

Synopsis- 15th AIGMF International Conference on AI and Digitalisation -the future for Sustainable Glassmaking

(Sept 11, 2025)

at

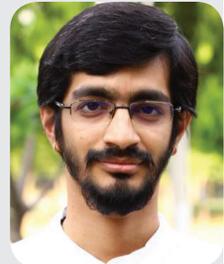
 GLASS PRODUCTION TECHNOLOGIES & PROCESSES INDIA

 FLAT GLASS PROCESSING, PRODUCTS & ACCESSORIES INDIA
 10-12 SEPTEMBER 2025
 Bombay Exhibition Centre

Revolutionizing Glass Development through AI and Large Language Models: from Laboratory to Industry

Professor N. M. Anoop Krishnan has made outstanding contributions to the field of glasses through multidisciplinary approaches spanning computational materials science, artificial intelligence, and experimental collaborations. He is an Associate Professor in the Department of Civil Engineering, IIT Delhi with a joint appointment in the Yardi School of Artificial Intelligence.

Prof. N M Anoop Krishnan
 Department of Civil Engineering and
 Yardi School of AI (joint appointment)
 INDIAN INSTITUTE OF TECHNOLOGY DELHI India
 krishnan@iitd.ac.in



He has published more than 140 international peer-reviewed journal publications and has 2 granted patents. He has developed a first-of-its-kind package for glass design and discovery, named, python or glass genomics (PyGGi). The package has more than 400 registered users and the commercial version has been sold to several glass companies across the world. He has founded a start-up Substantial AI vt. Ltd., incubated at IIT Delhi, for AI-driven glass discovery and process optimisation. He has received prestigious recognitions including Humboldt Fellowship (2023) for experienced researchers, Google research scholar award (2023), W. A. Weyl International Glass Science Award by ICG and Penn State University (2022), Indian National Academy of Engineering Young Engineer Award (INAE YAE 2020), BRNS-DAE Young Scientist Award (2021), National Academy of Science India Young Scientist Award (NASI YSA 2021), and Indian Academy of Sciences Associateship (2022).

His contributions to education and the research community are evident through his mentorship of Ph.D. students, the first of whom has gone to become a faculty member at IIT Indore. His balanced integration of fundamental science, computational innovation, and practical applications exemplifies the interdisciplinary spirit central to advancing glass science.

The Indian glass industry, valued at approximately \$8.6 billion (₹70,000+ crores) in 2024 and projected to grow at over 7% annually, stands at the threshold of a technological revolution. As manufacturers grapple with evolving consumer demands for specialized properties—from scratch-resistant smart phone screens to energy-efficient architectural glass—artificial intelligence (AI) and large language models (LLMs) are emerging as game-changing tools to accelerate glass discovery and optimize manufacturing processes.

THE CHALLENGE: FROM YEARS TO MINUTES

Traditional glass development relies on the centuries-old “trial-and-error” approach, where discovering new compositions can

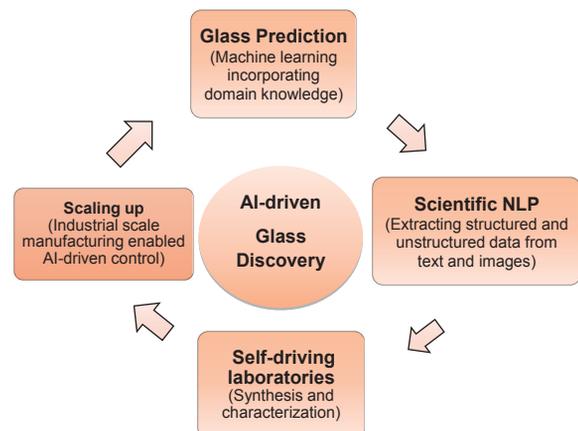


Figure 1: The cyclic process of AI based glass discovery

take 10-20 years. In today's fast-paced market, this timeline is unsustainable. Artificial intelligence and machine learning approaches to materials design can accelerate the discovery of new glasses in an economical fashion, offering the promise of reducing development cycles from years to months or even days.

Our research at IIT Delhi demonstrates how AI can transform glass science and research through a systematic four-step cyclic process (Figure 1). This comprehensive framework begins with data curation, where scientific natural language processing extracts information from literature to create large-scale databases. The second step involves exploiting this information through machine learning models combined with optimization to predict new materials and decode intricate patterns for tailored glass discovery. The third step focuses on actualization through high-throughput experiments using robotics and AI automation. The fourth critical step is scaling up, where successful laboratory discoveries are translated to industrial manufacturing processes, completing the cycle and feeding back into the data curation phase for continuous improvement. Data-driven approaches such as machine learning have gained a lot of interest in the recent past and can prove key to predict structure and composition of materials for tailored applications.

PYGGI: DEMOCRATIZING GLASS DISCOVERY

Our efforts toward AI-driven glass discovery have resulted in a first-of-its-kind package, namely, Python for Glass Genomics (PyGGi). PyGGi is a software package for predicting and optimizing the properties of inorganic glasses, trained on over 300,000 glass compositions encompassing more than 180 compounds and 25 different properties. This pioneering platform, commercialized through our start-up Substantial AI, embodies the complete four-step AI-based glass discovery cycle illustrated in Figure 1.

PyGGi Bank represents the data curation pillar, providing access to extensive glass property databases and allowing manufacturers to explore existing knowledge systematically. PyGGi Seer exemplifies the machine learning prediction phase, predicting properties like density, elastic moduli, and glass transition temperature from composition alone. PyGGi Zen demonstrates the optimization component for actualization, discovering compositions to meet specific property targets. The platform's industrial adoption represents the scaling up phase, enabling engineers to design glasses with precise characteristics for applications ranging from optical components to protective screens at commercial scale.

The software has already demonstrated remarkable success. PyGGi will allow researchers and companies to easily predict glasses with superior properties like scratch resistance and crack resistance at the tap of a button. Indian glass manufacturers can now access these capabilities through both desktop applications and cloud-based platforms, making advanced AI tools accessible to companies of all sizes.

LARGE LANGUAGE MODELS: THE NEXT FRONTIER

Beyond traditional machine learning, our recent work on large language models specifically trained for materials science represents the advanced data curation phase of the four-step AI discovery cycle (Figure 1). MatSciBERT, trained on a large corpus of peer-reviewed materials science publications, was the world's first materials-aware language model. We also present LLaMat, a family of foundational models for materials science developed through training on an extensive corpus of materials literature and crystallographic data.

These models can automatically extract information from scientific literature, identify patterns in vast databases, and even suggest novel glass compositions based on textual descriptions of desired properties. For glass researchers, this represents the data curation pillar of Figure 1 in action—accessing decades of global research knowledge instantaneously and systematically, enabling the complete four-step AI-driven discovery cycle that includes scaling up to industrial applications.

