ŞİŞECAM

35th GLASS SYMPOSIUM

Glass in the Sustainable Future:

THE PANDEMIC and NEW ECOSYSTEM

November 9, 2020, Online

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Dear Colleagues and Guests,

As a strong symbol of commitment to scientific and technological development, Şişecam has been organizing annual Glass Symposium since 1985. Initially designed to facilitate sharing of knowledge and best practices within the company, the symposium has evolved to be the prominent scientific platform for the Turkish glass industry, bringing academia and industry together while receiving more and more international contributions each year. The International Commission on Glass held its annual meetings in conjunction with Şişecam Glass Symposium in 1985, 1996 and 2017. In 2019, "Şişecam International Glass Conference combined with the 34th Şişecam Glass Symposium" welcomed more than 500 participants from 26 countries.

We feel impelled to bring the ecosystem together to communicate the latest developments in glass science and technology and to affirm glass as the material of the future with a glorious past.

2020 has been an extraordinary year marked by the global pandemic and its harsh socio-economic consequences. In these unusual circumstances, sustainability, operational excellence, and innovation are ever more important for a rapid recovery.

Glass, with its ever-expanding usage such as in construction for architectural purposes, in automotive and renewable energy systems, in electronics and communication, in biotechnology as well as with demands for higher performance in its conventional usage is more relevant than ever. As glass manufacturers, scientists and technologists, it is our duty to achieve the highest value and quality with the lowest impact on the world we live in, to find new and better ways of doing what we are doing and to achieve greater success.

Due to the unfortunate pandemic conditions, this year's 35th Şişecam Glass Symposium is organized online and will be a unique experience. We will be hearing very convincing new ideas in glass science and technology and we hope our gathering will be home to fruitful discussions.

We would like to thank those whose invaluable contributions made this event possible.

Prof. Dr. Ahmet Kırman
Conference President
Vice Chairman and
Chief Executive Officer, Şişecam

Dr. Reha Akçakaya
Conference Executive Chair
Acting Chief Research and Technological Development Officer, Şişecam

SYMPOSIUM EXECUTIVE COMMITTEE

President	Prof. Dr. Ahmet Kırman
Executive Chair	Dr. Reha Akçakaya
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Conference Secretary	Ebru Çelebi

PROGRAM AT A GLANCE

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November 9, 2020, Online

PROGRAM AT A GLANCE

NOVEMBER 9, 2020 ONLINE	
Time Zone: ISTANBUL (CET +02:00)	Registration: Online
09:00 - 09:20	Welcome / Opening Remarks
09:20 - 09:50	NEW ECOSYSTEM: Keynote Speech
09:50 - 09:55	Break
09:55 - 11:15	ADVANCED TECHNOLOGY MATERIALS
11:15 - 11:20	Break
11:20 - 11:50	NEW ECOSYSTEM: Keynote Speech
11:50 - 13:30	SUSTAINABLE GLASS MANUFACTURING
13:30 - 14:30	Lunch Break
14:30 - 16:30	OPERATIONAL EXCELLENCE
16:30 - 16:35	Closing

