INTERNATIONAL YEAR OF GLASS 2022

Glass is Future

ŞİŞECAM

36th GLASS SYMPOSIUM

NOVEMBER 12, 2021 - "ONLINE"

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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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WELCOME MESSAGE

Dear Colleagues and Guests,

Şişecam has long regarded scientific and technological development as one of the key drivers of its business success. This understanding and commitment are best showcased by the annual Glass Symposium. Incepted in 1985, Şişecam Glass Symposium was initially designed as a medium to exchange ideas and share the best practices within Şişecam.

Over the years the Symposium has evolved to become the prominent scientific platform for the Turkish glass industry while steadily attracting more international attendance and contributions. This paved the way for International Commission on Glass to hold its annual meeting in conjunction with the Şişecam Glass Symposium three times. Finally, to accommodate the growing interest, in 2019, Şişecam International Glass Conference was organized for the first time in combination with the 34th Şişecam Glass Symposium. We were happy to see that the premise of physical format expansion was fulfilled as more than 500 participants from 26 countries gathered to share and discuss the latest developments in glass science and technology. In 2020, despite the 35th convention was forced to take place in a virtual symposium format, it managed to attract 758 participants from 39 countries.

Ever changing market demands and regulations along with fast paced scientific and technological developments pose new challenges and opportunities for glass manufacturers, technologists, and scientists. Conventional glass products are expected to perform better, and production processes are expected to be more efficient than ever to minimize environmental impact. Digitalization, adaptive process control, and fundamental research combining bench-top experiments with modelling studies down to atomistic resolution will be instrumental in tackling these pressing challenges. Glass, thanks to a large number of novel applications in areas such as electronics, communications, and biotechnology, promises to be the “material” key to the future.

Ongoing Covid-19 pandemic forces the 36th Şişecam Glass Symposium to be held online again. Our distinguished presenting participants will share their latest work on established topics as well as cutting-edge developments in emerging research topics in glass science and technology to confirm once again that glass is future.

GÖRKEM ELVERİCİ
Conference President
Chief Executive Officer, Şişecam

DR. REHA AKÇAKAYA
Conference Executive Chair
Chief R&D and Quality Officer, Şişecam

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PROGRAM AT A GLANCE

NOVEMBER 12, 2021 (ONLINE)

ISTANBUL TIME (CET +02:00)	SCIENTIFIC PROGRAM
REGISTRATION	ONLINE
10:00 - 10:30	Welcome/Opening Remarks
10:30 - 11:00	GLASS IS FUTURE: Keynote Speech
11:00 - 11:05	BREAK
11:05 - 12:05	ADVANCED MATERIALS
12:05 - 12:55	LUNCH BREAK
12:55 - 13:25	GLASS IS FUTURE: Keynote Speech
13:25 - 14:25	ENERGY & DIGITALIZATION
14:25 - 14:30	BREAK
14:30 - 15:00	GLASS IS FUTURE: Keynote Speech
15:00 - 16:20	OPERATIONAL EXCELLENCE
16:20 - 16:30	CLOSING

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SCIENTIFIC PROGRAM

Istanbul Time (CET +02:00)	**November 12, 2021**
REGISTRATION	Online
OPENING	WELCOME / OPENING REMARKS
10:00-10:10	**Dr. REHA AKÇAKAYA** *(Chief R&D and Quality Officer, Şişecam, TR)*
10:10-10:20	**GÖRKEM ELVERİCİ** *(Chief Executive Officer, Şişecam, TR)*
10:20-10:30	**Prof. Dr. AHMET KIRMAN** *(Chairman, Şişecam, TR)*
PLENARY SESSION	GLASS IS FUTURE
SESSION CHAIR	**Dr. REHA AKÇAKAYA** *(Chief R&D and Quality Officer, Şişecam, TR)*
10:30-11:00	**"The United Nations International Year Of Glass-2022"** **Keynote Speech:** **Prof. Dr. ALICIA DURAN** *(Research Professor CSIC, President of ICG, Chair of IYOG2022, ES)*
11:00-11:05	BREAK
SESSION TOPIC	ADVANCED MATERIALS
CHAIR	**Dr. İLKAY SÖKMEN** *(Glass Technologies Director, Şişecam, TR)*
11:05-11:25	**"Special Glass and Glass Ceramics"** **Dr. MARTIN KILO** *(Senior Scientist, Fraunhofer ISC, DE)*
11:25-11:45	**"Graphene Based OLED Displays"** **Prof. Dr. İSMET İNÖNÜ KAYA** *(Distinguished Researcher, SUNUM, Sabancı University, TR)*
11:45-12:05	**"New High-Strength and High-Modulus Fiber Glasses"** **Dr. HONG LI** *(Senior Scientist, Nippon Electric Glass, US)*
12:05-13:00	LUNCH BREAK