LEARNING FROM CEMENT: INDUSTRIAL-SCALE SUCCESS

Our recent breakthrough in cement manufacturing provides a roadmap for implementing the fourth step AI discovery cycle (Figure 1) in glass industries. Using a comprehensive two-year industrial dataset, we develop machine learning models that outperform conventional Bogue equations with mean absolute percentage errors of 1.24%, 6.77%, and 2.53% for alite, belite, and ferrite prediction respectively. X-ray-based clinker checks can take up to four hours, while our AI models deliver predictions in just 1/100 of a second—making quality control a million times faster.

This work demonstrates all four phases of Figure 1: data curation from industrial datasets, machine learning model development for prediction, actualization through real-time quality control, and successful scaling up to full industrial deployment. Similar approaches can revolutionize glass manufacturing by enabling real-time quality control, optimizing furnace operations, and predicting product properties during production rather than after cooling. Indian glass plants can implement these systems to reduce waste, improve consistency, and accelerate product development cycles, completing the full four-step AI discovery cycle from data to industrial deployment.

IMPACT ON INDIAN GLASS INDUSTRY

For Indian glass manufacturers, AI adoption offers several immediate benefits. Cost reduction becomes possible by minimizing expensive trial-and-error experimentation through predicting successful compositions computationally before physical testing. Quality enhancement can be achieved by implementing real-time quality control systems that ensure consistent product properties and reduce rejection rates. Innovation acceleration allows manufacturers to discover novel compositions for emerging applications like flexible displays, smart windows, and advanced optical components. Finally, competitive advantage can be gained by accessing global knowledge and accelerating R&D to compete with international glass giants.

THE PATH FORWARD

The integration of AI and LLMs in glass development represents more than technological advancement—it's an opportunity for Indian glass industry to lead global innovation. With initiatives like PyGGi making these tools accessible and ongoing research developing more sophisticated capabilities, manufacturers can transform their approach to glass development from reactive to predictive.

As we move toward Industry 4.0, the companies that embrace AI-driven materials discovery will define the future of glass technology. The question is not whether AI will transform glass manufacturing, but how quickly Indian industries will adopt these revolutionary tools to maintain their competitive edge in the global market.

REFERENCES

1. <https://pyggi.substantial.ai/>
2. <https://ceramics.org/ceramic-tech-today/deep-learning-provides-deep-help-researchers-develop-publicly-available-software-for-rational-design-of-oxide-glasses/>
3. https://ceramics.org/wp-content/bulletin/2024/articles/F-Sachan_aug24.pdf
4. Zinke, L. Clinker phase prediction. Nat. Rev. Clean Technol. 1, 379 (2025). <https://doi.org/10.1038/s44359-025-00077-7>

Cruise Control for Glass Furnaces: Automated Furnace Control and Batch Monitoring Systems

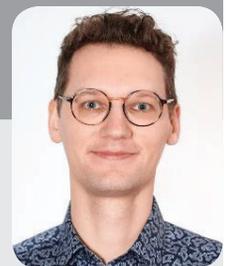
Dr. Malte Sander studied materials engineering at the RWTH Aachen University in Germany, focusing on glass and process engineering. After investigating the batch-to-melt conversion in his master's thesis in 2017, Dr. Sander started a position as a doctoral candidate at the Chair of Glass and Glass-Ceramics in Aachen, Germany.

During his time at the chair, Dr. Sander investigated the effects of electric fields on the crystallization behavior of glass-ceramics and developed glasses for industrial applications. In 2023, Dr. Sander defended his doctoral thesis entitled "Structure and properties of thermally poled lithium aluminosilicate glasses and glass-ceramics".

At the same time, Dr. Sander 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.

Besides his work for Glass Service, Dr. Sander is Vice-Chairman of the technical committee "Glass melting technology" of the German Society of Glass. In May 2024, the German Society of Glass honoured him with the "Adolf-Dietzel Industry Price" for his valuable and ongoing contribution to the glass society.

Dr. Malte Sander
 Consultant and Sales
 GLASS SERVICE Czech Republic
malte.sander@glass-service.eu



Furnaces are the heart of each glass factory, operating continuously to keep production running 24/7. At temperatures around 1500°C, raw materials are transformed into a viscous melt. The energy required for this chemical transformation and heating is typically provided by fossil fuels like natural gas, oil, and sometimes pet coke. Additionally, electric power supplied via electrodes directly into the melt can accelerate the melting process and reduce energy consumption.

Depending on production planning, availability of cullet, and energy supply and costs, furnace operators must control the energy input to ensure stable furnace temperatures. However, the slow response times of the melter to changes in energy input challenge operators to find efficient melting conditions.

Glass Service offers a model-based predictive control software, “Expert System III,” to the glass industry to automate furnace control and address these slow response times. The software analyzes past and current production data to determine the optimal energy settings for stabilizing melting temperatures. By stabilizing the melting temperatures, the software helps reduce wasteful energy usage and lower energy costs.

Additional information about the glass level, waste gas composition, or batch coverage from our AI batch monitoring system can be integrated into the Expert System III furnace control. This integration further enhances the control behavior, optimizing furnace operations and improving the overall efficiency.

Glass melting is an energy intensive process which needs constant supervision of furnace operators for a flawless production. Glass Service provides different solutions to the glass industry to improve furnace control and monitoring. The software Expert System III uses a model-based predictive control approach to control different aspects of a glass furnace, like temperature, glass level, and combustion. The improved control reduces the energy consumption and can increase the pack to melt. Until 2025, Glass Service has installed Expert System III more than 400 times on all types of glass furnaces (regenerative fired, oxy-fuel, hybrid, all-electric).

Besides furnace control Glass Service is specialized in furnace monitoring. The proprietary near infrared camera coupled with an AI Batch Monitoring System helps to understand the batch movement on top of the glass melt. The integration of batch information into the Expert System III can help to further improve the melting process. For all-electric furnaces Glass Service provides a batch thickness measurement system to monitor the batch coverage.

Driving Efficiency in the Smart Plant

Mr. Michael Toelle has many years of experience in machinery and plant engineering and passion for driving customer success.

With a strong focus on building long-term relationships and understanding customer needs, Mr. Toelle together with his team enhances strategies and further elevate the level of services for the Glass industries worldwide.

Michael Toelle

Director Sales

HEYE INTERNATIONAL GmbH Germany

MToelle@heye-international.com



Glass plants are under unprecedented pressure to cut energy, curb CO₂ and bridge an ever-widening skills gap, all while increasing output and preserving glass quality.

The Heye Smart Plant concept brings proven Industry 4.0 ideas together to make this possible. Highly automated, it safeguards first-class quality at low unit cost through three interlocking pillars:

- Smart Data – integrated production and quality data
- Smart Machine Controls – intuitive user interfaces, e-timing and servo technology
- Smart Process Intelligence - closed-loop control for the forming process and lightweight containers

Advanced Digitalization in Inspection for Predictive Defect Detection

Mr. Altay Capanoglu is the Export Manager since 2021 at IRIS Inspection Machines, well experienced at all working environments after a career in manufacturers (mechanics, medical and industrial gas, energy).

