seven different laboratories as a round robin test. A large amount of data was obtained, which clearly indicate that the hydrolytic resistance performance of the Type I Borosilicate glass vials is not affected even by such extreme depyrogenation conditions. This result, based on the 12,000 analytical data collected during the interlaboratory activity, is important and useful both for glass and pharma companies.

Notes

All the members of TC12 and the technicians who contributed to the round robin runs of the TC during its eleven years of activity are heartily thanked for their valuable contribution.

Keywords

pharmaceutical glass, depyrogenation, hydrolitic resistance

João Vitor Campos[1], Isabela Reis Lavagnini[1], Ana Candida Martins Rodrigues[1], Vincenzo Maria Sglavo[2]

[1]Federal University of Sao Carlos, Brazil
[2]University of Trento, Italy

Session	Materials Science in Glass (I)
Date	APRIL 10, 2025
Time (CET)	14:30 - 14:45
Chair	Dr. İlkay Sökmen

Ultrafast and Energy-Efficient Crystallization of Glasses for All-Solid-State Battery Applications: A Case Study of $Li_{1.5}Al_{0.5}Ge_{1.5}(PO_4)_3$

Abstract

Ceramic materials typically exhibit higher ionic conductivity in their amorphous states compared to crystalline counterparts. NaSICON phases stand out as an exception, offering ionic conductivities several orders of magnitude higher than their glass equivalents. This makes them particularly attractive for solid-state electrolytes in battery applications. NaSICON-based materials are commonly synthesized via the glass-ceramic route, which involves glass melt-quenching followed by controlled crystallization. This method provides excellent microstructural control and enables the production of high-density glass-ceramics. However, conventional crystallization processes often require prolonged high-temperature treatments, leading to volatilization of light elements such as Li and Na, which negatively impact material performance. In this study, we utilized an ultrafast technique, which employs Joule heating through carbon felt layers to achieve rapid and energy-efficient heating. This approach was applied to bulk pieces of $Li_2O–Al_2O_3–GeO_2–P_2O_5$ glass system, enabling crystallization within seconds while minimizing Li volatilization. The resulting glass-ceramics exhibit a high crystalline volume fraction and a pure NaSICON phase structure with excellent ionic conductivity at room temperature. These findings suggest that said technique offers a rapid and energy-efficient approach to glass crystallization, making it particularly suitable for glasses containing highly volatile elements.

Notes

This study was financed, in part, by the São Paulo Research Foundation (FAPESP), Brazil. Process Numbers #2023/18168-7, 2021/06509-9, 2013/07793-6, 2023/18171-8. Financial support from the University of Trento is also acknowledged.

Keywords

glass-ceramics, solid-electrolyte, energy consumption, heat treatment

Mattia Biesuz, Levent Karacasulu, Vincenzo M. Sglavo
Department of Industrial Engineering, University of Trento, Italy

Session	Materials Science in Glass (I)
Date	APRIL 10, 2025
Time (CET)	14:45 - 15:00
Chair	Dr. İlkay Sökmen

Structural Characterization of the Chemical Tempering Process of Soda-Lime Silicate Glasses

Abstract

Chemical tempering is a well-established and commonly used method for improving the mechanical properties of glasses. However, further research is still required to understand the structure and property relationships of the chemical tempered glasses.

In this study, chemically tempered glasses were characterized by positron annihilation spectroscopy technique to evaluate changes in network structure and get new information on the free volume evolution as a result of the K/Na ion exchange. The results reveal a modification of the free volume both in terms of density and amount. The change in the free volume size cannot be explained by a simple elastic model underscoring the activation of inelastic phenomena leading to stress relaxation. Furthermore, the trends in terms of free volume size are not monotonical and mimic the residual stresses evolution.

This work underscores for the first time experimentally the role of free volumes in the relaxation phenomena active during ion exchange.

Keywords

soda-lime silicate, chemical tempering, ion exchange, glass structure, positron annihilation spectroscopy

Levent Karacasulu, Riccardo Meggiolaro, Gian D. Sorarù, Mattia Biesuz
Industrial Engineering, University of Trento, Italy

Session	Materials Science in Glass (I)
Date	APRIL 10, 2025
Time (CET)	15:00 - 15:15
Chair	Dr. İlkay Sökmen

Structural and Property Modifications in Soda-Lime Silicate Glass via Hydrothermal Treatment

Abstract

Glasses play a crucial role in modern technology thanks to their diverse optical and mechanical properties. Enhancing these properties remains a key focus for advancing both scientific understanding of the glasses and practical usability. In this study, hydrothermal treatments were applied to soda-lime silicate glass at different temperatures to investigate their potential in tailoring the glass's structure and properties. The surfaces of the glasses were chemically, structurally, and thermally characterized by various techniques such as differential scanning calorimetry (DSC), positron annihilation spectroscopy (PALS), and spectroscopic analyses. The mechanical properties were also determined using nano-indentation, and the crack formation probability was evaluated. The results showed that soda–lime silicate glass treated in hydrothermal conditions led to notable modifications in the structure, which was vigorously associated with enhanced optical and mechanical properties.