PLENARY SESSION	GLASS IS FUTURE
SESSION CHAIR	**TOLGA UYSAL** *(Melting Technologies & Engineering Director, Şişecam, TR)*
12:55-13:25	**"Supercritical CO2 Power Cycle Demonstration In Operational Environment Locally Valorising Industrial Waste Heat"** **Keynote Speech: DR. RENE VIJGEN** *(Senior Technical Manager, European Turbine Network, BE)*
SESSION TOPIC	ENERGY & DIGITALIZATION
CHAIR	**TOLGA UYSAL** *(Melting Technologies & Engineering Director, Şişecam, TR)*
13:25-13:45	**"Overview of Concentrating Solar Thermal Technologies and Applications"** **PROF. DR. DEREK K. BAKER** *(Department of Mechanical Engineering, Middle East Technical University, TR)*
13:45-14:05	**"Mass Transfer Around a Rising Bubble in a Glass-Forming Liquid Involving Oxidation-Reduction Reaction"** **PROF. DR. FRANCK PIGEONNEAU** *(Enseignant Chercheur, CEMEF, Mines-ParisTech PSL, FR)*
14:05-14:25	**"Smarter Approach to Glass Production"** **ÖMER BAYRAKTAR** *(Lead Senior Project Engineer, Control & Automation, Şişecam, TR)*
14:25-14:30	BREAK

PLENARY SESSION	GLASS IS FUTURE
SESSION CHAIR	**OZAN ÖZER** *(Coating Technologies Director, Sisecam, TR)*
14:30-15:00	**"Specialty Glasses"** **Keynote Speech:** **DR. MATHIEU HUBERT** *(Glass Development Assoc., Corning Research and Development Corp. (CRDC), US)*
SESSION TOPIC	**OPERATIONAL EXCELLENCE**
CHAIR	**OZAN ÖZER** *(Coating Technologies Director, Şişecam, TR)*
15:00-15:20	**"Standardization: A Powerful Tool to Achieve Excellence in Container Glass Technology"** **DR. ESTELA ALEJANDRO** *(Glass Technology Manager, Vidrala, ES)*
15:20-15:40	**"Double Action Baffle for IS Machines & Plasma Coating for Troughs"** **ARTUR BIISHEV** *(Technical Director, Ruscam LLC. Kuban, Şişecam, RU)*
15:40-16:00	**"LIFE Smart Oxygen Boosting System Implemented in Flat Glass Furnace"** **GYUNAY REDZHEB** *(Plant Engineer, Trakya Glass Bulgaria, Şişecam, BG)*
16:00-16:20	**"Composition Optimization of Crystalline & Soda Lime Silicate Glass"** **MERT ÇAĞDAŞ** *(Batch and Furnace Engineer, Glassware Kırklareli Plant, Şişecam, TR)*
16:20-16:30	CLOSING DR. REHA AKÇAKAYA *(Chief R&D and Quality Officer, Şişecam, TR)*

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PLENARY SPEAKERS

PROF. DR. ALICIA DURAN
President of ICG, Chair of IYOG2022
Research Professor CSIC, Spain

Session	PLENARY
Date	NOVEMBER 12, 2021, FRIDAY
Time	10:30 – 11:00 (Istanbul time, CET+02:00)
Chair	DR. REHA AKÇAKAYA

The United Nations International Year of Glass-2022

Biography

Dr. Alicia Durán obtained a degree in Physics from the National University of Córdoba in Argentina and a PhD in Physical Sciences from the UAM, developing her professional career at the Institute of Ceramics and Glass of the Spanish Research Council (CSIC). Research Professor of CSIC and the responsible of the GlaSS group **(http://glass.icv.csic.es)**, with more than 250 publications in WOK (H index of 47), she is currently President of the International Commission on Glass (ICG). She received the Phoenix Award from the international glass industry, being named Glass Person of the Year 2019. Now she is leading the International Year of Glass 2022, approved by the GA of United Nations on May 18th, 2021.