Altay Capanoglu

Middle East, Africa, Central Asia and

India Sales Manager

IRIS INSPECTION MACHINES France

acapanoglu@iris-im.fr



Wherever you look at, "Artificial Intelligence" is an overriding theme, in our daily life and of course in the industry.

But what are the main benefits of AI, for real needs of glassmakers? IRIS intelligent solutions connect each of the individual players within a value creation network.

IRIS aims at improving quality and productivity and meanwhile reducing carbon footprint and human skills dependence. IRIS pioneering use of AI technology is bringing lower costs and higher satisfaction to glassmakers around the world.

Furthermore, IRIS now offers an AI-based innovation called iBot®. iBot® does not simply monitor and manage the optimization of settings but goes beyond this, by integrating the prediction of process defects.

Reducing Glassmaking Emissions: A Gateway to the Digital Future of Process Control Technology



Mr. Magdi El-Awdan holds the position of Senior Manager – Glass & Solar at Siemens AG, Germany with 25+ years of experience, and is recognized for his leadership in automation, digitalization, and quality control processes across solar, glass, and semiconductor manufacturing environments.

Magdi El-Awdan
Senior Manager Glass & Solar
SIEMENS Germany
magdi.el-awdan@siemens.com

He oversees business development, solution innovation, and customer engagement for automation and monitoring systems that support critical infrastructure in industrial plants.

His contributions span integration of advanced digital solutions, such as digital twins, and Industrial IoT Solutions, and has spearheaded collaborations to digitally transform industrial production, enhance quality control, and minimize downtime.

Siemens will showcase its cutting-edge solutions aimed at transforming the glass industry through:

Sustainability Initiatives

- Adoption of green and clean energy
- Integration of Carbon Capture
- Promotion of cullet recycling to reduce raw material usage

Digital Transformation

- End-to-end digitalization of glassmaking processes
- Advanced process optimization for energy and resource efficiency
- Waste heat recovery technologies to minimize energy loss

Operational Excellence

- Enhanced equipment and facility efficiency
- Improved lifecycle productivity
- Development of future-ready plants aligned with evolving industry standards

AI for Mirror and Container Glass

Er. Pulkit Gaur is the Chief Technology Officer of Gridbots Technologies and drives the companies Innovation and Technological advancements. An Engineer by education and the founder of Gridbots Technologies - Robotics is his passion. He has been building robots since his childhood.

Er. Pulkit Gaur
Chief Technology Officer
GRIDBOTS TECHNOLOGIES PVT. LTD. India
contact@gridbots.com



Er. Gaur and Gridbots Technologies have won a number of awards and accolades from many Indian and International agencies. Gridbots was awarded India's hottest start-ups award. Er. Gaur has received TED Fellowship – MIT Young Innovator Award and Rajiv Motwani Circle Fellowship for his technological innovations. Gridbots is a winner of NASSCOM Innovation Awards – 2011 under most promising technologies. In 2015, Siemens steering committee (Comprising of Nobel Laureates) invited Er. Gaur to provide inputs on their future policy on robotics. In 2017, PM Narendra Modi invited Er. Gaur for their flagship program “Champions of Change” for providing inputs of policy matters.

*In 2023, Er. Gaur won the AIGMF's prestigious annual **CK Somany Award for Innovation and Technology** for having designed and developed non-contact pattern glass thickness measurement sensors which can sample glass for thickness 100 times a second and measure it with an accuracy of 50 Microns.*

Er. Pulkit Gaur will be sharing the use of AI and modern technologies for the inspection of glass and mirrors.

He will also share how this technology is changing and evolving and is able to find defect which are impossible to find with traditional approaches.

And how through the use of advanced mathematical models and fast computers has enabled the glass companies to address challenges and reduce wastages.

AI-Driven Optimization of Glass Production: Overcoming Industry Challenges with Celfos

Dr. Oscar Verheijen received his master's degree in Chemical Engineering at the Eindhoven University of Technology in the Netherlands in 1995. Following this, he started as a Glass Technologist at the Dutch Research Institute TNO.

Dr. Oscar Verheijen
Commercial Director
CELSIAN GLASS & SOLAR BV Netherlands
oscar.verheijen@celsian.com



In 2003, Dr. Oscar finalized his Ph.D. study entitled ‘Thermal and chemical behaviour of glass-forming batches’. After being active for 12 years in the field of glass melting technology, glass tank modeling, and process control, Dr. Oscar became responsible within TNO for the business development of sustainable technologies with an emphasis on thin-film solar technologies. In September 2013, Dr. Oscar joined CelSian. Currently, Dr. Oscar is the Commercial Director of CelSian and Chairman of GlassTrend, the global platform of pre-competitive R&D and knowledge exchange. Dr. Oscar's key activities are dedicated to smart sustainable glass manufacturing.

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 behaviour 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 ■



The All India Glass Manufacturers' Federation
in partnership with:



presents:

15th AIGMF International conference on

AI and Digitalisation - the future for sustainable glassmaking

(Sept 11, 2025)

at Bombay Exhibition Centre, Mumbai INDIA

TIME (hrs.)	TOPIC/s	ORGANIZATION	SPEAKER
0930	Registration / Tea / Coffee Unveiling of the Touring Exhibition - 'Glass or Class' <i>Featuring award-winning artwork, poetry, photography and essays by young participants (2018–2025) showcasing the role of glass in our daily life</i>		
1015	Keynote Address on Artificial Intelligence <i>by Mr. Rajesh Khosla</i> President AIGMF and CEO/President AGI Greenpac Introduction of Speakers and need for Digitalisation <i>by Mr. Dave Fordham</i> Global Engagement Lead, Glass Futures, United Kingdom; Member Editorial Board of AIGMF's quarterly journal 'KANCH' (Glass) and Former Publisher of Glass Worldwide magazine, UK		
1030	Release of Book- Excellence in Container Glass Manufacturing <i>written by Er. Ashoka Rao Manikala</i> Former President Operations PGP Glass and AGI Greenpac; and Member Editorial Board of AIGMF's quarterly journal 'KANCH' (Glass) Launch of Calendar Glass Bottle 2026		
1040	Revolutionizing Glass Development through AI and large Language Models: <i>from laboratory to industry</i>	INDIAN INSTITUTE OF TECHNOLOGY DELHI INDIA	Prof. N M Anoop Krishnan Department of Civil Engineering and Yardi School of AI (<i>joint appointment</i>)
1100	Cruise Control for Glass Furnaces: <i>automated furnace control and batch monitoring systems</i>	GLASS SERVICE CZECH REPUBLIC	Dr. Malte Sander Consultant and Sales
1120	Driving Efficiency in the Smart Plant	HEYE INTERNATIONAL GmbH GERMANY	Mr. Michael Toelle Director Sales
1140	Advanced Digitalization in Inspection for Predictive Defect Detection	IRIS INSPECTION MACHINES FRANCE	Mr. Altay Capanoglu Middle East, Africa, Central Asia and India Sales Manager
1200	Reducing Glassmaking Emissions: <i>a gateway to the digital future of process control technology</i>	SIEMENS GERMANY / INDIA	Mr. Magdi El-Awdan Senior Manager Glass & Solar