Keywords

soda-lime silicate glasses, hydrothermal treatment, optical properties

Prof. Dr. Reinhard Conradt (Invited Speaker)
UniglassAC GmbH, Germany

Session	Materials Science in Glass (II)
Date	APRIL 11, 2025
Time (CET)	09:50 - 10:20
Chair	Osman Burak Okan

Properties of Pure Substances in Their Crystalline, Liquid and Glassy States – Their Relevance for Industrial Glass Development

Abstract

Some well-known phenomenological features on the glassy state are recalled first: The enthalpies HGL and entropies SGL of pure substances in their glassy state GL differ from the standard values of their isochemical crystalline states X (resp. their lowest density polymorphs) by distinct positive differences Hvit and Svit, respectively. Between room T and Tg, both states have nearly identical heat capacity. At the glass transition temperature Tg, the heat capacity cGL of a glass jumps towards the value cL of the equilibrium liquid state L within a narrow temperature interval. This jump delta-cP occurs when cGL reaches the Dulong-Petit value cDP = 3·R per g-atom; hence delta-cP = cL – cDP. Thus, the position of Tg of a glass-forming system can be assessed by the cross-over of cGL and cDP. The elastic moduli of both GL and any polymorphs of X show a linear dependence on the atomic packing density p which is inversely proportional to the molar volume VM.

In multicomponent glasses, all above properties superimpose linearly with composition if glasses are treated as homogeneous mixtures of components corresponding to the equilibrium phases k of state X. The above features are by far more than just rules of thumb. It is shown how these features can and should be used in the development of industrial glass compositions.

Keywords

glass development, pure substance, heat capacity, elastic moduli, glass transition temperature

Ateş Gösterişlioğlu[1,2], Banu Arslan[1], İlkay Sökmen[1], Miray Çelikbilek Ersundu[2], Ali Erçin Ersundu[2]

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Session	Materials Science in Glass (II)
Date	APRIL 11, 2025
Time (CET)	10:20 - 10:35
Chair	Osman Burak Okan

Thin Glass Composition Design Study for Float Furnaces

Abstract

Thin glasses (<1mm) are gaining attention for numerous industrial flat glass applications such as laminated windshield for automobiles where lightweighting and high mechanical strength are sought together. Although the increase in demand for thin glasses is mainly originating from the market pull, another strong motivational push for thinner glasses arises with the global decarbonization targets. Reducing the plate thickness for the main applications will eventually minimize the production volume and decrease the emissions and energy consumption, thus make a great contribution for achieving sustainable future for the glass industry. Hence, increasing mechanical strength of thin glasses has great importance in terms of expanding their usage area and converting them to high added value products. Composition design and optimization in SiO2-Al2O3-R2O-RO-(B2O3) system can enable production of thinner and durable flat glass plates to be further strengthened via chemical strengthening process later on. In this study, care was given to design glass compositions that will meet both processing demands and performance expectations. Glass compositions are designed by both conventional method and utilizing AI&ML tools, in parallel with structural feature predictions such as NBO/T, Vm and APD. Designed glasses sythesized by melt-quench and structural characterization techniques were employed such as Raman, FTIR and NMR. Thin glass slides obtained by grinding and polishing (t:~0,75mm) and tested for thermal properties, surface and bulk mechanical performance. Surface compressive stress profile after strengthening were evaluated and correlated with compositional modifications. This work shows that manipulation of glass structure by compositional alterations leads significant imrovements for chemical strengthening and mechanical performance that will enable thin float glasses used in various applications.

Notes / Acknowledgement

This work was supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK) under project number 119C098.

Keywords

thin glass, composition, structure, mechanical performance

Jiri Schwarz[1], Petr Knotek[1], Roman Yatskiv[2], Petr Kostka[2], Petr Kutalek[1], Jan Smolik[1]
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Session	Materials Science in Glass (II)
Date	APRIL 11, 2025
Time (CET)	10:55 - 11:10
Chair	Osman Burak Okan

Formation of Copper Nanoparticles in Oxide Glasses

Abstract

This contribution focuses on the preparation of Cu nanoparticles in microscopic glass and lead phosphate glass.

Cu nanoparticles were prepared in microscope glass by ion exchange in 54 mol. % eutectic melt of CuSO4 and 46 mol. % Na2SO4 at 590 °C. After ion exchange (2 Na+ ↔ Cu2+), the individual glasses contained Cu2+ ions, which were subsequently reduced to Cu0 nanoparticles by H2 followed by annealing. Characterization was performed using XRD (characteristic diffraction of Cu0), UV-Vis spectra (surface plasmon band at λ = 570 nm), XRF (Cu content) and SEM/EDX (thickness of Cu layer thickness). Alternatively, the possibility of preparing copper nanoparticles in lead phosphate glasses by UV-induced disproportionation of monovalent copper ions to form atomic and divalent copper was investigated. Specifically, glasses of the system 55PbO - 10ZnO - 35P2O5 with 0.25 mol. % CuO and SnO doped were synthesized. The effect of synthesis time on the resulting physical properties, including the presence of monovalent copper ions, was studied for the prepared glasses. Samples of these glasses were subsequently exposed to UV light to prepare copper nanoparticles. The presence of monovalent copper ions and the subsequent formation of copper nanoparticles were confirmed for the glasses with short synthesis times by UV-Vis spectroscopy and luminescent behavior.