Abstract

On May 18, 2021 the United Nations General Assembly approved the resolution to declare the year 2022 “The International Year of Glass”. This is a seminal and celebratory moment for the global glass community. It is noteworthy that this is the first time that UN has accorded such a recognition to a specific material and represents an acknowledgment of the vital role glass has played and will continue to play in the advancement of human society. The UN resolution is the culmination of the vigorous leadership of the International Glass Commission (ICG) and enormous efforts of many individuals and organizations from all over the world. The vision for the International Year of Glass (IYoG) emerged from a series of activities centered on the theme of the “Glass Age” that took place during 2016-2018 and presentations made at various international glass forums. The talk will provide background information on the UN resolution and discuss the scientific, technological, and economic significance of glass, a vitally important material for meeting the challenges of climate change and developing equitable and sustainable society. The talk will also highlight the role glass has played in arts and advancing human civilization throughout the history and outline various events planned around the world to celebrate the year 2022 as the Year of Glass.

Keywords: glass, glass age, international year of glass, IYoG

DR. RENE VIJGEN
Senior Technical Manager
European Turbine Network, Belgium

Session	PLENARY
Date	NOVEMBER 12, 2021, FRIDAY
Time	12:55 – 13:25 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

Supercritical CO2 Power Cycle Demonstration in Operational Environment Locally Valorising Industrial Waste Heat

Biography

Rene Vijgen is a Senior Technical Manager at ETN Global, responsible for the management and coordination of ongoing and future ETN projects. Previously he worked as a Head of Sulzer's Gas Turbine Services EMEA and was involved in the business growth in China and Russia. He started his career as R&D engineer in gas turbine component repair and gradually took over different management positions in the turbomachinery service business. Through technical innovations and product development he was able to grow the business significantly. Rene studied Mechanical Engineering and received a PhD degree at Eindhoven, University of Technology.

Abstract

The presentation will address a general introduction to the CO2OLHEAT project, its objectives, complexity and the initial results and findings. CO2OLHEAT is an EU funded project started in June 2001. It will demonstrate at TRL 7 the operation of a 2 MW Waste-Heat-to-Power (WH2P) skid in the CEMEX cement manufacturing plant in Prachovice (Czech Republic).
The technology is based on a 2MW-sCO2 cycle able to efficiently valorize local waste heat at a significant temperature above 400°C and will demonstrate the EU MW scale first-of-a-kind waste heat-sCO2 plant. The project consortium will analyse sCO2 WH2P potential from a technical, economic and environmental point of view, developing innovative models for the design of the cycle and of the turbomachinery. In addition to this, the project team will assess the CO2OLHEAT cycle benefits in the glass, aluminium, steel, and power generation sectors via techno-economic and Life Cycle based replication feasibility studies, involving relevant EU industrial players. The consortium, involving the key turbomachinery OEMs, energy intensive industries, energy utilities and R&D partners, is highly committed to bring soon CO2OLHEAT sCO2 cycle technologies on the market. Thanks to its robust demonstration and replication campaign, CO2OLHEAT can be considered a "demonstration to market" project, being keystone for EU sCO2 turbomachinery industry and for a more effective waste heat valorisation.