1220	AI for Mirror and Container Glass <i>(with live display of Robots)</i>	GRIDBOTS TECHNOLOGIES PVT. LTD. INDIA	Er. Pulkit Gaur Chief Technology Officer
1240	AI-Driven Optimization of Glass Production: overcoming industry challenges with Celfos	CELSIAN GLASS & SOLAR BV NETHERLANDS	Dr. Oscar Verheijen Commercial Director
1300	Discussions / Q&A: <ul style="list-style-type: none"> - Prof. N M Anoop Krishnan Dept. of Civil Engineering and Yardi School of AI <i>(joint appointment)</i> IIT Delhi - Mr. Manoj Mahato Senior Technical Architect and AIGMF Webmaster - Mr. Dave Fordham Global Engagement Lead, Glass Futures, UK; Member Editorial Board of AIGMF's quarterly journal 'KANCH' (<i>Glass</i>) and Former Publisher of Glass Worldwide magazine, UK - Mr. Pulkit Gaur Chief Technology Officer, Gridbots Technologies Pvt. Ltd. - Mr. Tariq Kachwala Director, FG Glass and Executive Committee Member Federation of Safety Glass (FOSG) - Prof. A S Rao Vice Chancellor, Vikrama Simhapuri University, Nellore- Andhra Pradesh and Member Editorial Board of AIGMF's quarterly journal 'KANCH' (<i>Glass</i>) - Mr. Gohul Deepak Executive Director, Glazing Society of India (GSI) - Mr. Vinit Kapur Secretary, The All India Glass Manufacturers' Federation (AIGMF) - Dr. Indrajit Tah Scientist (<i>Specialty Glass Division</i>), CSIR-Central Glass & Ceramic Research Institute (CGCRI) - Dr. M. Jayasimhadri Associate Dean, School of Integrated Learning and Research (SILR), Delhi Technological University 		
1315	Wrap-up <i>by Mr. Purvish Shah</i> Hon. General Secretary AIGMF and Director in Gopal Glass Works Ltd., and Gobind Glass and Industries Ltd.		
1320	Presentation on glasstec 2026 <i>by Mr. Lars Wismer</i> Director of glasstec and A+A at Messe Düsseldorf		
1335	Vote of Thanks <i>by Mr. Pawan Shukla</i> Hon. Treasurer AIGMF; and President and Managing Director, Schott Glass India Pvt. Ltd. Group Photo and Networking Lunch		

PARTICIPATION: FREE OF CHARGE

However, those requiring a Kit Bag, Glass Memento and Lunch may register under the following:

Delegate Type	Fee (INR)
Main Delegate	5,000
Additional Delegate/s (per member)	2,500

Cheque payable to 'The All India Glass Manufacturers' Federation', at New Delhi may be sent to Secretary AIGMF, 812 New Delhi House, 27 Barakhamba Road, New Delhi – 110 001 INDIA

or Make an online payment at:

Account No. : 0411156983
 Bank : Kotak Mahindra Bank
 Name : The All India Glass Manufacturers' Federation
 Bank Branch : G-11 Marina Arcade, Connaught Circus, New Delhi-110 001
 IFSC Code : KKBK0000214
 Swift Code : KKBKINBB

Pre-REGISTRATION at info@aigmf.com in the following format:

S. No.	Company / Organization	Participant/s (Name, Designation, Address, Tel, E-mail)
--------	------------------------	---

**Order
Your copy now**

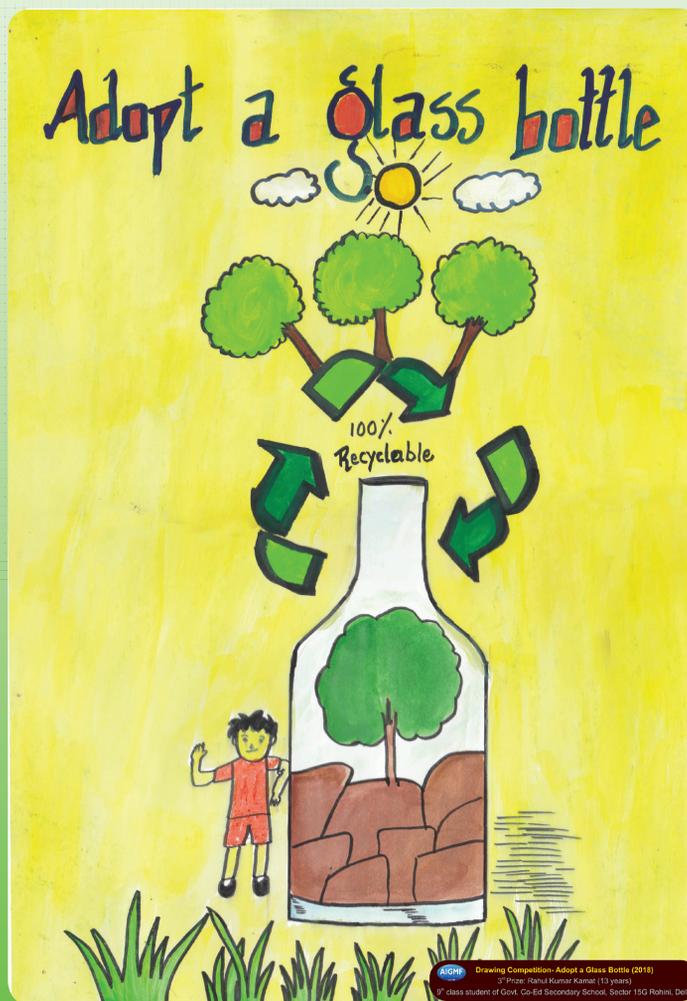
Contents

1.	Introduction to Container Glass Manufacturing	1
2.	Container Glass Batching	19
3.	Furnace Design, Operations and Maintenance	47
4.	Glass Conditioning and Colouring Forehearth (CFH)	103
5.	Container Glass Forming	139
6.	Glass Surface Treatments	175
7.	Glass Annealing and Stress Testing	199
8.	Container Glass Inspection & Quality	213
9.	Container Glass Packaging, Storage & Transport	239
10.	Engineering Equipments & Maintenance	247
11.	Container Glass Bottle Mould Design & Mould Maintenance	259
12.	SHE (Safety, Health and Environment) in Container Glass Manufacturing	283
13.	Energy Conservation in Container Glass Manufacturing	303
14.	Operation Excellence in Container Glass Manufacturing	361
15.	Quality Requirements of Bottles for Specific Segments	375