Notes / Acknowledgments

This work has been supported by the Czech Science Foundation, project I.D. 25-15635S.

Keywords

metallic nanoparticles, ion exchange, oxide glass, UV exposure

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Session	Materials Science in Glass (II)
Date	APRIL 11, 2025
Time (CET)	11:10 - 11:25
Chair	Osman Burak Okan

Atmospheric DCSBD Plasma Technology for Surface Treatment, Activation and Adhesion Improvement of Glass for Performance Improvement of Glass Products

Abstract

We present low-temperature atmospheric pressure plasma technology for glass surface modification and materials for glass products. Extremely high-power density and uniformity of plasma generated by diffuse coplanar surface barrier discharge (DCSBD) enables very short plasma treatment times. Even very fast plasma treatment (in-line treatment speed ~ 1-5 cm/s) results in effective surface cleaning and activation of a glass surface. The plasma-generated surface hydroxyl species, improved micro-uniformity of glass, together with changed interface properties led to improved adhesion and affected the properties of coatings deposited on DCSBD plasma-treated glass.

We will present two configurations of atmospheric DCSBD plasma, one for fast large-area surface modification of flat glass, and the second one designed for plasma modification of complex 3D surfaces (rough, structured, porous) such as glass fibres or curved automotive glasses and other components made of different materials.

The application potential of DCSBD plasma technology will be presented with two examples: i) large-area plasma surface modification of float glass and example how plasma surface modification can affect the properties of deposited coatings; and ii) plasma surface activation of curved automotive glasses and ABS and PU plastic components for adhesion improvement. As will be presented, atmospheric DCSBD plasma has potential to replace the application of chemical primer and thus make the process more easier and eco-friendly.

The scalable, energy efficient and effective, low-temperature atmospheric pressure DCSBD plasma technology can be integrated into in-line production lines or in the robotic arm production processes. These characteristics together with experimental results of improved wettability, bonding, increased interfacial properties, and adhesion of plasma-treated surfaces make DCSBD plasma interesting for the production of various glass products.

Notes

This research has been supported by the project LM2023039 funded by the Ministry of Education, Youth and Sports of the Czech Republic.

Keywords

atmospheric plasma, DCSBD, DCSBD linear jet, glass surface modification, adhesion

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Session	Materials Science in Glass (II)
Date	APRIL 11, 2025
Time (CET)	11:25 - 11:40
Chair	Osman Burak Okan

Synthesis and Characterization of SiO2-B2O3-Na2O-K2O-ZnO Glass System: The effect of SnO2 on the Structural and Radiation Shielding Properties

Abstract

In this study, the physical, structural, thermal and radiation properties of [SiO2-B2O3-Na2O-K2O-ZnO] glass system with 2.5%, 5%, 7.5%, 10% weight SnO2 content were investigated. All glasses with these specific ratios are designated as Sn-X, where X represents the ratio value (Sn-0, Sn-2.5, Sn-5.0, Sn-7.5, Sn-10). Glass preparation was performed using the melt-quench technique. The densities of glasses were measured according to Archimedes' principle. The prepared glasses were characterized through X-ray diffraction (XRD), Fourier transform infrared (FT-IR) spectroscopy, and their radiation properties were evaluated. The amorphous structure of the material has been proven by X-ray diffraction analysis. FT-IR studies revealed the presence of two fundamental structural units: trigonal BO3 units and tetrahedral BO4 units. The radiation shielding properties of Sn-X glasses were determined by experimental measurements with a 3"x3" NaI(Tl) scintillation detector. The results were compared with the Geant4 simulation program and Phy-X/PSD results and validated with each other. The glass containing 10 wt.% SnO2 (Sn-10) exhibited a significant gamma-ray shielding potential due to its high linear attenuation coefficient (LAC) value (0.2111(3) cm-1 at 0.662 MeV, 0.1553(15) cm-1 at 1.173 MeV, and 0.1532(22) cm-1 at 1.332 MeV) and radiation protection efficiency (RPE), together with low half value layer (HVL), mean free path (MFP), and transmission factor (TF). A comparative analysis of the LAC values for the present Sn-X and some other glasses is also presented.