Keywords: sCO2, WH2P, CO2OLHEAT, turbomachinery, waste heat

DR. MATHIEU HUBERT
Glass Development Associate
Corning R&D Corp. (CRDC), United States

Session	PLENARY
Date	NOVEMBER 12, 2021, FRIDAY
Time	14:30 – 15:00 (Istanbul time, CET+02:00)
Chair	OZAN ÖZER

Specialty Glasses

Biography

Dr. Mathieu Hubert is a Glass Development Associate at Corning. He received a MSc and a PhD in Chemistry from the Univ. of Rennes 1, France, and a PhD in Materials Science and Engineering from the Univ. of Arizona, Tucson, AZ, working on chalcogenide glasses and glass-ceramics for optical applications in the infrared. He joined CelSian Glass&Solar in Eindhoven, The Netherlands, in 2013, as glass scientist / glass technologist, where his activities included contract research and consulting for companies in the glass industry. He joined Corning in 2016, working on the development of new glass products. He is the author or co-author of 14 peer-reviewed papers, 6 book chapters, holds 2 patents, plus 6 pending patent applications. Mathieu Hubert is a member of the Coordinating Technical Committee of the ICG (International Commission on Glass) and a board member of the GlassTrend consortium.

Abstract

Glass has been produced and found in multiple applications for centuries, thanks to its outstanding properties, versatility, and progress made in both glass science and glass engineering. While having a rich history, glass remains a material of the future, as notably highlighted by the decision of the United Nations to declare 2022 at the UN International Year of Glass (IYOG2022). In this presentation, examples of how specialty glasses enable and support our future will be presented, and some of the challenges for the glass industry to meet these goals will be discussed.

Keywords: glass, specialty glasses, future applications

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INVITED SPEAKERS

DR. ESTELA ALEJANDRO

Glass Technology Manager

Vidrala, Spain

Estela Alejandro, Ph.D., is the Glass Technology Manager at Vidrala Group. She obtained her Ph.D. degree in Physical Chemistry at University of the Basque Country (Spain). She has been the responsible of the Glass Technology department in Vidrala since 2002 and manages an international group of 7 people and 2 laboratories. She is the responsible of the glass technology for all the productive plants of Vidrala, which includes glass quality, raw materials and cullet quality, colour changes, R&D projects, etc. She has contributed with papers to international glass conferences, seminars and international glass journals. She has participated on behalf of her company in numerous consortium groups for research and development projects. She is part of the Glass Trend Board since 2021.

PROF. DR. DEREK K. BAKER

Department of Mechanical Engineering

Middle East Technical University, Turkey

Dr. Derek Baker leads the Concentrating Solar Thermal (CST) research division ODAK at Turkey's Centre of Excellence on Solar Energy ODTÜ-GÜNAM and is a Professor in Mechanical Engineering at Middle East Technical University (METU). He completed his PhD in Mechanical Engineering from The University of Texas-Austin in 2000, was an Assistant Professor at Humboldt State University, California, from 2000 to 2002, and joined METU in 2003. He is coordinating the multi-national European Union (EU) Horizon 2020 (H2020) SolarTwins project, is the Institutional Principle Investigator for the EU H2020 HORIZON-STE, SFERA-III, and GeoSmart projects, and was a researcher on the recently completed EU H2020 INSHIP project.

PROF. DR. İSMET İNÖNÜ KAYA

Distinguished Researcher

SUNUM, Sabancı University, Turkey

Ismet I. Kaya studied Electrical and Electronics Engineering for his BSc degree and Physics towards his MSc degree at METU. After working as a research engineer in two leading companies in military electronics and consumer electronics in Turkey, he geared towards basic science and obtained his PhD in experimental condensed matter physics from Bilkent University. He later worked at Max-Planck Institute in Stuttgart and Rowland Institute at Harvard as a scientist before joining Sabancı University as a faculty member in Istanbul in 2003 where he is currently a professor of Physics. His current scientific interests are quantum devices, 2D electron systems and graphene. His active research projects in his Quantum Transport and Nanoelectronics Lab at SUNUM span over fabrication of nanostructures, low temperature transport experiments, and synthesis and applications of graphene in various fields including energy, thermal management and display technologies.