SCIENTIFIC PROGRAM

ŞİŞECAM

35th GLASS SYMPOSIUM

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November 9, 2020, Online

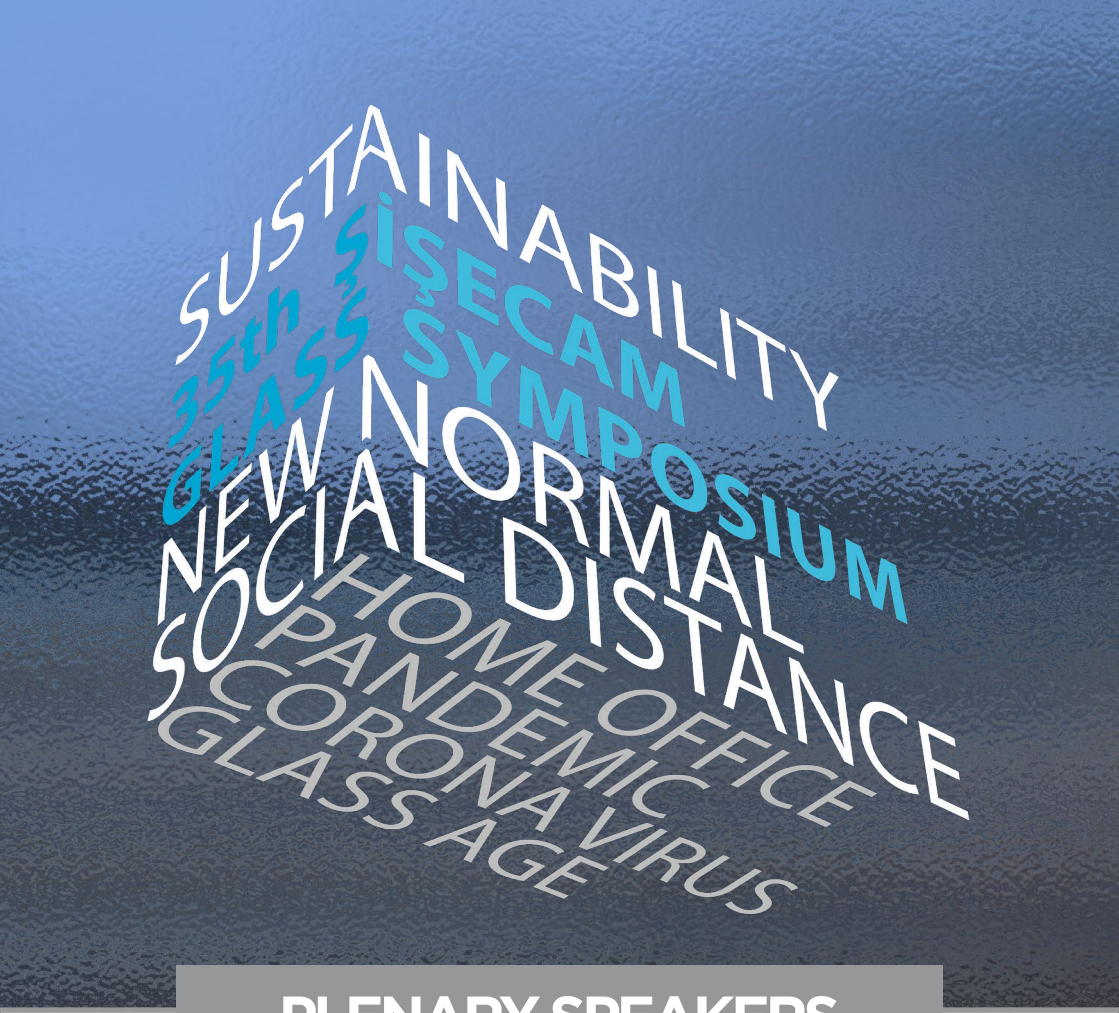
SCIENTIFIC PROGRAM

Time Zone: ISTANBUL (CET +02:00)	**NOVEMBER 9, 2020** **ONLINE**
Registration	Online
OPENING	**Welcome / Opening Remarks**
09:00-09:10	**Dr. REHA AKÇAKAYA** *(Acting Chief Research & Technological Development Officer, Şişecam, TR)*
09:10-09:20	**Prof. Dr. AHMET KIRMAN** *(Vice Chairman and Chief Executive Officer, Şişecam, TR)*
PLENARY SESSION	**NEW ECOSYSTEM**
SESSION CHAIR	**Dr. REHA AKÇAKAYA** *(Acting Chief Research & Technological Development Officer, Şişecam, TR)*
09:20-09:50	**"The Effects of the Pandemic Process on The Glass Industry (Future Trends of 2020+)"** Keynote Speech: **ÖZLEM VERGON** *(Chief Strategy Officer, Şişecam, TR)*
09:50-09:55	Break

SESSION TOPIC	ADVANCED TECHNOLOGY MATERIALS
CHAIR	**Dr. İLKAY SÖKMEN** *(Coating Technologies Director, Şişecam, TR)*
09:55-10:15	**"Augmented Reality Head Up Displays"** **Prof. Dr. HAKAN ÜREY** *(Department of Electrical Engineering, Koç University, TR)*
10:15-10:35	**"Recent Technical Achievements in Transparent MgAl2O4 Ceramics"** **Dr. İSMAİL ÖZGÜR ÖZER** *(Department of Materials Science and Engineering, Eskişehir Tech. Univ., TR)*
10:35-10:55	**"Production of Single Crystal Germanium and Sapphire"** **Prof. Dr. SÜLEYMAN ÖZÇELİK** *(Director of Photonics Application and Research Center, Gazi University, TR)*
10:55-11:15	**"Şişecam's V-block Technology: Scalable Deposition of Durable Antimicrobial Thin Film Coatings on Complex Shaped Glass Substrates"** **Dr. OSMAN BURAK OKAN** *(Executive Senior Researcher, Atmospheric Coating Technologies, Şişecam, TR)*
11:15-11:20	Break

PLENARY SESSION	NEW ECOSYSTEM
SESSION CHAIR	TOLGA UYSAL *(Melting Technologies & Engineering Director, Şişecam, TR)*
11:20-11:50	**"How Glass Furnaces will Look in a De-Carbonised Future"** Keynote Speech: STUART HAKES *(Chief Executive Officer, F.I.C. Limited, UK)*
SESSION TOPIC	**SUSTAINABLE GLASS MANUFACTURING**
CHAIR	TOLGA UYSAL *(Melting Technologies & Engineering Director, Şişecam, TR)*
11:50-12:10	**"Şişecam's Practices in Value Chain Footprinting"** BAHAR UBAY GÜÇLÜSOY *(Sustainability Director, Şişecam, TR)*
12:10-12:30	**"Hydrogen as a Potential New Source of Energy Combustion for Glass Melting"** LUC JARRY *(Global Market Director Glass & Metals, Air Liquide, FR)*
12:30-12:50	**"Emission Reduction by Optimized Combustion and Advanced Control Technology"** FLORIAN STADLER *(Head of Energy and Environmental Tech. Dept., UAS Messtechnik GmbH, DE)*
12:50-13:10	**"Energy Audits Across Şişecam Group"** GÜRHAN DURAL *(Head Senior Project Engineer, Energy Efficency Management, Şişecam, TR)*
13:10-13:30	**"The Glass Manufacturers Net Zero Journey"** Dr. NICK KIRK *(Technical Director, Glass Technology Services Ltd., UK)*
13:30-14:30	LUNCH BREAK

SESSION TOPIC	OPERATIONAL EXCELLENCE
CHAIR	HALUK ERDEM *(Atmospheric Coating Technologies Manager, Şişecam, TR)*
14:30-14:50	**"Automated Quality Control of Glass Production with Artificial Intelligence"** Dr. ALİ BAHRAMISHARIF *(Chief Executive Officer, Machine2Learn, NL)*
14:50-15:10	**"Lean Six Sigma Approaches on Glass Processes"** AYHAN AYDEMİR *(Production Manager, Şişecam Flat Glass Mersin Plant, TR)*
15:10-15:30	**"Anadolu Cam Eskişehir Plant SmartWarehouse Project"** TUĞBA ÖZER *(Supply Chain Manager, Şişecam Glass Packaging Eskişehir Plant, TR)* EKİN YİĞİT *(Production Planning Engineer, Şişecam Glass Packaging Eskişehir Plant, TR)*
15:30-15:50	**"4 Individual Section Machine for 3400 mm Metal Line"** EGE ARTUN *(Technical Manager, Şişecam Glassware Eskişehir Plant, TR)*
15:50-16:10	**"Energy Monitoring System (EnIS)"** Dr. LEVENT KILIÇ *(Head Senior Project Engineer, Energy Efficency Managment, Şişecam, TR)*
16:10-16:30	**"Simulation-Driven Design on Glass Container"** GÖKHAN TORAMAN *(Design Responsible, Glassware Design, Şişecam, TR)* ALP ARUCA *(Design Responsible, Glassware Design, Şişecam, TR)*
16:30-16:35	**CLOSING** Dr. REHA AKÇAKAYA *(Acting Chief Research & Technological Development Officer, Şişecam, TR)*