Keywords

tin oxide, glass system, characterization, radiation shelding

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Session	Materials Science in Glass (II)
Date	APRIL 11, 2025
Time (CET)	11:40 - 11:55
Chair	Osman Burak Okan

Ultrafast and Energy-Efficient Crystallization of Glasses with Low Thermal Expansion

Abstract

Ultrafast High-Temperature Sintering (UHS) has been recently proposed for producing ceramics in a very short time. The used apparatus offers a sustainable alternative also for producing glass-ceramics. By enabling rapid heating to extremely high temperatures within seconds through the application of an intense electric current to a carbon felt containing the sample, it allows to significantly reduce energy consumption and production times compared to conventional methods. In this study, the technology was employed to promote rapid crystallization in bulk glass samples of the Li2O-Al2O3-SiO2 system, demonstrating its effectiveness in controlling microstructure and tailoring material properties. Glass specimens were subjected to Joule heating within carbon felt electrodes under an argon atmosphere. Various electric currents were applied, resulting in distinct power outputs and temperature profiles, suitable to identify optimal conditions for efficient crystallization. The resulting glass-ceramics were analyzed for their crystalline phase composition, microstructure and thermal expansion behavior. The findings point out that higher power densities enhance crystallization efficiency and allow to control the crystallized fraction and thermal properties. Ultrafast crystallization emerges as a promising route for producing glass-ceramics with tailored properties and reduced environmental impact, supporting sustainable manufacturing practices in the glass industry.

Keywords

Crystallization, glass-ceramics, low thermal expansion, ultrafast crystallization

Chris Holcroft[1], Marlin Magallanes[1], Ragni Hatlebakk[2], Knut Rudi[3], Ewelina Blanka Grad[3], Helen Cox[4]
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Session	Materials Science in Glass (II)
Date	APRIL 11, 2025
Time (CET)	11:55 - 12:10
Chair	Osman Burak Okan

Use of Controlled Dissolution Glasses for Marine Habitat Restoration

Abstract

This research investigates the use of glass-based technologies to contribute to the restoration of marine habitats and so create marine carbon sinks to capture carbon from the atmosphere. This has the potential to offset emissions from the industry and provide future sources of fuel, food and raw materials.

The use of controlled dissolution glasses for manipulating biological processes is well established in the biomedical field. In this piece of work, supported by RFF Oslo, the authors set about to test the feasibility of using this exciting aspect of glass chemistry to stimulate the regeneration of light deprived and eutrophic marine ecosystems in Oslo Fjord, Norway.

Glasses were prepared based on a literature review of nutrient requirements of macroalgae species identified as contributing to health and balanced ecosystems in the area which are currently struggling due to pollution from agricultural and urban land run off.

The glass systems were tested in sea water aquaria under different temperature and light regimes in both the UK and Norway. Macroalgae specimens and seawater samples were collected from the UK and Norwegian coasts and allowed to equilibrate in the laboratory prior to addition of the glass treatments.

Water quality and biomass change were monitored over a period of 3 months and compared to a baseline system containing no glass.

Over this period the glass containing systems exhibited improvement both in water clarity and increase in biomass compared to non-glass systems. DNA analysis of microalgae present in the different tanks also showed the potential of the glasses to influence the species present in the water column opening the possibility of harnessing this to further support regeneration, amongst a host of other possible uses.

We will present the latest findings of our second phase research to the conference and outline our thoughts for further work in this area.

Keywords

carbon sequestration, specialist glass, sustainability

Owen McGann
Glass Technology Services Ltd, United Kingdom

Session	Materials Science in Glass (II)
Date	APRIL 11, 2025
Time (CET)	12:10 - 12:25
Chair	Osman Burak Okan

Vanadate Glass as an Alternative for Radiation Hard Photonics and Optics

Abstract

Vanadate glasses have been considered over the past 50 years as possible materials for use in near-infrared (NIR) and mid-infrared (MIR) optical materials. Due to the presence of vanadium in mixed oxidation states these glasses exhibit electrical conductivity and a high resistance to radiation driven defect formation. As such these materials are of interest for use in a range of applications including un-doped optical and doped solid state gain materials, suitable for use in laser and photonic devices in high radiation applications (e.g earth orbit).

The objective of this study was to optimise forming behaviour and optical transmission across a range vanadate glass compositions and to investigate their response to ionizing radiation, with a focus on alkali vanadate and phospho-vanadate systems relevant to optical applications.

Glasses were produced via melt-quench techniques under an oxidizing atmosphere, with samples cast and splat-quenched. A subset of the glasses were subjected to 0.6 MGy of irradiation using a laboratory X-ray source. The materials were analysed through FT-IR transmission, FT-IR reflectance spectroscopy and XPS spectroscopy in order to assess NIR and MIR transmission, structural modification, and the characterise the oxidation state of vanadium.

It was found that in alkali vanadate systems the use of high atomic mass alkali species increased both the thermal stability and optical transparency of the resultant glass materials. The phospho-vanadate system was found to possess superior glass forming behaviour but significantly reduced optical properties relative the alkali vanadate glasses. Radiation testing demonstrated that both vanadate glass systems exhibited a high resistance to ionising radiation damage. Consequently, these glasses have strong potential for use in radiation hard optical and photonic applications.