Excellence in Container Glass Manufacturing

An **AIGMF** Publication
www.aigmf.com

Written By **Er. Ashoka Rao Manikala**
(Former President Operations PGP Glass and AGI Greenpac)



Technical Articles

Price: INR 1000 (within India and including postage)
Overseas: US\$ 75 (including postage and bank charges)

Pay via bank transfer:

Account No. : 0411156983
Name : The All India Glass Manufacturers' Federation
A/c Type : Savings Account
Bank : Kotak Mahindra Bank
Branch : G-11 Marina Arcade, Connaught Circus, New Delhi-110 001
IFSC Code : KKBK0000214
SWIFT Code : KKBKINBB

AIGMF SIGNS MOU WITH BEE, MINISTRY OF POWER ON REDUCING CARBON EMISSIONS

The Assistance in Deploying Energy Efficient Technologies in Industries & Establishment (ADEETIE) scheme is initiated by the Ministry of Power, supported by the Bureau of Energy Efficiency (BEE).

The objective is to facilitate MSMEs to upgrade with energy efficient technologies/ measures through financial instruments and handholding them in carrying out investment grade energy audit, detail project report, monitoring and verification of the implementation. The scheme provides a 5%

(Small – Micro) and 3% (medium) interest subvention on loans for technology adoption.

On July 15, 2025 at the launch event in the august presence of Hon. Minister of Power Mr. Manohar Lal Khattar, AIGMF signed an MoU with

BEE on reducing energy consumption and carbon emissions, aligning with India’s commitment to sustainable development and energy efficiency covering Glass clusters in Ambala, Chirkunda, East & West Godawari, Firozabad and Jaipur.



15 जुलाई 2025 को माननीय ऊर्जा मंत्री श्री मनोहर लाल खट्टर की गरिमामयी उपस्थिति में लॉन्च कार्यक्रम में एआईजीएमएफ ने ऊर्जा खपत और कार्बन उत्सर्जन को कम करने के लिए बीईई के साथ एक समझौता ज्ञापन पर हस्ताक्षर किए, जो भारत की सतत विकास और ऊर्जा दक्षता के प्रति प्रतिबद्धता के साथ मेल खाता है, जिसमें अंबाला, चिरकुंडा, पूर्व और पश्चिम गोदावरी फिरोज़ाबाद और जयपुर के पाँच क्लस्टर सम्मिलित हैं।



Welcomes its New Members

Company	Products / Services
<p>CALDERYS INDIA REFRACTORIES LIMITED Ms. Amisha Karemore / Mr. Prateek Pandey 6th Floor, Fidvi Tower, Opp Saraf Chambers Mount Road, Sadar, Nagpur- 440 001 MAHARASHTRA Tel: +91 90966 36488, +91 90289 54620 E: amisha.karemore@calderys.com, prateek.pandey@calderys.com</p>	<p>Refractory services, material selection and project management for Glass manufacturing units</p>
<p>SUBAAN LIME PVT. LTD. Dr. H.R. Dandi Unit No.17, 8th Floor, Tower-2, AIPL Business Club, Golf Course Extension Road, Sector-62, Gurugram HARYANA Tel: +91 124-4140233, +91 96190 00770 E: drhrd@drlime.in</p>	<p>Ultra-low iron, high grade limestone granule and powder</p>

Youth and Glass Industry Awards presented

(August 30, 2025 DELHI)

At the Annual General Meeting of The All India Glass Manufacturers' Federation, Youth and Industry Members were felicitated at Pride Plaza Aerocity Hotel, DELHI on August 30, 2025.

The program was organized to honour Youth of the country who participated from India-wide schools and colleges in the annual contest



Glass mementos being handed over to the achievers in the morning assembly on Aug 30 at Sant Nandlal Smriti Vidya Mandir, Ghatsila JHARKHAND



on 'Glass is Pure' or कांच जीवन है coinciding with the International Youth Day on August 12, 2025. Online entries were invited from the age group between 7-24 years where hundreds of entries were received from educational institutes and youth across India.



Chairman of Mascot Engineering Company, Mr. Mohan Lalvani (second from the right) receiving the Life Achievement Award from AIGMF Office Bearers

The Jury comprised of Mr. Gurmeet Singh, Chairman, Federation of Safety Glass (FOSG) and Managing Director, Gurind India (P) Ltd.; Mr. G N Gohul Deepak, Executive Director,

Glazing Society of India (GSI); Mr. Dave Fordham, Member Editorial Board of KANCH (AIGMF's Glass journal), Former Publisher of Glass Worldwide magazine and Global





Jury Member Mr. Gurmeet Singh (Chairman FOSG) presenting certificate to the 1st Prize winner



Engagement Lead for Glass Futures (United Kingdom); and Mr. Vinit Kapur, Secretary of The All India Glass Manufacturers' Federation (AIGMF) who judged top 3 entries:

1st Prize (Rs. 25,000) was given to Rashi Sharma aged 13 years, 8th class student of Bal Bharti School, Bahadurgarh, HARYANA

2nd Prize (Rs. 15,000) was given to Avira Jain aged 13 years, 8th class student of Bhavan's B.P. Vidya Mandir, Nagpur, MAHARASHTRA

3rd Prize (Rs. 10,000 each) were given to:

- a) Ananya Maity aged 14 years, 9th class student of Sant Nandlal Smriti Vidya Mandir, Ghatsila, JHARKHAND
- b) Dakshit Sinsinwar aged 14 years, 9th class student of DPS Ranipur, Haridwar, UTTARAKHAND



The annual '**CK Somany Award for Excellence**' was given to Mr. P. K. Kheruka, Former President AIGMF, Chairman of the Glass panel in CAPEXIL, and Chairman of Borosil Ltd. The '**Balkrishna Gupta Award for Exports**' was bestowed to M/s Schott Glass India Pvt. Ltd. The 2nd '**Lifetime Achievement Award**' was given to Mr. Mohan Lalvani of Mascot Engineering Company. The previous winners are listed at www.aigmf.com

Former President of the AIGMF Mr. P.



A presentation on International Glass Manufacturing Show (IGMS) was given by Mr. Mohamed Sherif, Business Development Manager, Strategic Management & Exhibitions and Ms. Kanika Kapoor of Trade Marketing & Events DELHI and representative of Strategic Management & Exhibitions DUBAI.

IGMS 2026 to be held from April 21-23 at Dubai Trade Centre is the flagship event of Africa and the Middle East dedicated to the glass industry and its entire value chain.