PLENARY SPEAKERS

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ÖZLEM VERGON
Chief Strategy Officer
Şişecam, Turkey

Session	PLENARY
Date	NOVEMBER 9, 2020, MONDAY
Time	09:20 – 09:50 (Istanbul time, CET+02:00)
Chair	Dr. REHA AKÇAKAYA

THE EFFECTS OF THE PANDEMIC PROCESS ON THE GLASS INDUSTRY

(Future Trends of 2020+)

Biography

Özlem Vergon graduated from Istanbul University, Department of Economics (English) in 1995. She later received her MBA from San Diego State University and completed the General Management program at Harvard University in 2013. Ms. Vergon joined Şişecam Flat Glass in 1996 as Planning Specialist Assistant and worked in various positions leading to Şişecam Flat Glass - Planning Director. Since January 2015, Ms. Vergon has been the Chief Strategy Officer at Şişecam Group.

Abstract

Many forces shaped the formation of new generations and mega trends. Lifestyles, work life and industries have been affected by these mega trends. Developments of products & services are affected by these drivers. While mega trends trigger changes in products and services, demand for products and services also has influenced trends with circular interactions. As the main drivers of mega trends; demographics, technology and sustainability were always on the top of the list.

There can be some unexpected drivers as well that stimulate or disrupt the mega trends. In 2020, Covid-19 have disrupted many trends and sectors and accelerated some of the existing ones, such as digitalization and technologies in health care. Covid-19 has changed our daily life, the work life, the way industries operate, the needs and products and services, while increasing the level of uncertainties.

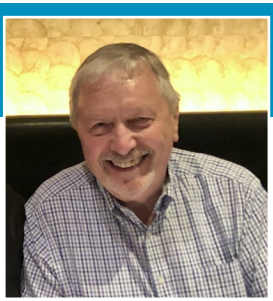
We all needed to accelerate our existing solutions and or needed to find new ones.

Why we do we need to follow and understand the trends? It is to be ready for the change (that has been accelerating), to manage risks, to seize opportunities and to overcome challenges. Technology and innovation for a sustainable future plays the major role in the changing world.

Being input to variety of industries with different applications, glass remains as solution to changing trends even to the effects of Covid-19. Glass is a product of today and the future with its innovative solutions, its integration to various applications and its contributions to circular economy. With close collaborations of the glass world, technological developments end efforts, glass will always continue to support a sustainable future.

Keywords
future trends, mega trends, pandemic, glass, glass industry

STUART C. HAKES
Chief Executive Officer
FIC (UK) Limited, United Kingdom



Session	PLENARY
Date	NOVEMBER 9, 2020, MONDAY
Time	11:20 – 11:50 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

HOW GLASS FURNACES WILL LOOK IN A DE-CARBONISED FUTURE

Biography

Stuart C. Hakes has been in the glass industry for 66 years. He has a tertiary qualification in Glass Technology and has spent 35 years in the operational side of glass-plants. Apart from a short stint in Europe, he returned to his native New Zealand working for Australian Consolidated Industries a glass manufacturer of flat, hollow and fiber glass products and held a number of positions in New Zealand, Australia and the Far East, culminating in General Manager for the worldwide mould operations based in China. Whilst back in New Zealand he was responsible for converting the New Zealand operation from fossil fuel to all-electric melting throughout the process. The New Zealand plant manufactured tableware and high-quality cosmetic bottles, mainly for export. He joined FIC (UK) Limited as C.E.O. in 1999 and has been there ever since guiding the company to its pre-eminent position in electric boosting of float furnaces of which FIC has installed more than 80 systems. He was also responsible for developing the water cooled bubblers that eliminate high rates of wear on the furnace floor with conventional ceramic bubbler tubes. He has led the development of hybrid all-electric furnaces for CO_2 reduction to assist in reversing climate change. He is currently President of the Society of Glass Technology, finishing his term in 2023 and is active in the Glass Futures programme which is putting down a 30tpd research furnace to look at carbon reduction options. This is an International programme.

Abstract
This paper sets out the advantages and disadvantages of conventional all-electric furnaces and the limitations on their use for mainstream, commercial glass melting. The paper will look at recent developments by F.I.C. and Glass Service of Czech Republic that have produced a hybrid electric furnace suitable for the future to cover any commercial furnace size above 300tpd up to 1200-1500tpd for both flat and hollowware sectors of soda-lime glasses. The paper will examine the benefits from these hybrid furnaces and then look at the mechanisms in how it would be possible to transition slowly from the existing conventional fossil fuel fired furnaces with the minimum of disruption and cost.

Coauthors
Erik Muijsenberg (Glass Service, A.S)
Christoph Jatzwauk (F.I.C. Germany Gmbh)

Keywords
de-carbonisation, hybrid electric furnaces, large electric furnaces

INVITED SPEAKERS

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Dr. ALİ BAHRAMISHARIF

Chief Executive Officer
Machine2Learn, Netherlands

Ali Bahramisharif is a co-founder and managing director of Machine2Learn. He holds an interdisciplinary PhD in neuroscience and artificial intelligence and is a former assistant professor at the University of Amsterdam. He has a track record of working in various high-tech sectors including healthcare, telecom, and manufacturing industries.

LUC JARRY

Global Market Director Glass & Metals
Air Liquide, France

Luc Jarry is a Senior Expert in combustion processes with Air Liquide's Glass and Metal Markets World Business Line. With a Master's degree in Energy and Engineering, and more than 25 years of experience in industrial gas for the glass industry, Luc's extensive experience in the development of technologies, management of related R&D and industrialization programs makes him an industry leader in the combustion field. In addition to leading multi-functional, global combustion projects , most notably for oxy-combustion technologies, Luc has been granted 24 patents, been published multiple times in numerous industry journals, and was awarded by COP21 for the best innovative technology development application for "Climate Solutions".