Keywords

radiation, rad-hard, vanadate, photonic, space

39th

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POSTER PRESENTATIONS

Alessandro Liani, Valle Gianni

Video Systems Srl

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

25 Years of AI Exploration: Pioneering Quality Control in Glass Manufacturing

Abstract

For 25 years, we have pioneered AI-driven optical inspection of glass containers, evolving our approach to meet industry challenges. Until recently, some inspections could not be fully automated, relying on manual verification, while traditional **machine vision** systems—without AI—often struggled with high false positive rates and required complex setup. AI has transformed quality control, improving defect detection, reducing human intervention, and simplifying system configuration. The rise in computational power and lower AI costs are accelerating the evolution of glass inspection, mirroring changes across all industries. These advancements enable more precise, reliable, and efficient systems, supporting greener and more sustainable production.We'll explore AI's role in optical inspection with real-world applications, including Linea, a contactless system for cut analysis, Pyxides for pharmaceutical bundle inspection and Oculus a camera based inspection solution for carousel-based machines. These AI-powered solutions enhance accuracy, minimize false positives, and support the ongoing evolution of glass manufacturing.

Notes

2023 IEEE Computational Intelligence Society Outstanding Organization Award

For contributions using computational intelligence for product quality control.

2020 European Commission Seal of Excellence

Keywords

artificial intelligence, glass inspection, zero defect manufacturing, industry digitalization

Davide Zenere, Marco Beninca
BDF Industries, Italy

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Feeder Flowtech

Abstract

Feeder Flowtech aims to automatically adjust all parameters that affect the gob using the data from Gob Scan (3D Gob shape, gob falling angle, gob temperature map, surface defects).

Feeder Flowtech analyzes and solves the root cause of possible imperfections in the gob.

The system automatically acts on Radiative Electric Forehearth, Independent Servo Plunger, and Servo Parallel Shear.

Keywords

flowtech, process optimization, gob scan, feeder, root cause

Ekaterina Trusova[1], Sergey Kichanov[2]
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Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

The Approaches to The Synthesis of Oxyfluoride Glass Ceramics

Abstract

The composite glassy materials, based on nanoparticles embedded in a glass matrix, have attracted the attention of scientists due to the unique physical phenomena associated with electron quantum confinement and unusual nonlinear optical response. Furthermore, from this perspective, fluoride glasses offer several advantages, including a low melting and softening point, as well as high ultraviolet transmission compared to conventional silicate oxide glasses. Oxyfluoride glasses based on SiO2–GeO2–PbO–PbF2–CdF2–YbF3 system co-doped Ho3+, Tm3+ and Er3+ have gained the trust of researchers as a good matrix for nanoparticle-based rare-earth ion systems. These nanostructured glassy materials exhibit higher quantum efficiency in up-conversion luminescence, a phenomenon where optical emission occurs through cooperative energy transfer among different optically active ions. The distinct temperature treatments of doped oxyfluoride glasses are an efficient way to structurally modify optical nanoparticles. This corresponds to the crystallization of initially amorphous PbF_2 nanoparticles and the formation of up-conversion luminescent nanostructured centers. It was indicated a two-stage process for the formation of up-conversion luminescent nanoparticles in the composite glasses. At the first stage, relatively large amorphous nanoparticles of lead fluoride form in a glass matrix, and it is assumed that rare earth ions are then introduced into these amorphous nanoparticles. During the second stage, when temperature treatment is applied above 380°C, there is a gradual change in size and morphology of the original amorphous particles. It was assumed this is due to crystallization processes occurring during temperature treatment. In the presented work, we tested this assumption on glasses with up-conversion luminescent nanoparticles. Interestingly, this crystalline phase formation is observed when several rare earth oxides are present simultaneously.

Keywords

oxyfluoride glass, glass ceramics, rare-erth ion, up-conversion luminescent

Ekaterina Trusova, Anatol Yasukevich, Victor Kisel, Valerij Gurin
Belarusian State Technological University, Belarus

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Oxyfluoride Glass-Ceramics Doped with Ytterbium, Erbium and Thulium Ions as Efficient Up-Conversion Light Converters

Abstract

Oxyfluoride glass-ceramic materials activated by rare earth ions are effective up-conversion converters of IR radiation into the visible region of the spectrum. Such materials are of considerable interest for applications as secondary radiation sources in lighting devices and information display systems.

This paper presents the results of a study of the spectroscopic characteristics of glass-ceramic materials based on PbO–PbF2–CdF2–GeO2–SiO2 glass with Yb3+, Er3+ and Tm3+ ions. Glasses of this composition were subjected to secondary annealing in the temperature range of 390 – 415 °C for 5-15 h. As a result, glass-ceramic materials with a β-PbF2 crystalline phase were obtained. It is shown that the spectrum of up-conversion luminescence of Er3+ and Tm3+ ions, upon excitation into the absorption line of Yb3+ ions (≈970 nm), significantly depends on the secondary heat treatment regime and the content of rare earth ions. For example, at a molar content of YbF3 – 1.0%, Er2O3 – 0.01% and Tm2O3 – 1.0%, secondary heat treatment at 415 °C for 5 h leads to the predominance of lines in the red region of the spectrum, 650 nm (1G4→3F4, Tm3+) and 700 nm (4F9/2→4I15/2, Er3+) in the spectrum of up-conversion luminescence. During secondary heat treatment at 385 °C for 10 h, the luminescence spectrum is dominated by the line in the blue region of the spectrum, 475 nm (1G4→3H6, Tm3+). Thus, variation of the composition and heat treatment regime of the oxyfluoride glass-ceramic material allows changing the spectral composition of the up-conversion luminescence of glass-ceramic samples.