DR. MARTIN KILO

Senior Scientist

Fraunhofer ISC, DE

- Born 1965
- Study of Chemistry, University Mainz/Germany
- PhD in Chemistry, University Bayreuth/Germany
- Habilitation in Materials Science, TU Clausthal/Germany
- From 2009-2018: Fraunhofer ISC, Würzburg/Germany: Special Glass and Glass Ceramics
- From 2018 -2021: TU BA Freiberg, Germany, Interim head of professorship for glass and enamel technology
- Since 2021: Fraunhofer ISC, Würzburg+Bronnbach, Germany

DR. HONG LI

Senior Scientist

Nippon Electric Glass, United States

Hong Li has a Ph.D. degree in Metallurgical Engineering (University of Nevada, Reno, USA, 1992). As a Senior Scientist, Dr. Li currently work at Nippon Electric Glass. Previously he was with PPG Industries for 15 years. His major R&D activities include new fiber glass product development for a wide range of market applications, covering high-modulus fiber for wind turbine blades, corrosion resistant fiber for chemical protection, low dielectric fiber for high end print circuit board, etc. Besides, Dr. Li worked in the fields of vitrification of high-level radioactive waste glass and high-power laser glass in various roles at Pacific Northwest National Laboratory and SCHOTT North America, Inc., respectively.

Dr. Li is a recipient of PPG Industries INNOVA AWARD and a Distinguished Member of PPG Collegium. Dr. Li is the Fellow of the American Ceramic Society (ACerS) and formerly chaired the Glass and Optical Materials Division (GOMD, ACerS). At present he serves as a Council Member of International Commission on Glass. Dr. Li has co-authored more than 100 publications in peer reviewed technical journals and served as an editor-in-chief and co-editor of two monographs, “Fiberglass Science and Technology” and “New Specialty Glass”, respectively. Dr. Li is an inventor or co-inventor of more than 100 patents/patent applications worldwide in the fields of glass fiber and laser glass.

PROF. DR. FRANCK PIGEONNEAU

Enseignant Chercheur

CEMEF, Mines-ParisTech PSL, France

Franck Pigeonneau is currently working as research fellow in the Centre of Materials Forming of the engineer school Mines ParisTech PSL University since 2017. Before, he was associate researcher in the joint research laboratory between the CNRS and Saint-Gobain Research, Glass Surface, and Interfaces. His research focuses on the transport phenomena in heterogeneous and reactive materials like glass forming liquids and polymers. His activity is a coupled work between experimental and numerical investigations. He is an expert of finite element method applied to two-phase flows using boundary-element, level-set and phase-field methods.

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PRESENTATIONS

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ADVANCED MATERIALS

(Invited Speaker)
MARTIN KILO
Fraunhofer ISC, Germany

Session	ADVANCED MATERIALS
Date	NOVEMBER 12, 2021, FRIDAY
Time	11:05 – 11:25 (Istanbul time, CET+02:00)
Chair	DR. İLKAY SÖKMEN

Special Glass and Glass Ceramics

Abstract
More than 80% of all glass produced worldwide is soda lime glass, where the composition is more or less similar for all manufacturers. The remaining 20% of glass are special glasses, where the compositions are differing quite largely. Here are some glasses and glass ceramics which are produced in small amounts, but of large value, but on the other hand, there are also glasses which are prepared in larger amounts but of low price.

In the current paper, the development of two materials is being described:

- Special glasses which are used for coating of glass. These glasses are being used as the base material for decorating hollow glass, either lab glass (borosilicate glass) or soda lime glass, after addition of respective color pigments. The special glass should have the same properties as the glass to be decorated, except that the glass transition temperature of the glass should be significantly lower than the glass transition point of the base glass. Both for soda lime glass as well as for borosilicate glass, there are several solutions available, including lead-free solutions. The base glasses can be crystallizing during the application process, leading to decorations with other properties.

- Foam glass. This is a special glass system which is used for various applications, mainly in the building application. The base of the material is glass powder, added with some foaming agents. By tuning the system due to addition of further components to the glass powder mixture, and by tuning the foaming process, it is possible to prepare foamed glass with different shapes and pore size distributions and pore types (open, closed pores). The material can be used also for the construction of high-temperature furnaces with high thermal insulation properties, and higher energy efficiency.

Furthermore, some fundamental aspects on the development of new glass systems are described in the presentation.