Dr. NICK KIRK

Technical Director

Glass Technology Services Ltd., United Kingdom

Nick has been at GTS for over 15 years, the organisation which provides technical support to glass sector and the supply chain. He now provides technical leadership and consultation within the organisation and to the wider glass supply chain including, energy efficiency, recycling, raw material utilisation, product innovation, process improvements, product verification and as a legal technical expert.

Nick has been involved in glass sector since his PhD on glass surface chemistry in the early '90s. He represents the interest of the glass sector nationally and internationally as well as fostering the innovation and collaboration to secure a sustainable future for glass. Nick is active on the 2050 decarbonisation action plan working with the UK Government and stakeholders to develop the opportunities and technology to reduce the CO_2 impact from the glass manufacturing process. He also works on recycling legislation and policy, food contact material legislation, packaging and flat glass standards to name a few.

He is a fellow of the Institute of Materials, Minerals and Mining (FIMMM), Chartered Engineer (CEng) and Chartered Environmentalist (CEnv), with over 25 years' experience in the glass industry including being a project manager at TECO and an environmental glass consultant before joining GTS in 2003.

Prof. Dr. SÜLEYMAN ÖZÇELİK
Photonics Application and Research Center (Gazi Photonics)
Gazi University, Turkey

Prof. Dr. Süleyman Özçelik is the founder and director of Photonics Application and Research Center of Gazi University. He is also head of Photonic Department of Applied Sciences Faculty of Gazi University. He has 20-years' experience in conducting research and development activities for development of photonic devices, functional surfaces; is also experienced in modeling, designing, epitaxial growth, bulk single crystal growth, development of 3D and 2D thin films and space grade PV cell fabrication. He has conducted more than 30 projects in the field of advanced materials, semiconductor and photonic technologies. He has more than 200 articles published in international journals. Under his supervision, 20 PhD theses and more than 40 Master's theses have been completed. About 25 graduate students and post-doctoral researchers have been working in his directed projects that are currently underway.

Dr. İSMAİL ÖZGÜR ÖZER
Department of Materials Science and Engineering
Eskisehir Technical University, Turkey

Dr. İsmail Özgür Özer has been working as an academician in the Material Science and Engineering Department, Eskişehir Technical University (formerly Anadolu University) since 2001 and the founder of Magspin Advanced Technology A.Ş. His expertise is in the electronic and optical properties of ceramics and particularly in transparent ceramics; their production technologies and in-depth material characteristics. He has more than 20 scientific publications published in both national and international journals and conference proceedings. He also participated in 15 scientific research and development projects both as coordinator and researcher. Dr. Ozer holds 4 patents in relation with the transparent ceramic production.

FLORIAN STADLER

Head of Energy and Environmental Technologies Department

UAS Messtechnik GmbH, Germany

Florian Stadler studied Environmental Engineering at Technical University of Applied Sciences Amberg. After graduating in 2010, he joined UAS Messtechnik as project engineer. Since 21012 Stadler serves as project manager and head of department for energy and environmental technologies at UAS.
Stadler engineered different systems to increase efficiency of combustion processes and lower emissions by re-utilizing waste heat or enhanced optimized measurement and control methods.
Over the last years, he was involved in different public founded R&D projects in cooperation with universities and research institutes for the development of e.g. preheating systems to heat up gas and oxygen at oxyfuel fired furnaces, micro-steam turbine systems or high temperature heat transfer loops.
Florian Stadler is certified project manager and, in this position, he is/ was responsible for several projects in the glass industry for combustion systems and utilities for endport-, crossfired- recuperative- and oxyfuel-fired furnaces, also for feeder- and forehearth- combustion, NOx- and energy reduction systems.

Prof. Dr. HAKAN ÜREY
Optical MEMS Laboratory,
Engineering Faculty Koç University, Turkey

Hakan Urey is a Professor of Electrical Engineering at Koç University, Istanbul. He received the BS degree from Middle East Technical University and MS and Ph.D. degrees from Georgia Institute of Technology all in Electrical Engineering. He worked for five years at Microvision Inc in Seattle. Since 2001, he has been a faculty member at Koç University.

He is the inventor of more than 60 issued and pending patents in the areas of displays, holography, imaging systems, sensors, micro-optics and microtechnologies. His inventions have been licensed by various companies for commercialization and resulted in 4 spin-off companies from his lab. He published about 200 papers in international journals and conferences, gave more than 50 invited talks at international conferences, and received a number of awards. He received the prestigious European Research Council Advanced Grant to develop the next generation augmented reality display technologies.

ORAL PRESENTATIONS

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ADVANCED TECHNOLOGY MATERIALS

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Session	ADVANCED TECHNOLOGY MATERIALS
Date	NOVEMBER 9, 2020, MONDAY
Time	09:55 – 10:15 (Istanbul time, CET+02:00)
Chair	Dr. İLKAY SÖKMEN

AUGMENTED REALITY HEAD UP DISPLAYS

(Invited Speaker)

Hakan Ürey
Koç University, Turkey

Abstract
There has been tremendous advancements in sensor technologies for advanced driver assistance systems (ADAS). Through advanced use of human-machine interface, ADAS increases car and road safety. Augmented reality (AR) and head-up displays (HUD) offer the most advanced form of human-machine interface for vehicles and the windshield glass is a critical pieces in creating the ultimate display experience. In this talk, we'll discuss the evolution of HUDs and the latest developments in AR HUDs for vehicles.