IGMS serves as a top regional meeting point bringing together leading manufacturers, traders, and decision-makers in the glass industry showcasing cutting-edge technologies in Glass Products to Glass Production Technologies, Glass Manufacturing Machinery, Glass Processing Machinery, and Glass Finishing Machinery, alongside the latest advancements in Digitalization and Automation.

AIGMF is the supporting association as well as Media partner for the event.



K. Kheruka is the Chairman of Borosil Limited. He is a Commerce graduate and has over 5 decades of experience in the glass industry. He possesses a multi-faceted experience in strategy formulation and implementation, setting up of Projects, planning and execution. He has a firm grip over the technicalities pertaining to manufacturing and production of soda lime flat glass, as well as borosilicate drawn, blown and pressed glass. He has immense knowledge in marketing of glass products in the domestic and international markets.

"It has been a privilege for me to have had the opportunity to work in the field of glass! Glass is magic. God knows how much time I have spent battling a problem which has seemed unsolvable: and then the solution is suddenly found! My father has been my Guru - most of my learning, which started when I was an adolescent, has been from him. My dear uncle, Chandra Kumar ji Somany, has also been a major influence in my life. I have led an enriched life!" said Mr. P K Kheruka, recipient of CK Somany Award for Excellence.

M/s Schott Glass India Pvt. Ltd., is a 100% subsidiary of the German technology group SCHOTT AG. SCHOTT is one of the world's leading manufacturers of special glass tubing, FIOLAX® established and long-standing experience since 1911. SCHOTT has foreseen in 2018; a global 5.0 pharma tubing demand is going to increase. As



Select photos of the event and top 3 winners can be viewed at <https://aigmf.com/past-events.php>





On Aug 30, parallel to the AGM of AIGMF, a presentation on ADEETIE Scheme was given by Mr. P Shyam Sundar (left), Director at the Bureau of Energy Efficiency, Ministry of Power, GoI on the Assistance in Deploying Energy Efficient Technologies in Industries & Establishment (ADEETIE) scheme.



Mr. Pawan Kumar Shukla (left), Managing Director, Schott Glass India Pvt. Ltd. receiving 'Balkrishna Gupta Award for Exports'.



already that time the supply was short compared to demand, the expected market growth offers the opportunity to increase market share by establishing incremental capacity faster than competition.

Most recently, SCHOTT, a global pioneer in specialty glass announced the addition of syringe and cartridge glass tubing reinforcing SCHOTT's commitment to the 'Make in India' initiative. This strategic action positions the company as Asia's largest producer of syringe and cartridge glass tubing.

The jury for the awards comprised of Dr. K. Annapurna, Chief Scientist, Glass Division, CSIR-Central Glass & Ceramic Research Institute (CSIR-CGCRI) and Member, Editorial Board, KANCH; Mr. Dave Fordham, Member, Editorial Board, KANCH (AIGMF's Glass journal), Former Publisher, 'Glass Worldwide' magazine and Global Engagement Lead for Glass Futures (United Kingdom); Mr. Amit Malhotra, President of Confederation of Construction Products and Services, Treasurer of uPVC Window & Door Manufacturers Association and Managing Director of McCoy Silicones Ltd.; and Mr. Pawan Kumar Shukla, Treasurer, AIGMF and Managing Director, Schott Glass India Pvt. Ltd.

"My heartiest congratulations to Shri Pradeep Kheruka for winning the prestigious C K Somany Award for



Excellence for his key R&D initiatives in developing eco-friendly solar glass formulations as well as fully tempered 2 mm thick solar panel. His contributions in the laboratory, consumer glassware and especially in the solar cover glass, have a high impact globally, including India. Further, I congratulate M/s Schott Glass India Pvt. Ltd., for receiving the esteemed Balakrishna Gupta Award for its attaining remarkable exports.” said Dr. K. Annapurna, Chief Scientist, CSIR- Central Glass & Ceramic Research Institute, Kolkata.

“Not only does acknowledging the achievements of Mr. Pradeep Kheruka gives me immense personal pride having had the privilege of collaborating with him over many decades, officially honouring him with the prestigious C K Somany award provides a perfect opportunity for his outstanding

achievements to be forever etched into glass industry history. Mr. Kheruka’s remarkable contributions will leave a lasting impression on not only the Indian sector but on the global scale too. His name will always be synonymous with trailblazing developments in sustainable glass solutions for a greener planet. SCHOTT Glass India Pvt. Ltd., are also very worthy winners of the Balkrishna Gupta Award for Exports and fully deserve recognition for their flourishing export business despite challenging global trade conditions”, said Mr. Dave Fordham, Member Editorial Board of KANCH (AIGMF’s Glass journal), Former Publisher of Glass Worldwide magazine and Global Engagement Lead for Glass Futures (United Kingdom).

“The 2nd Lifetime Achievement Award was given to the Editor of KANCH

(quarterly journal of the AIGMF) Mr. Mohan Lalvani, Chairman of MASCOT Group of companies for his dedicated 4 decades in the glass industry and as an Associate Member of AIGMF since 1989. A Mechanical Engineer from ECOLE DES METIERS VERSAILLES in France, Mr. Lalvani brought technical know-how to India from German and other European principals of Mascot Engineering Company representing hi-tech companies in glass industry and has contributed to the modernisation of the Indian Glass Industry”, said the Secretary, AIGMF, Mr. Vinit Kapur.

The cash prizes for the winning students were once again sponsored by Schott Glass India Pvt. Ltd., producing Type I pharma tubing primarily meant for Glass Vials which were supplied worldwide for packaging the COVID vaccination. Most recently, SCHOTT, a global pioneer in specialty glass announced the addition of syringe and cartridge glass tubing reinforcing SCHOTT’s commitment to the ‘Make in India’ initiative. This strategic action positions the company as Asia’s largest producer of syringe and cartridge glass tubing. Mr. Pawan Kumar Shukla, Managing Director of Schott Glass India Pvt. Ltd., and Treasurer AIGMF while congratulating the students said “sustainable packaging is the key to create a better living society for eco and health reasons; and the Youth plays a very important role in spreading these right messages”.

Top 100 entries will get specially designed Glass Mementos ■



Mr. Shreevar Kheruka (left), Sr. Vice President AIGMF and Managing Director/CEO Borosil Ltd., receiving ‘C K Somany Award for Excellence’ on behalf of Mr. P K Kheruka.

Young brigade inks 'Glass is Pure'

(August 12, 2025, DELHI)

The Young Brigade in large numbers commemorated the International Youth Day by participating in The All India Glass Manufacturers' Federation (AIGMF) contest on 'Glass is Pure' or कांच जीवन है। The contest invited online entries from the Youth between 7-24 years by means of essays, poems, drawings, photography, etc. Hundreds of entries were received from schools and colleges across India.