Keywords: inorganic color glass, foam glass, special glass

(Invited Speaker)
İSMET İNÖNÜ KAYA
SUNUM Sabancı University, Turkey

Session	ADVANCED MATERIALS
Date	NOVEMBER 12, 2021, FRIDAY
Time	11:25 – 11:45 (Istanbul time, CET+02:00)
Chair	DR. İLKAY SÖKMEN

Graphene Based OLED Displays

Abstract
Graphene is considered as a super material to replace a range of materials due to its outstanding properties. One of the potential functions attributed to graphene is to use it as a transparent conducting electrode material on glass for various applications including displays. High conductivity, high transparency, low reflectance and mechanical flexibility of graphene makes it an ideal choice. Despite all the hurdles before it can replace the industry standard materials such as ITO, there is a steady progress. In this talk, I will explain our recent research efforts to realize graphene-based OLED display prototypes. I will overview key findings in graphene synthesis and transfer on glass, and demonstration of an OLED display with a graphene anode layer. I will summarize other related graphene applications that branched out from this research and future directions in displays and graphene.

Keywords: OLED, graphene, CVD

(Invited Speaker)
HONG LI[1], SANDEEP VENNAM
[1]Nippon Electric Glass (US), Shelby, United States

Session	ADVANCED MATERIALS
Date	NOVEMBER 12, 2021, FRIDAY
Time	11:45 – 12:05 (Istanbul time, CET+02:00)
Chair	DR. İLKAY SÖKMEN

New High-Strength and High-Modulus Fiber Glasses

Abstract
Ultra-long wind turbine blade and cost effective, high-pressure vessels can take the advantage of using high-modulus and high-strength of glass fibers, respectively. A recently patented glass system, RE2O3 (rare earth oxide)-MgO-CaO-Al2O3-SiO2, has presented commercial potentials addressing the above unmet needs. The new family of S-Glass derivatives enables fiber processing at lower temperature (TF at 100 dPa.s well below 1400°C) by using a standard E-CR Glass manufacturing technology, comparing with the traditional S-Glass fiber making process, which requires fiber drawing temperature near 1500°C or greater. This presentation discusses RE-effects on mechanical properties, high temperature viscosity, liquidus temperature, softening and glass transition temperature. Mechanical properties of high-performance glass fiber and its reinforced composites, UD laminate panel and high pressure vessel, are followed comparing with its counterpart of E-Glass fiber.

Keywords: fiber glass, fiber modulus, fiber strength, fiber reinforced composite, composite mechanical properties

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ENERGY & DIGITALIZATION

(Invited Speaker)
DEREK K. BAKER
Concentrating Solar Thermal Division (ODAK)
Center for Solar Energy Research and Applications
(ODTÜ-GÜNAM), Ankara, Turkey
Department of Mechanical Engineering, METU, Ankara, Turkey

Session	ENERGY & DIGITALIZATION
Date	NOVEMBER 12, 2021, FRIDAY
Time	13:25 – 13:45 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

Overview of Concentrating Solar Thermal Technologies and Applications

Abstract
Concentrating Solar Thermal (CST) is an umbrella term covering diverse technologies that are typically classified using four concentrating geometry categories and four application categories. Two concentrating geometries are "Point Focus" (Parabolic Dish and Central Receiver) and two are "Line Focus" (Parabolic Trough and Linear Fresnel). Each geometry has advantages and disadvantages, and the "best" geometry depends on the application. The four main applications are Solar Thermal Electricity (STE) / Concentrating Solar Power (CSP), Solar Heat for Industrial Processes (SHIP), Solar Fuels (e.g. H2), and Solar Water Treatment and Desalination (Solar4Water). Among these, STE/CSP is the most mature and when combined with Thermal Energy Storage (TES) is the low-cost solution to deliver dispatchable solar electricity during times of peak demand or at night. Both SHIP and Solar Fuels markets are largely undeveloped but have very large growth potentials due to the global need for cost-effective solutions to decarbonize the industrial and transport sectors. Solar4Water markets are also largely undeveloped and have large growth potential due to the largest end-use of water being irrigation, and the potential for Solar4Water technologies to produce irrigation water in the quite common regions where agriculture, solar resources, and water scarcity are co-located. CST opportunities for the glass industry include as a supplier of value-added glass products (e.g. reflective materials and low-iron glass), using SHIP to decarbonize glass production processes, and potentially being a supplier of CST components (e.g. complete linear receiver tubes) and systems (e.g. complete collectors).