Keywords

oxyfluoride glass ceramics, spectroscopic characteristics, up-conversion luminescence

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Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Securing Interoperability in Mechanical Engineering and Flat Glass Processing

Abstract

OPC UA is a widely adopted communication architecture in mechanical engineering, known for its integrated cybersecurity features and semantic information models. The 1st OPC UA industry standard for flat glass processing already provided capabilities for identification, machine condition monitoring, and job management, enabling the seamless exchange of job-related process information regardless of the machine manufacturer or software used.

The second version, published in October 2024, builds upon this foundation with improved harmonization with the ISA 95 specifications and the CS OPC UA for Machinery OPC 40001-1 (Basic Building Blocks) and OPC 40001-3 (Job Management). These updates, developed with input from the Flat Glass Industries working group, have made job management more universally applicable across industries. For flat glass processing specifically, the new JobTargetDefinition, defined in VDMA standard sheet 24124, serves as a recipe for producing panes or insulating units.

Moreover, definitions for calculating key performance indicators (KPIs) outlined in ISO 22400 have been expanded and refined in collaboration with the ISO 22400 committee. By combining definitions of time elements from ISO 22400 with machine-specific states, the calculation of Overall Equipment Efficiency (OEE) is now more precise.

The next step will be the standardization of data for machine qualification, particularly for functional qualification.

The presentation will provide an overview of OPC UA interoperability principles and demonstrate the application of the presented specification to support flat glass processing in the digital age.

Keywords

OPC UA, flat glass processing, global production language, harmonization

Hamid-Reza Bahari, Roza Raoufi
Center of Innovation for Green and High Technologies (CIGHTech), Iran

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Thermal Diffusivity Measurement of Germanate-Based Glass-Ceramic System Using Photoacoustic Strategy

Abstract

In the present study, transparent glass ceramic (TGC) synthesized from GeO2-PbO base glass with Er/Ag doping using a controlled annealing process at different annealing times of 0, 12, 24, and 40 hours at a heating temperature of 450°c was studied. Primarily, ultrasonic sound velocity and elastic moduli of the GeO2-PbO binary glass (melt-quenching) measured by ultrasonic pulsed echo technique were reported. The crystallization behavior of the materials during the heat treatment process was studied using XRD measurement and the generation of the Ge2Pb3O7 phase which is known as ferroelectric material was confirmed. Optical transparency evaluation of the material during annealing was investigated by UV-Visible absorption spectroscopy and material opaqueness was observed in the longer time of heat treatment process. A photoacoustic (PA) set-up was designed to measure the thermal diffusivity (TD) of the samples using a 632.8 nm He-Ne laser beam followed by an optical chopper and amplifier system, as well as a photoacoustic chamber equipped with a microphone device. High thermal diffusivity values were observed in the samples starting with 1.04 mm2/s for mother GeO2-PbO glass and growing to 1.82 mm2/s by increasing annealing time to 40 hours, which can be described by the development of more crystalline phase in the glass matrix. This functional material is recommended to be used for thermal management and sensing applications.

Keywords

heavy metal oxide glass, transparent glass ceramics, photoacoustic technique, thermal diffusivity

Hana Kaňková, Branislav Hruška, Lenka Buňová, Jaroslava Gombárová, Katarína Faturíková, Dagmar Galusková

A. Dubček University of Trenčín, Slovakia

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Development of a Series of Lithium-Containing Reference Glasses

Abstract

Lithium-containing minerals are the source of new technologies. Accurate assessment of the chemical composition and detection of impurities is essential in the evaluation and search for new raw materials discoveries. One of the methods for the evaluation of geological samples is laser ablation coupled to ICP-MS. This method uses direct analysis of a solid sample and allows determination of the overall composition as well as characterization of mineral grains, zonation, or distribution of element in the sample.

The use of a suitable standard (similar to the analysed samples in matrix and elemental content) is essential for the accurate interpretation of measured data. Due to the limited supply of commercial standards, the solution is to prepare in-house glass calibration material in the laboratory.

Series of glasses with matrix SiO2-Na2O-CaO-Al2O3-K2O-Li2O were prepared. The main composition was based on the NIST standard 61X series. The Li2O content was incrementally increased up to 11 wt.%. To extend the applicability of the standard to the analysis of impurities, the glasses may additionally contain 0.05 wt.% or 0.1 wt.% of selected oxides.

The process of preparing these standards was optimized by extending the melting time, increasing the number of stirrings during melting, and also by increasing the melting temperature. During optimization of the melting process, melt samples were taken at different time intervals of 4, 5, 6, and 7 hours.

The composition of the prepared glasses was determined by XRF and ICP-OES. The homogeneity was evaluated by laser ablation. The relative standard deviations of isotopes were calculated from the measured values of ablated spot intensities of samples intended as reference materials and commercially obtained NIST 610 reference material . Glasses with chemical homogeneity < 5% determined with LA-ICP-MS were fulfilling the criteria for the in-house glass standards and can be applied for Li-containing raw materials.