Keywords
windshield hud, augmented reality display

Session	ADVANCED TECHNOLOGY MATERIALS
Date	NOVEMBER 9, 2020, MONDAY
Time	10:15 – 10:35 (Istanbul time, CET+02:00)
Chair	Dr. İLKAY SÖKMEN

RECENT TECHNICAL ACHIEVEMENTS IN TRANSPARENT $MgAl_2O_4$ CERAMICS

(Invited Speaker)

İsmail Özgür Özer[1], Hazal Gürkaş[2], Hüseyin Burak Kocabaş[3]
[1]Eskisehir Technical University, Turkey
[2]MagSpin Inc., Turkey

Abstract
The potential of transparent $MgAl_2O_4$ (Mg-spinel) ceramics to be used in advanced applications such as transparent armor and IR-dome, which require high visible and IR-transmittance along with extreme durability, has been recognized for years. However, the use of these materials has been limited due to the optical inclusions even though the excellent transmission was possible to achieve. Recently, emerging powder synthesis and processing technologies that enabled the production of "laser quality" spinel ceramics with lower costs, pave also the way for civil applications, where high scratch resistance is required, such as watch and phone screens. Besides, a deeper understanding of structure-property relations resulted in the improved engineering properties and increased the chance of Mg-spinel among its single crystal and glass competitors in terms of the cost/performance rate, particularly for non-military applications. The cubic crystal structure of Mg-spinel both assures isotropic view in the visible and IR spectrum and provides available sites for doping. Therefore, the control of the defect structure with proper doping strategies will enable to control their ultimate properties along with the sintering and microstructure development. Powder processing in their fabrication allows local doping and accordingly functionally graded properties, which is hard to achieve in single crystals.

Moreover, high temperature plastic deformation properties of the crystal structure have been utilized to achieve high sintering kinetics that yield to fine microstructures exhibiting high mechanical properties. It was also reported that the residual stresses developed during sintering in non-stoichiometric spinel can be used to increase the toughness. In this presentation, such recent technical achievements will be reviewed and the market response to these achievements will be reported.

Keywords
transparent ceramics, $MgAl_2O_4$, Mg-spinel

Session	ADVANCED TECHNOLOGY MATERIALS
Date	NOVEMBER 9, 2020, MONDAY
Time	10:35 – 10:55 (Istanbul time, CET+02:00)
Chair	Dr. İLKAY SÖKMEN

PRODUCTION OF SINGLE CRYSTAL GERMANIUM AND SAPPHIRE

(Invited Speaker)

Süleyman Özçelik
Gazi University, Turkey

Abstract
Depending on the development of IR technology, IR optical materials such as Ge, Sapphire, Si, ZnSe, etc. have been used to production and design of plano-optics, aspherical, achromatic lenses and optical windows. In addition, some optical materials can be used production of domes for missile as well as armor windows in armed vehicles. Germanium having low band gap energy and high refractive index is a unique material for many electro-optical devices. The main applications of bulk monocrystalline germanium are optical lens and window in infrared systems, active material in gamma radiation detectors, and substrates for III - V based opto-electronic devices such as multi-junction solar cells, sensors. The Ge crystals can also be produced with having property of EMI shielding by increasing the conductivity during the growth process from the melt. Among the optical materials Sapphire is an ideal material for UV-Vis and IR applications since it has high optical transmission from 150 nm up to around 5Qm. In addition, due to its excellent mechanical hardness, high thermal and chemical resistance, sapphire is a perfect material to production of the dome for missile as well as armor windows. Sapphire glasses are used in gas cryostats and helium microstats, metallic flanges as sealed or by sealing in the sockets of the devices. In addition, sapphire can be used optical material as watch smartphone windows and jewelry stone as well.

In this talk, technological information about the studies carried out within the scope of bulk crystal growth in the Gazi Photonics Research Center and their applications of produced crystals will be presented.

Acknowledgement
This work was supported CSBB under the 2016K121220 project.

Keywords
photonics crystals, germanium, sapphire, single crystal, growth from melt

Session	ADVANCED TECHNOLOGY MATERIALS
Date	NOVEMBER 9, 2020, MONDAY
Time	10:55 – 11:15 (Istanbul time, CET+02:00)
Chair	Dr. İLKAY SÖKMEN

ŞİŞECAM'S V-BLOCK TECHNOLOGY: SCALABLE DEPOSITION OF DURABLE ANTIMICROBIAL THIN FILM COATINGS ON COMPLEX SHAPED GLASS SUBSTRATES

Osman Burak Okan[1], Refika Budakoğlu[1], Çağdaş Kadakal[1], Anıl Özen[1], Gizem Aydın[1], Zeynep Aydın[1], Nihat Ünal[1], Burcu Apak[1], Levent Kazas[1], Mine Özkök[1], Ahmet Canlı[1], Gürkan Yiğiter[1], Faruk Erkal[1], Semin Atılgan[1], Fulya Elgin[1], Melih Üstün[1], Burcu Öğüt[1]
[1]Şişecam, Turkey

Abstract
COVID-19 global pandemic forces the glass industry to reposition itself because pristine glass surface is a forgiving host for microorganisms. Bacteria and viruses can survive for long durations on untreated glass surfaces thereby facilitating fomite transmission. For the case of SARS-CoV-2 virus, which is the underlying cause of the ongoing COVID-19 pandemic, reported residence time is up to two days.

Despite the availability of several antimicrobial-coating treatments, glass industry is also bound with fundamental production constraints, which severely limit the applicative range of such treatments. The standing challenges include the need to preserve the optical characteristics of the treated articles (low optical haze, high transmission, color neutrality, low reflection), need for a scalable and cost-effective deposition technology, cost effectiveness, and meeting of extensive chemical/mechanical durability requirements.

This talk is a status report on the recent progress on V-block antimicrobial thin film coating development at Şişecam. V-block is a nanometer thick inorganic coating that bears transition metal doped oxide semiconductor chemistry deposited with the atmospheric pressure chemical vapor deposition technique. This deposition method is well suited for coating complex shaped articles and accommodates high line speeds and high temperature gradients observed on the glass surface. For products with extended lifespan such as the flat glass range, it can be deposited in tandem with a suitably chosen Na+ barrier layer with optical constants and thickness tuned to minimize iridescence and visible reflections.

We will discuss the performance characteristics of V-block coating system in reference to antimicrobial test protocols, possible sources of antimicrobial activity, thin film optical properties and durability characteristics. We will conclude by highlighting the pending challenges associated with the chemical characterization of ultra-thin doped semiconductor thin films with low carrier mobility.