Keywords: concentrating solar thermal, concentrating solar power, CST, CSP

(Invited Speaker)
FRANCK PIGEONNEAU
MINES ParisTech, PSL University,
CEMEF - Centre of Materials Forming,
CNRS UMR 7635, Sophia Antipolis cedex, France

Session	ENERGY & DIGITALIZATION
Date	NOVEMBER 12, 2021, FRIDAY
Time	13:45 – 14:05 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

Mass Transfer Around a Rising Bubble in a Glass-Forming Liquid involving Oxidation-Reduction Reaction

Abstract

In glass melting processes, in which the bubble removal (fining) is the limiting stage, the mass transfer is fundamental to study the overall bubble dynamics in a glass bath. The fining process is mainly achieved by adding multivalent elements in raw materials. Consequently, the redox state of the glass-forming liquid plays a crucial role during the fining. How oxygen species is transported in glass-forming liquid stays an open question in glass science.

To investigate this important issue, the mass transfer of a rising bubble in creeping flow regime is numerically investigated. A reversible oxidation-reduction reaction is taken into account. Two coupled equations are needed to study the oxygen and reduced species transport. Three dimensionless numbers are involved: the Péclet and Damköhler numbers and the ratio of the diffusion coefficient of the reduced species to the diffusion coefficient of oxygen. The problem is solved numerically with a discontinuous Galerkin finite element method with a h-adaptation method to catch carefully the chemical boundary layer around the rising bubble.

Numerical computations are applied to a soda-lime-silica and a borosilicate glass-forming liquid. Results are focused on the determination of the Sherwood number. The mass transfer enhances strongly when the chemical reaction is very fast, i.e. at large value of Damköhler number. Correlations to determine the enhancement factor are proposed in the two limits of small and large Péclet numbers. The Sherwood number enhances when the diffusion coefficient of the reduced species increases. A correlation of the Sherwood number is proposed taking into account advection and reaction. Simple laws are written useful to introduce in CFD software.

Keywords: glass fining, bubble, creeping flow regime, mass transfer, CFD

ÖMER BAYRAKTAR
Şişecam Science, Technology and Design Center, Turkey

Session	**ENERGY & DIGITALIZATION**
Date	NOVEMBER 12, 2021, FRIDAY
Time	14:05 – 14:25 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

Smarter Approach to Glass Production

Abstract

Glass production is an energy intensive process. Great amount of energy consumed by glass furnaces is mostly produced by combustion of natural gas. Today electricity is a secondary energy source to be used directly for melting and conditioning of glass.

The fact that stricter governmental legislations are foreseen to be in place in the near future to decrease carbon footprint of manufacturing, a global challenge is on the way for the energy intensive industries including glass industry.

Şişecam has been focusing on combustion and control systems to improve energy efficiency of furnaces. The challenges are continuously measuring physical values at extremely high temperatures, deriving meaning from measured data and translating data to smartly control field instruments. A smart control system is inevitable for an optimized process.

Smart sensor and control system applications regarding energy use, emissions and process stabilization will be presented. Additionally, the latest technologies and solutions will be discussed for future of glass production process.

Keywords: smart sensors, advanced control systems, combustion optimization, energy efficiency, emission reduction

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OPERATIONAL EXCELLENCE

(Invited Speaker)
ESTELA ALEJANDRO
Glass Technology Dept. Glass & Melting Dept. Vidrala, Spain

Session	**OPERATIONAL EXCELLENCE**
Date	NOVEMBER 12, 2021, FRIDAY
Time	15:00 – 15:20 (Istanbul time, CET+02:00)
Chair	OZAN ÖZER

Standardization: A Powerful Tool to Achieve Excellence in Container Glass Technology

Abstract
Standardization is a powerful tool for any industrial process; it reduces the variability of the processes, enhances the predictability, gives a more consistent and constant quality, and helps reducing waste. But standardization is not just a pure operational technique, it is also a culture that can transform the performance of a whole organization. A standardization culture delivers a collective way of working that, based on the application of the best practices, promotes a continuous improvement mindset, enables the capture and transfer of knowledge and expertise, supports the change and helps all stakeholder to contribute to and benefit from a shared value. As a process itself, glass technology is not alien to these benefits. Glass technology manages the raw materials used to produce the glass, that is, the material from which the manufactured products are made. Its location at the beginning of the glass manufacturing industrial process, together with the high complexity of glass formation process in the furnace, means that its impact contributes greatly to the performance of a production plant, so a correct and rigorous management of the glass technology stage is essential. Thus, a standardization of the glass management procedures can give a priceless opportunity to reduce glass quality losses and acquire knowledge very fast, leading the process to its operational excellence. This paper looks at how standardization culture and techniques can be applied successfully to the glass management of container production plants.