1st Prize (Rs. 25,000) was given to Rashi Sharma aged 13 years, 8th class student of Bal Bharti School, Bahadurgarh HARYANA

2nd Prize (Rs. 15,000) was given to Avira Jain aged 13 years, 8th class student of Bhavan's B.P. Vidya Mandir, Nagpur MAHARASHTRA

3rd Prize (Rs. 10,000 each) were given to:

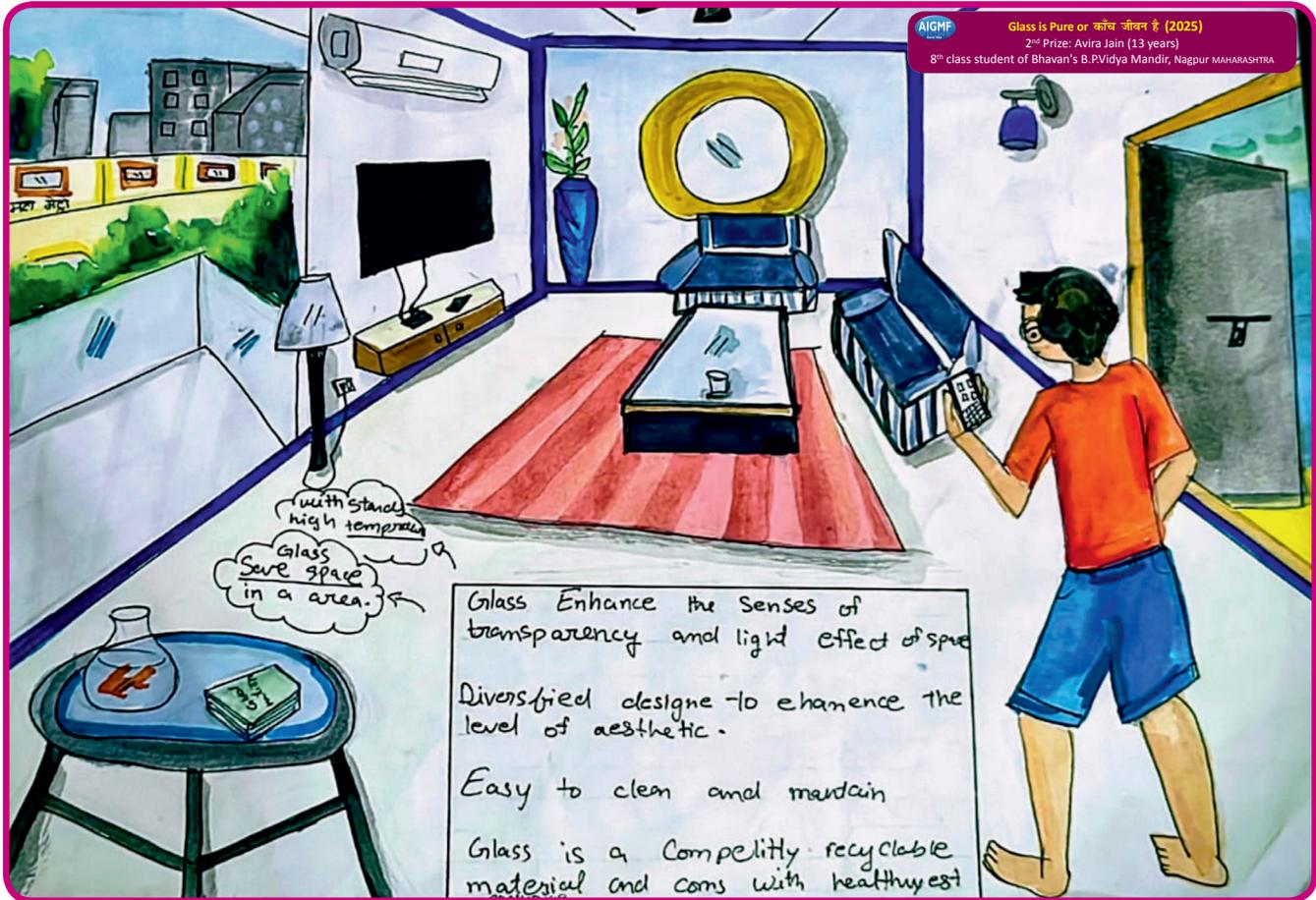
a) Ananya Maity aged 14 years, 9th class student of Sant Nandlal



Smriti Vidya Mandir, Ghatsila JHARKHAND

b) Dakshit Sinsinwar aged 14 years, 9th class student of DPS Ranipur, Haridwar UTTARAKHAND

The Jury comprised of Mr. Gurmeet Singh, Chairman, Federation of Safety Glass (FOSG) and Managing Director, Gurind India (P) Ltd.; Mr. G N Gohul Deepak, Executive Director, Glazing Society of India (GSI); Mr.



Dave Fordham, Member Editorial Board of KANCH (AIGMF's Glass journal), Former Publisher of Glass Worldwide magazine and Global Engagement Lead for Glass Futures (United Kingdom); and Mr. Vinit Kapur, Secretary of The All India Glass Manufacturers' Federation (AIGMF).

"Great continuous initiative of AIGMF unleashing the young minds into the world of Glass through art and innovation. Proud to be a part of this initiative and very privileged and enterprising to go through the sound and interesting artworks, poems and essays on pure glass. The creativity and thought process of young students on glass are splendid and thorough in all aspects. Wishing AIGMF and the student community for the successful journey in glass universe" said Mr. GN Gohul Deepak, Executive Director, Glazing Society of India (GSI).

Glass Is Pure

AIGMF Glass is Pure or काँच जीवन्त है (2025)
 3rd Prize: Dakshit Sinsinwar (14 years)
 9th class student of DPS Ranipur, Haridwar UTTARAKHAND

In silence born, from fire refined,
 A breath of earth, with soul aligned.
 It sings in light, yet speaks no word,
 Its truth, in stillness, always heard.

It holds no lies, reflects the skies,
 A mirror deep to watchful eyes.
 So fragile made, yet brave and sure —
 A heart like this... yes, glass is pure.

Through molten pain it found its shape,
 No mask to wear, no false escape.
 You see it all, you see it through,
 What glass becomes, the soul does too.

It does not bend to hidden scheme,
 It breaks — but never kills the dream.
 A thousand shards may fall obscure,
 But every edge says: glass is pure.

It catches light the way hearts do,
 Each ray a truth, each curve a clue.
 In palace, prism, window, lore —
 It lets the world come in... and more.

So raise the glass — not just to cheer,
 But to the strength of crystal-clear.
 What holds the stars and sea demure?
 A spirit rare... for glass is pure.

“Entries to this very worthy competition were of an exceptionally high standard and it was inspiring to witness the passion for glass shown by the younger generation who will be pivotal in shaping a carbon free world. The winners and all those who took part should be highly commended” said

Mr. Dave Fordham, Member Editorial Board of KANCH (AIGMF’s Glass journal), Former Publisher of Glass Worldwide magazine and Global Engagement Lead for Glass Futures (United Kingdom).