Keywords
thin film deposition, antimicrobial glasses, atmospheric pressure chemical vapor deposition

SUSTAINABLE GLASS MANUFACTURING

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Date	NOVEMBER 9, 2020, MONDAY
Time	11:50 – 12:10 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

ŞİŞECAM'S PRACTICES IN VALUE CHAIN FOOTPRINTING

Bahar Ubay Güçlüsoy[1], Efe Çağlayan[1], Aslı Fırat[1], Özlem Erkan[1]
[1]Şişecam, Turkey

Abstract

Urgent actions are needed to combat the climate emergency. Accelerating the transition to a net zero carbon economy is now a priority for businesses including the glass industry which is playing a significant role both in terms of CO_2 emission reduction and in delivery of several sustainable development benefits. Value chain approach to measure and report GHG emissions provides a best framework for estimating climate change related footprint of manufactured products. Beyond the achievements on measuring and reducing scope I and scope II emissions, the glass industry has been already providing solutions for tackling CO_2 emissions throughout post-consumer phase. It is already possible to quantify CO_2 reductions gained upon glass cullet recovery processes in line with the UN Clean Development Mechanism methodologies. In addition to that, the voluntary carbon standards provides a robust tool for measuring other environmental and societal benefits beyond emission reduction in link with the UN Sustainable Development Goals (SDGs).

This presentation will include a case study on recovery of glass cullet delivering quantified CO_2 emission reductions while delivering other benefits in pursuit of achieving the UN SDGs. Adopting a SDG linked impact measurement approach has the potential to help the glass recovery industry to better demonstrate its operations in line with the SDGs while driving interests of impact investors in this field.

Keywords

CO_2 emission, sustainable development goals, CDM methodologies, glass cullet

Session	SUSTAINABLE GLASS MANUFACTURING
Date	NOVEMBER 9, 2020, MONDAY
Time	12:10 – 12:30 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

HYDROGEN AS A POTENTIAL NEW SOURCE OF ENERGY COMBUSTION FOR GLASS MELTING

(Invited Speaker)

Luc Jarry[1], J. Caudal[1], Xavier P.[1]
[1]Air Liquide, France

Abstract

Clean hydrogen is one possible option to replace fossil fuels (notably NG or fuel oils) as feedstock, and significantly reduce GHG emissions. H_2 combustion could be one feasible and efficient route toward decarbonization. Several options might emerge, stand-alone or combined, with the electrical melter, co-firing with Biogas or Hydrogen, heat recovery and ultimately Carbon capture (CCS). All these energies can be combined with oxy-combustion technology for better effectiveness.

A recent Air Liquide study, based on the LCA (life cycle analysis) approach, showed that one of the most effective solutions, economically and for CO_2 reduction purposes, is the Hybrid furnace. It consists of using decarbonized electricity for one-half and for the other decarbonized H_2, associated with heat oxy combustion technology. This solution would enable up to 78% CO_2 reduction of emissions from the combustion process.

This Hybrid melting tank (electrical + H_2 oxy-firing furnace, possibly combined with Air Liquide HeatOx solution) could be the solution to upgrade air-firing furnaces in use to produce container, flat and technical glass, while addressing more stringent environmental regulation.

The presentation will disclose the results of an Air Liquide study regarding CO_2 reduction efficiencies and operating cost of glass production for H_2 combustion produced through different technologies.

Other applications for H_2 to fight climate change:
As part of its climate objectives, Air Liquide is working with its customers to develop low carbon solutions for a sustainable industry.

For example, the Group is developing innovative projects with its steel industry customers. The use of hydrogen in the blast furnace during steel production could reduce CO_2 emissions in the production process by up to 20%.

Air Liquide is also promoting the use of Hydrogen energy for clean mobility. Used with a fuel cell, hydrogen combines with the oxygen present in air to produce electricity and move cars, forklifts, trains or trucks forward. Without any emissions nor particles.

Keywords
hybrid melting, H_2 oxy-firing, HeatOX, CO_2 reduction, clean energy

Session	SUSTAINABLE GLASS MANUFACTURING
Date	NOVEMBER 9, 2020, MONDAY
Time	12:30 – 12:50 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

EMISSION REDUCTION BY OPTIMIZED COMBUSTION AND ADVANCED CONTROL TECHNOLOGY

(Invited Speaker)

Florian Stadler
UAS Messtechnik GmbH, Germany

Abstract
Increasing governmental restrictions and direct taxation for emissions pave the way to a sustainable future for next generations but represent a great challenge to all kind of energy intensive industries, like the glass industry.
Since early 2000s, UAS was focussed on these topics and engineered and modified their combustion and automation systems to provide cost and energy efficient solutions Made in Germany.

The interaction between well-engineered recording of process specific and relevant parameters with an advanced and adaptive control system enables an optimized combustion process for furnace and feeder / forehearth. Supported by additional primary and secondary solutions like oxygen enrichment, utilization of waste heat or NOx-reduction by selective catalytic reduction (SCR), clear energy savings and emissions reductions can be achieved.

UAS will present examples of optimized combustion solutions for different kind of furnaces and products and identify possible benefits regarding energy, emission reduction and process stabilization.

Furthermore, the audition will get a rough overview about state-of-the-art technologies to increase competitiveness by decreasing costs for fuel and emissions for new or already operating furnaces. Additionally, a summary of latest developments and pilot installations will give a perspective view to upcoming technologies and solutions for the future glass melting process.

Keywords
optimized combustion, energy efficiency, emission reduction, waste heat recovery

Session	SUSTAINABLE GLASS MANUFACTURING
Date	NOVEMBER 9, 2020, MONDAY
Time	12:50 – 13:10 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

ENERGY AUDITS ACROSS ŞİŞECAM

Gürhan Dural
Şişecam, Turkey

Abstract
Energy Audits Across Şişecam presentation will explain, Şişecam's energy efficiency perspective, motivation, and general principles of an efficient energy audit at glass plants.