Keywords: standardization, glass technology, container glass, operational excellence

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Session	OPERATIONAL EXCELLENCE
Date	NOVEMBER 12, 2021, FRIDAY
Time	15:20 – 15:40 (Istanbul time, CET+02:00)
Chair	OZAN ÖZER

Double Action Baffle for IS Machines & Plasma Coating for Troughs

Abstract I
As market requirements become more demanding, light bottles are needed and a new double action baffle mechanism provides an innovative approach for BB process to make bottles lighter. There is no need to use funnel mechanism to supply settle blow air when using this new system. Settle blow air goes through baffle holder in the new system. So, time between settle blow and counter blow is reduced. As a result of this, better glass distribution is ensured and bottles produced with this new mechanism will weigh 5% less and production speed will increase by 5% without quality problems (compared to traditional BB process). Double action baffle system has already been patented by the Sisecam Group (worldwide geography).

Keywords: double action baffle, funnel mechanism

Abstract II
Plasma coating ensures more stable coating thickness on the delivery equipment's. So, it helps more stable gob loading and reduces defects. Additionally, it reduces stoppage time especially in job change because it has life cycle 1.5 year without any additional operation. Furthermore, environmental impact will improve as no additional coating materials is needed and waste produced during cleaning process will reduce also. This new type of surface on the troughs will reduce expenses related to production losses/component replacement by more than 70% and can help to increase total efficiency of production up to 2%.

Keywords: plasma coating, delivery system

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Chair	OZAN ÖZER

LIFE Smart Oxygen Boosting System Implemented in Flat Glass Furnace

Abstract
Sisecam seeks and invests in innovative energy and emission reduction technologies to improve furnace efficiency without compromising glass quality. In partnership with Air Liquide, Sisecam has started the implementation of Smart Oxygen Boosting technology in an air-fuel regenerative flat glass furnace in Trakya Glass Bulgaria EAD plant on 1 July 2018. Co-funding by European Commission LIFE 17 program was leveraged. Life 17 program is designed to provide funding to industry to reduce its environmental footprint. The benefits of Smart Oxygen Boosting are increased production, decreased energy consumption, reduced specific GHG emissions and particulate emissions, which are proved in the Sisecam factory. The presentation will share experiences in partial oxy-fuel conversion of side-fired float glass furnace with air-gas fuel by the help of smart burners equipped with sensors and wireless transmitters, collecting real time data to improve burner efficiency. The outputs of this project can also guide glass manufacturers in reducing costs for melting glass under a variety of operating constraints.

Keywords: LIFE, smart oxygen boosting, energy efficiency

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Date	NOVEMBER 12, 2021, FRIDAY
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Chair	OZAN ÖZER

Composition Optimization of Crystalline & Soda Lime Silicate Glass

Abstract
The cost of raw materials used for soda lime and crystalline glass composition produced in Şişecam Glassware Kırklareli Plant have increased considerably over time. The project focused on reducing the use of costly raw materials and obtaining the same glass quality with lower batch costs by changing the proportions of oxides in the compositions.

By reducing the sodium oxide ratio in the IGC 4th Tier glass composition in SLS Glass, it is aimed to reduce the cost of batch by reducing the use of sodium carbonate, which is a major contributor to the cost of raw materials. Due to decreasing of the sodium oxide ratio, magnesium oxide ratio was increased to minimize the change of working range.

In crystalline glass, oxides in the glass composition have been optimized in order to reduce the effect of unit price increases on the glass cost due to the pandemic, especially of raw materials supplied from the Far East. Along with this optimization, in addition to cost savings, an increase in the specific pull rate of the furnace by lowering the melting temperature of the composition was also considered.

Keywords: SLS, crystalline, cost reduction, optimization, pull rate increase

AUTHOR INDEX