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Kañch

Quarterly Journal of **The All India Glass Manufacturers' Federation**

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AIGMF at glasstec

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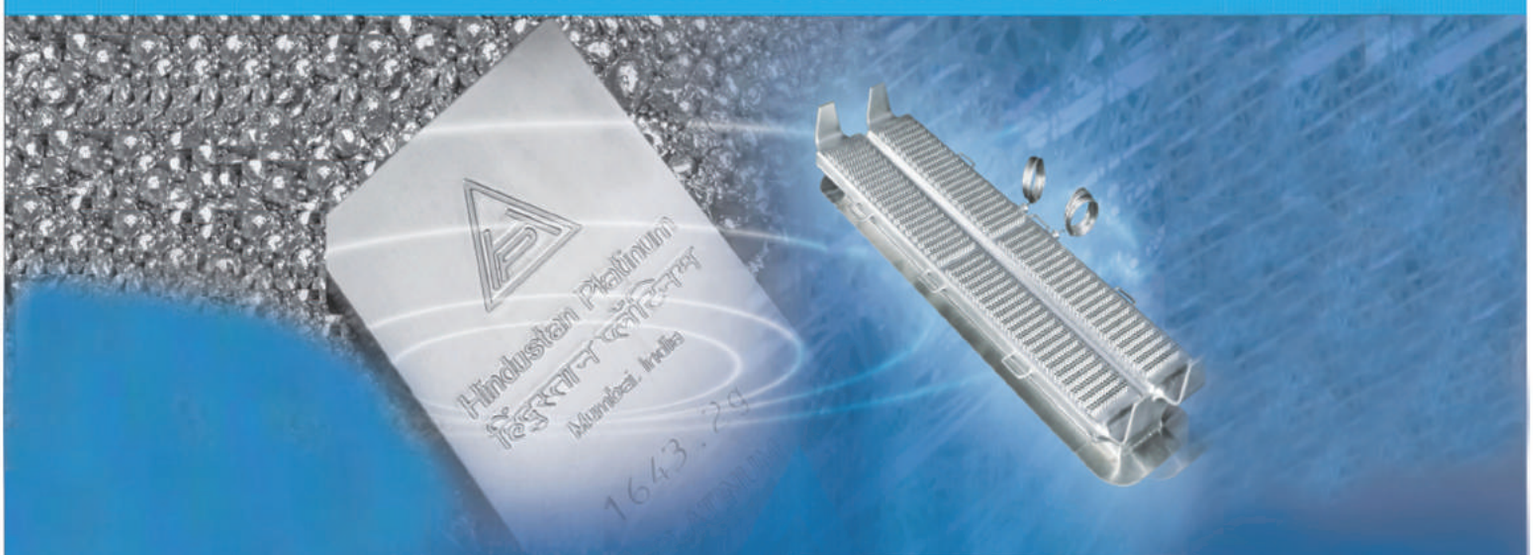

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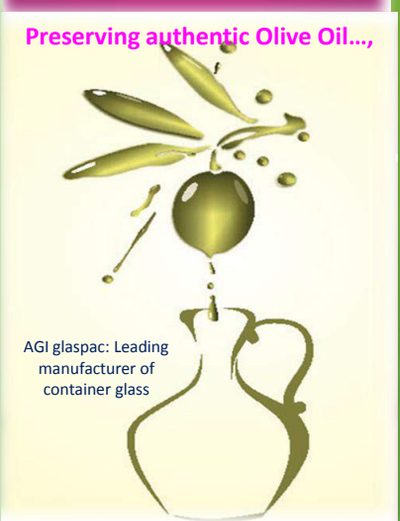

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From President's Desk

AIGMF participated at the 25th anniversary event of glasstec 2018 *(leading global trade fair for the glass sector covering areas of mechanical engineering, glass production, processing and finishing, skilled crafts, architecture/construction as well as window/façade and solar systems)* from October 23-26, 2018 where more than 42,000 visitors from over 120 countries came to Düsseldorf, GERMANY to convince themselves of the innovative power of this industry. The glass industry presented itself in high spirits and top investment shape thereby impressively confirming the position of glasstec as a leading trade fair and premiere platform for the international glass sector.