What are the key performance indicators for audits, how energy saving potentials detected, what are the principles, who will lead the projects, which process are more important and what will be the profit end of this long term project? Aiming to answer all of these questions with real field audits experiences.

Şişecam energy audits, designed according to the energy efficiency law, actual energy audit report standard and the previous audits (2012-2014 years) experiences. Prolonged scope of energy audits were completed at Şişecam's 4 main production groups at 14 factories in 2019-2020.

Keywords
energy audits, field experiences, energy management system, renewable energy, carbon capture

Session	SUSTAINABLE GLASS MANUFACTURING
Date	NOVEMBER 9, 2020, MONDAY
Time	13:10 – 13:30 (Istanbul time, CET+02:00)
Chair	TOLGA UYSAL

THE GLASS MANUFACTURERS NET ZERO JOURNEY

(Invited Speaker)

Nick Kirk
Glass Technology Services Ltd., United Kingdom

Abstract
Glass already makes a significant contribution to building a sustainable society, for example through developing high performance glazing, light-weighting of products and most significantly, being a 100% recyclable material that meets circular economy principles. Glass manufacturers have been engaged in energy and carbon reduction for many years, with over 50% increase in energy efficiency over the past 40 years.
In order for the UK glass industry to achieve net zero glass production by 2050, the glass industry and British Glass established a decarbonisation roadmap in 2014 with the UK Government, which gained international recognition and has been replicated by many other countries. The roadmap sets out the potential opportunities for carbon reduction from recycling, energy, raw materials, process technologies, product design and other areas such as carbon capture and storage and offsetting. Much progression has been made over the past 6 years and new technologies have been developed that were not included in the original roadmap such as hydrogen combustion. This presentation will provide an update on what had been achieved and more importantly want needs to be achieved over the next 30 years for the glass industry to become a net zero manufacturing sector and continue to develop products that reduce society's carbon emissions.

Keywords
carbon reduction, carbon emissions, energy efficiency, emission reduction

OPERATIONAL EXCELLENCE

ŞİŞECAM

35th GLASS SYMPOSIUM

Glass in the Sustainable Future:

THE PANDEMIC and NEW ECOSYSTEM

November 9, 2020, Online

Session	OPERATIONAL EXCELLENCE
Date	NOVEMBER 9, 2020, MONDAY
Time	14:30 – 14:50 (Istanbul time, CET+02:00)
Chair	HALUK ERDEM

AUTOMATED QUALITY CONTROL OF GLASS PRODUCTION WITH ARTIFICIAL INTELLIGENCE

(Invited Speaker)

Ali Bahramisharif
Machine2Learn, Netherlands

Abstract

Anomaly detection is of pivotal importance in many industries. But once there is a tool that can spot anomalies, what can be done with it? It can certainly help with taking actions to cope with the detected anomalies, but is it possible to do more?

There are some business processes where it is possible to go beyond coping with the detected anomalies: intervene in the process to prevent anomalies. Glass manufacturing is one of them. Once a link between sensor measurements and the anomalies is identified, anomalies occurrence can be controlled by controlling the linked measures.

Since an anomaly detection model can be based on many sources of measures, it is not feasible to use a trial and error approach to find the core sources driving the anomalies occurrence. Luckily, AI can support this quest: it is possible to determine what measures are the ones that have the most impact on the type of anomaly, and the nature of the impact.

Machine2Learn has applied this methodology on data from glass manufacturing and using historical data has shown to correctly identify about 16% of the anomalies that can explain the occurrence of blisters and bubbles in the final production 24 hours in advance. Root cause analysis has been applied to determine the underlying causes of the anomalies. The results allow for defining measures to prevent the anomalies.

Keywords
anomaly detection, defining measures, prevent anomalies

Session	OPERATIONAL EXCELLENCE
Date	NOVEMBER 9, 2020, MONDAY
Time	14:50 – 15:10 (Istanbul time, CET+02:00)
Chair	HALUK ERDEM

LEAN SIX SIGMA APPROACHES ON GLASS PROCESSES

Ayhan Aydemir
Şişecam, Turkey

Abstract

Dynamic market conditions of glass products force the producers to create flexible working style to optimize the critical components of industrial companies such as; cost, yield, capacity, quality, stock etc. Chronic problems, improvement opportunities, cost reduction potentials are the main fields of production teams to focus and make a difference to support the main strategies.

Most of the daily problems can be solved with experience or trial and error method. Relations between two variables can be determined by simple tools such as scatterplot, correlation, time series etc. But if we struggle with an issue that formed by three or more factors; moreover, if there are second, third, fourth degree interactions, it is impossible to find any effective relation with traditional approaches.

Lean techniques can demolish the seven wastes (transportation, inventory, motion, waiting, overprocessing, overproduction, defects) and create value added performance rises especially for offline processes. And six sigma techniques can present high resolution pictures for any complicated issue which includes too many factors with interactions. Both factors and outputs can be parametric and/or non-parametric. Although we need to design experiment on the process to get active data for some issues, we can also use passive data for most problems on continuous processes.

This presentation summarizes some of the projects which were managed with Lean-Six Sigma Principles in ŞİŞECAM-Flat Glass. Float glass lines, patterned glass lines, mirror lines and processed glass lines were the locations of the projects. All issues had been tried to optimized with traditional methods in the past but permanent and effective improvements were succeeded with Lean-Six Sigma techniques.

Keywords
Lean, six sigma, flat glass

Session	OPERATIONAL EXCELLENCE
Date	NOVEMBER 9, 2020, MONDAY
Time	15:10 – 15:30 (Istanbul time, CET+02:00)
Chair	HALUK ERDEM

ANADOLU CAM ESKİŞEHİR PLANT SMARTWAREHOUSE PROJECT

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Abstract
SmartWarehouse is the autonomous execution of the logistics movements of packaging material and finish goods warehouse management by unmanned vehicles called LGV (Laser Guided Vehicle). The purpose of the effectuation of this project is to reduce labor costs, shorten the access time to the required packaging material and finished goods by organizing the warehouse layout, thus increasing customer satisfaction by sending the correct product to the customer on time.