“I was overwhelmed to see the response of the youngsters to this amazing initiative of AIGMF. It was so wonderful to see the creativity of the young minds especially the girls who really went an extra mile to make their presentations which very well showcased the utility of glass in a comprehensive manner through paintings, poems and essays. The purpose of this effort is well accomplished.” said Mr. Gurmeet Singh, Chairman, Federation of Safety Glass (FOSG) and Managing Director, Gurind India (P) Ltd.

“It is extremely satisfying to engage with the young minds who are full of creativity and could paint some powerful messages on sustainability, health and how the purity of Glass is relevant in our daily lives” said Secretary of The All India Glass Manufacturers’ Federation (AIGMF) Mr. Vinit Kapur.

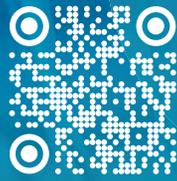
The cash prizes for the winners were once again sponsored by Schott Glass India Pvt. Ltd., producing Type I pharma tubing primarily meant for Glass Vials which were supplied worldwide for packaging the COVID vaccination. Most recently, SCHOTT, a global pioneer in specialty glass announced the addition of syringe and cartridge glass tubing reinforcing SCHOTT’s commitment to the ‘Make in India’ initiative. This strategic action positions the company as Asia’s largest producer of syringe and cartridge glass tubing. Mr. Pawan Kumar Shukla, Managing Director of Schott Glass India Pvt. Ltd., and Treasurer AIGMF congratulated the winners and said *crucial messages on health and environment coming from Youth are important in creating a better living society.*

Top 100 entries will get specially designed Glass Mementos.

Winning entries can also be viewed at <https://aigmf.com/past-events.php> ■

BECOME AN EXHIBITOR AT GLASSTEC 2026:

**Secure your Early Bird
rate until 30 Nov 2025!**



➔ glasstec.de/registration

glasstec

INTERNATIONAL TRADE FAIR FOR GLASS
PRODUCTION • PROCESSING • PRODUCTS

WE ARE GLASS

20-23 OCT 2026
DÜSSELDORF | GERMANY

➔ Join us at **glasspex INDIA & glasspro INDIA**
from September 10-12, 2025 in Mumbai

tm
Messe
Düsseldorf

October - December 2025 Issue

will carry detailed coverage of Glasspex/Glasspro exhibitions, 15th AIGMF International Conference on: AI and Digitalisation -the future for Sustainable Glassmaking, Glasstech Asia and Fenestration Asia (GAFA 2025), Technical Articles, Glass News and more.

To book advertisement space, mail to info@aigmf.com by Nov 30.

Kanch

is the leading choice for advertising in the glass and related industries. With several years of publishing experience, unrivalled coverage for the worldwide glass manufacturing community with up-to-date news, editorial and features, as well as exhibitions; KANCH is the best medium to communicate with stakeholders.

We understand your needs as an industry and are committed to assist you in making your advertising most profitable. This also popularises your brand and product portfolio by establishing contacts to suit your company's requirements.

Good quality advertisement material along with a Cheque

of the requisite amount payable to 'The All India Glass Manufacturers' Federation' may be sent to Secretary AIGMF at the registered office of the Federation.

It would be ideal if you could send your advertisement in PDF high resolution format (with auto enabled e-mail ID/website address, if any) helping readers to reach you directly on a single click in KANCH's e-version / AIGMF website.

A complimentary copy of KANCH along with the invoice will be sent to all advertisers. Those wanting more than one copy are requested to send their request in advance.

Advertisement Tariff	Indian Companies (₹)	Foreign Companies (US\$)
Ordinary Full page	15000	225
Extra Inside Cover Page	18000	250
Inside Cover Page	20000	275
Back Cover Page	40000	450
Extra Folded Cover (front/back)	40000	450
Bookmark Advt. (both sides)	20000	300
Bookmark Advt. (one side)	10000	150
Centerspread (two pages)	40000	450
Half Page	10000	150

Print area for Full Page Advertisement is 21.5 x 30.5 cm

Print area for Bookmark Advertisement (one side) is 8 x 16 cm

GST as applicable

For convenience, payment can also be remitted through wire transfer. Our bank details are as under:

(Deposit Cheque or make an online payment)

Account No. : 0411156983

Name : The All India Glass Manufacturers' Federation

Bank : Kotak Mahindra Bank

Branch : G-11 Marina Arcade

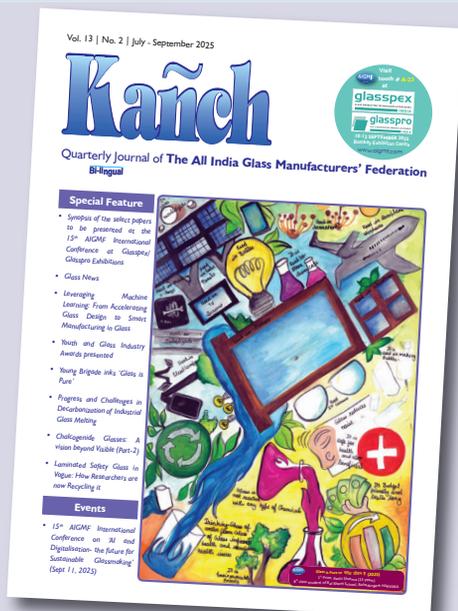
Connaught Circus

New Delhi-110 001

IFSC Code : KKBK 0000214

Swift Code : KKBKINBB

A copy of bank advice may please be sent at info@aigmf.com for reconciliation ■



Quarterly Journal of Glass Industry, published and printed by Vinit Kapur on behalf of The All India Glass Manufacturers' Federation from 812 New Delhi House, 27 Barakhamba Road, New Delhi - 110001 and printed by New United Process, A-26, Ph-II, Naraina Industrial Area, New Delhi-110028

T: +91 11 2331 6507 E: info@aigmf.com

Member Editorial Board:

K ANNAPURNA

Chief Scientist, Speciality Glass Division, CSIR-Central Glass & Ceramic Research Institute (CGCRI), Kolkata

DAVE FORDHAM

Former Publisher of Glass Worldwide Magazine and Global Engagement Lead Glass Futures, Ltd., (United Kingdom)

A S RAO

Vice Chancellor, Vikrama Simhapuri University, Nellore (Andhra Pradesh)

Er. ASHOKA RAO MANIKALA

Former President Operations PGP Glass and AGI Greenpac

Special Correspondent: PREM MALHOTRA - Glacera Engineers, Pune

Editor: MOHAN LALVANI

Complimentary copy for Members / Government Departments / NGO's and those connected with Glass Industry

Free online version at: www.aigmf.com/kanch.php

Charges for Print issue:

Indian Companies:

₹ 125 per copy

Annual Subscription ₹ 450

Foreign Companies:

US\$ 25 per copy

Annual Subscription US\$ 80