Notes / Acknowledgement

This abstract is a part of the dissemination activities of project FunGlass. This project has received funding from the European Union´s Horizon 2

Keywords

laser ablation, lithium, glass standard

Levent Karacasulu, Adane M. Abebe, Michele Cassetta, Gian D. Sorarù, Mattia Biesuz
University of Trento, Italy

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Transformation of Organosilicon Polymer to SiOC Glass in Different Atmospheres

Abstract

Polymer-derived glasses are a unique class of amorphous materials obtained through the pyrolysis of an organosilicon polymer in a controlled atmosphere. The structure and chemistry of those glasses can be precisely tailored by adjustments in composition, as well as changes in processing parameters such as pyrolysis time, temperature, and atmosphere. In this study, the transformation of methyl polysiloxane into a SiOC in an inert Ar and reactive CO2 environment was investigated by utilizing a range of complementary characterization techniques. Since the kinetics of porosity evolution were influenced by the glass compositions, densification proceeded more rapidly in the reactive CO2 environment, where the matrix closely resembles SiO2. At the highest pyrolysis temperature, the SiOC glass produced in Ar exhibited a higher density than those obtained in CO2. The mechanical properties and thermal conductivity were improved with increasing pyrolysis temperature by the structural modifications and were generally found to be higher in the Ar environment.

Keywords

polymer-derived glasses, pyrolysis, atmosphere effect

Menander Scheider
Heye International GmbH, Germany

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Check Detection in Container Glass with Intelligent Cloud Masking

Abstract

Check detection is one of the most important quality inspections in container glass production. The Ranger 2 from Heye International has been developed to exceed the customer's quality expectations, by using latest software technologies.

The principle: Every container produced must be regarded as a unique object and any check detection concept has to respect this. For this reason each Ranger 2 system is using Heye's unique Intelligent Cloud Masking (ICM). Zones of constant reflections are created (masked) automtically for each container individually, as every bottle or jar is slightly different. A teaching of the system is not necessary, moreover a teaching might lead to less precise results.

Of course, during the set-up phase, the areas of interest (AOEs, potential areas of checks) are defined by the user. Then, during the production run, the Ranger 2 system is able to detect different variations of checks in the areas. In sum, the solution leads to extrem precise results, as customers' confirm.

Fully modular and scalable system: A Ranger 2 system consists of one camera, collecting five images simultaneously via five lenses and fiber optic image guides, the illumination unit and the control unit with the software for image processing, including the decision "container okay or not okay". Based on the budget and needs of the glass plant, you can start with one system and add any number of additional systems whenever needed.

Keywords

check detection, ranger, AI

Petr Kostka[1,2], Roman Yatskiv[3], Jiri Zavadil[1], Olga Prochazkova[1], Petar Gladkov[3], Stanislav Tiagulskyi[3]
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Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

On Energy Transfer Processes Between Glass Matrices and Rare-Earth Doped Ions in Various Glass Types

Abstract

We compare the optical properties of glasses doped with rare-earth ions, focusing on glasses with different phonon energy values, absorption edge positions, and possibly the presence of suitable impurities. The study examines absorption spectra and photoluminescence properties of rare-earth doped pure silica and tellurite glasses, as well as tellurite glasses containing d-elements such as chromium. Using selected glass matrices, we demonstrate that under certain conditions, effective excitation of the embedded rare-earth ions can occur not only through direct absorption of photons at the appropriate energy (corresponding to the RE transition), but also via energy transfer from the excited glass matrix in the vicinity of the rare-earth ion. This allows the excitation of the doped rare-earth ions over a broad range of wavelengths.

Keywords

rare-earths, energy transfer, silica glass, tellurite glass

Philippe Kerbois
Ametek Land, France

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Enhancing Float and Container Glass Production with the AMETEK LAND LSP-HD Line Scanning System for Lehr Applications

Abstract

Efficient temperature monitoring and control are critical for ensuring product quality and operational efficiency in glass manufacturing. This paper introduces the AMETEK LAND LSP-HD Line Scanning System, designed for precise thermal monitoring in lehr applications for both float and container glass production lines. The LSP-HD system delivers high-resolution thermal profiles, enabling real-time detection of temperature variations, rapid response to process deviations, and optimization of cooling and annealing processes.

Through detailed analysis and case studies, we demonstrate the system's capabilities in ensuring uniform temperature distribution, reducing thermal stress, and improving overall product quality. By integrating advanced infrared scanning technology with data-driven insights, the LSP-HD system offers a robust solution for modern glass manufacturing challenges, contributing to improved efficiency and sustainability.