The Smart Warehouse Project was carried out in 4 steps with the 4-month "Functional Design" phase under the leadership of the Technical Directorate, Supply Chain Management, Quality Management and IT Team, and arrangements were planned for the optimum integration of all processes at this step. Subsequently, testing and implementation steps were followed.

The Smart Warehouse is followed through the online system program where all processes can be monitored until the shipment is made from printing RFID barcode labels on the finished products within the production zone. With the system program that is reported daily, all kinds of performance indicators can be monitored, parcels and selective racks can be used at the optimum level and a shipment plan can be made.

With the SmartWarehouse Project implemented in Anadolu Cam Eskisehir Plant, the traceability is increased by stocking the finished products on material and lot-based; In this way, shipping times are minimized and the possibility of shipping the wrong product to the customer is eliminated. In occupational safety, maximum advantage is provided, human resources are minimized and disruptions caused by negativities in industrial relations are prevented. Since the packaging material stocks can be monitored instantly, overstock or lack of stock is prevented and costs are reduced within the scope of Operational Excellence.
Within the scope of the SmartWarehouse, it is aimed to install an Automatic Pallet Packaging Control Camera in Anadolu Cam Eskişehir Plant in the next step in order to eliminate the secondary operations of bad packaging and at the same time to start the project of loading the automatic delivery vehicle.
It is aimed to spread the project in order to follow and consistently improve performance indicators of Şişecam Plants.

Keywords
LGV, optimization, operational excellence, functional design

Session	OPERATIONAL EXCELLENCE
Date	NOVEMBER 9, 2020, MONDAY
Time	15:30 – 15:50 (Istanbul time, CET+02:00)
Chair	HALUK ERDEM

4 INDIVIDUAL SECTION MACHINE FOR 3400 MM METAL LINE

Ege Artun[1], İsmail Bozoluk[1]
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Abstract
Machines known as Individual Section (IS) machines, which are used for the production of bottles in Glass Packaging Groups and for the production of products such as jar, pitcher, bowl, salt shaker in Tableware Groups, are procured from foreign manufacturers. The metal line required for the installation of these machines on the production line must be a minimum of 5.9 meters by machine design. Metal line is 3.4 meters in the Tableware Groups. For this reason, there is a preliminary requirement for the installation of such machines as a special infrastructural, mechanical, electrical and building construction structure, even foreheart replacement is required and it is technically not possible to install on every line in its current state. Due to the requirement of a 3.4 meter metal line, the need to lower the existing production line layout 2.5 meters from the ground causes high costs for line installation.

Due to the increase of competitive conditions in the world economy, in order to gain advantage in market conditions and to increase production capabilities within the scope of the efforts to reduce costs, a new compact machine with 4 sections that can work on each line of tableware group, adaptable to the existing 3,4 meter metal line, is needed.

In this study, it is aimed to make and realize the new design required to ensure that the IS machine, which has to be positioned on a minimum of 5.9 meters of metal line as a standard, operates on a standard 3.4 meters metal line in the tableware group.

With the own resources and the engineering and production skills of Sisecam Tableware Group, a new machine with mechanical, electrical and software capabilities was designed and implemented. In this way, dependence on foreign machinery manufacturers has been eliminated. The capacity and production planning flexibility has been provided since the new designed machine has the possibility to be installed on any line in the Tableware Group of Sisecam. Customer demands that require a short deadline can be met. In Eskisehir Plant of Tableware Group A0 line, 13 different molds with 17 campaigns and up to 1000 gr gob weight were mass produced in a total of 3.5 months working period.

Keywords
individual section, metal line, reducing installation costs

Session	OPERATIONAL EXCELLENCE
Date	NOVEMBER 9, 2020, MONDAY
Time	15:50 – 16:10 (Istanbul time, CET+02:00)
Chair	HALUK ERDEM

ENERGY MONITORING SYSTEM – ENIS

Levent Kılıç
Şişecam, Turkey

Abstract
Energy efficiency has assumed a critical role in our pursuit of sustainable development. The gains from energy efficiency have been harnessed the plants over without exception. Information from the industrial plants and other establishments reveal the rapid strides made in the area of energy efficiency in Sisecam. Examples of industrial practices which have achieved this potential are projected in the energy conversation award programme of Sisecam.

As the low hanging fruits appear to have been picked up the path to success in energy management is getting steeper and steeper. More and more information, innovations and knowledge are required to further exploit the energy conservation potential. The continuous efforts to upgrade and refine the energy monitoring system for Energy Managers and Energy Auditors are aimed at equipping the energy reader with the resources to identify and implement various energy conversation measures. Through the system of examination we have been able to build sufficient skilled manpower in the area of energy efficiency. We are pleasant by the enormous installation of system for all corners.

Keywords
energy efficiency, monitoring, industrial plant

Session	OPERATIONAL EXCELLENCE
Date	NOVEMBER 9, 2020, MONDAY
Time	16:10 – 16:30 (Istanbul time, CET+02:00)
Chair	HALUK ERDEM

SIMULATION-DRIVEN DESIGN ON GLASS CONTAINER

Gökhan Toraman[1], Alp Aruca[1]
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Abstract
Computer aided analysis (simulation) is one of the most important tool for the companies in digital age. Conventionally, simulation is the final step in product development. Engineers or designers use simulations to validate designs after they are nearly finished. Validation may point out many problems and open a way for creating revisions.

Design teams do not have to wait until they have completed a design for feedback and validation with Simulation-Driven Design concept. They analyze the glass packaging designs, quickly enabling them to assess how the design parameters affect the functions like internal pressure, vertical load or impact strength. After then, designers immediately redraw the design to achieve customer specifications and also this process enable them to optimize their designs. In addition, new and untried design alternatives could find their ways through the reality in terms of analysis. So, simulation-driven design process dramatically accelerate design cycles and avoid extra prototayping and testing.

Keywords
analysis, design 4.0, active revising, digital age, simulation-driven design

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