Keywords

Float lehr, LSP-HD Temperature line scanning, monitoring of temperature distribution in Lehrs

Rezzan Hasoglu, Selçuk Artut
Studio Sahil, United Kingdom

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Passing Down Cultural Design Heritage Through Craft Objects of Memoir

Abstract

Passing a skill (technē) learned from a master is carried across generations; therefore, a crafted object would also be considered a transitive element of a cultural heritance. Like the praxis of technology, skill is not an innate phenomenon but instead something artificial, made by humans. Crafted objects leave their marks in history by transferring tangible records of cultural heritage to the future, carrying traces of civilization of the period in which they exist. Investigating objects, which are produced in these terms as art and design objects within the diverse socio-cultural dimensions, would take a critical place in clarifying many contemporary fundamental views. This article explores the meaning and the process of design, artisanship and cultural influences on these concepts through reciting the story of Çeşm-i Bülbül glass, which has been a significant object at the Ottoman banquets. Using this design object as an example, the article questions the meaning of design and the transformation process of 'becoming a meaningful object' through references from Heidegger's 'The Question Concerning Technology' and Borgmann's article 'Focal Things and Practices'.

Keywords

cultural heritage, technology, objects of craft, glass design, technē

Vasco Sousa
Picvisa, Spain

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

PICVISA

Abstract

Picvisa is a technology-driven company specializing in advanced solutions that integrate robotics, artificial intelligence, and machine vision. We design and manufacture innovative equipment for the selection and classification of valuable materials, utilizing proprietary software to analyze composition, shape, and color. Our commitment to innovation drives the development of new products and the adoption of cutting-edge technologies. PICVISA serves both national and international markets, delivering comprehensive solutions in optical sorting, robotics, and AI. We are proud to be the first company in our sector to achieve B Corp certification, reflecting our dedication to sustainability and social responsibility.

Keywords

optical sorting, turnkey solutions, process engineering, artificial intelligence

Yury Pauliukevich, Sergey Grechuha, Ekaterina Trusova
Belarusian State Technological University, Belarus

Session	Poster Presentation
Date	APRIL 10, 2025
Time (CET)	17:20 - 18:20

Raman Spectroscopy as a Method for Investigating Inclusions in Glass

Abstract

The diagnosis of glass defects is a crucial component of technological quality control in production. The prompt identification of the type and composition of defects enables the determination of their causes and the prevention of significant production losses associated with the quality of glass products. Investigating the processes of glass formation while optimizing industrial glass compositions also necessitates the identification of the type and composition of inclusions, particularly crystalline ones. Crystalline inclusions, being the most significant defects in glass, warrant particular scrutiny as they may indicate serious violations within the technological process. The presence of batch inclusions (batch stones) could stem from inconsistencies in the preparation technology, as well as alterations in the phase and granulometric composition of the raw materials. Inclusions of refractories point to their active corrosion and may serve as a harbinger of issues with the lining of the glass furnace. The presence of crystallization stones typically signifies a disruption in the temperature regime within the melting zone. Additionally, other inclusions may also be present within the glass. The work presents the development of a methodology for investigating crystalline inclusions in glass using Raman spectroscopy. The application of Raman spectroscopy in the study of glass melting processes enables the determination of the composition of the products resulting from the interaction of batch components, as well as the temperature-time conditions required to achieve homogeneity in the melt. For instance, it has been established that the glass formation processes during the melting of glasses in the MgO–CaO–Fe2O3–Al2O3–SiO2 system culminate in the dissolution of quartz and the formation of anorthite during the silicate formation stage within the temperature range of 1250–1350 °C..

Keywords

glass, glass defects, raman spectroscopy

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High-Performance Glass Ceramics, Synthesized Based on Basalt of Uzbekistan

Abstract

Basalt rocks of the Karakiya deposit (Jizzakh region, Uzbekistan) were investigated to obtain of glass ceramics for architecture purposes. X-ray analysis showed that the crystalline phases of basalt are represented by calcite, anorthite, augite, chlorite, small amounts of magnetite and albite. To obtain acid- and heat-resistant materials, the batch composition was calculated to obtain of anorthite phase.

As a raw materials basalt of Karakiya deposit, primary enriched kaolin of Angren deposit and alumina containing waste of Shurtan gas chemical complex were choosen (all materials from Uzbekistan). Glass batch was melted in an electric furnace at a temperature of 1450° C. Glass crystallization was carried out in a laboratory muffle furnace. The glass samples were heat-treated at different temperatures - from 700 to 1000° C (temperature rise at a rate of 40° C/min) with holding at the final temperature for 3 h.

Glass-crystalline samples of black and dark violet-black colors were obtained. As a result of the studies, the optimal temperature of two-stage crystallization for the formation of a finely dispersed structure of anorthite glass ceramics was chosen as 800°C (1 h.) and 1000° C (1 h.). The properties of glass-crystalline materials significantly exceed the properties of glass materials: density increased from 2700 to 3100 kg/m3; compressive strength from 250 MPa to 670 MPa; chemical resistance to 35 % NaOH from 95 to 99.8; to concentrated HCl – from 99 to 99.9 %; to concentrated H2SO4- from 99.1 to 99.9 %. Calculation of composition of glass in accordance with laws of isomorphism made it possible to synthesize glass-ceramic with crystalline phase of a solid solution with an anorthite structure.

Keywords

Basalt, glass, glass-ceramics, isomorphism. Crystallization