AIGMF put up its stall # 13A42 jointly with its international partner 'Glass Worldwide' to promote activities of the Federation by distributing complimentary copies of Kanch, Glass News, Guidelines on use of Glass in Buildings – Human Safety, Book on Glass: A Sustainable Building and Packaging Material.

AIGMF also participated in the 3rd Global Container Glass Forum held parallelly with glasstec on Oct 25th which was organised by FEVE *(FEVE is the association of European manufacturers of glass packaging containers and machine-made glass tableware)* at Messe Dusseldorf Headquarters. Participants included from Brazilian Glass Association, FEVE (The European Container Glass Federation), The All India Glass Manufacturers Federation (AIGMF), Japan Glass Bottle Association and Russian Container Glass Association.

The next glasstec will be held in line with the regular cycle in two years from October 20-23, 2020 in Düsseldorf wherein AIGMF is again all set to participate as an exhibitor as well as an active member of the 4th Global Container Glass Forum.

Parallel to AIGMF Executive Committee Meeting held on Dec 1 at Novotel Hyderabad Airport, a special session was kept on the Opportunities for Indian Glass Companies at Port of Duqm Company S.A.O.C, Sultanate of Oman. Mr. Hilal Al Balushi of Port of Duqm Company S.A.O.C, Sultanate of Oman and their team gave a presentation on Creating a Hub- FOR THE FUTURE. Around 45 members participated in the meeting at Hyderabad, which was hosted by AGI glasspac (HSIL's Packaging Products Division) and South India Glass Manufacturers' Association (SIGMA)- Hyderabad.

With the support of Port of Duqm, AIGMF will plan a visit to Oman comprising of prospective companies looking for such investment opportunities in Feb/March 2019.

AIGMF will be organising an open session on "How can India become Glass Capital of the World"? at the next Executive Committee Meeting on Feb 22, 2019 at The Gateway Hotel, Vadodara. Select presentations will be made by the captains of Industry on manufacturing, raw materials, imports/exports covering all segments of glass. The session will be followed by Q&A and way forward.

Most of the AIGMF members will be participating and we have very limited seats for others, who will only be registered on first-cum-first served basis. Interested stakeholders may send their consent of participation at info@aigmf.com

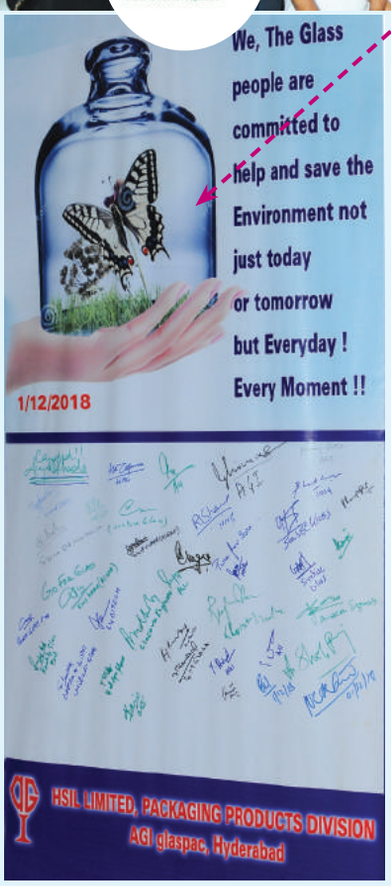
Participation is free but pre-registration is must for non-members. I invite one and all to participate and be a part of some interesting discussions ■

Raj Kumar Mittal

President AIGMF

President U.P. Glass Manufacturers' Syndicate (UPGMS) **and** Owner, Geeta Glass Works

Members participated in the Executive Committee Meeting on Dec 1 at Hyderabad and signed petition to use Glass every day and every moment in tune with Swachh Bharat Abhiyaan (clean India campaign). The meeting was hosted by AGI glasspac (HSIL's Packaging Products Division) and South India Glass Manufacturers' Association (SIGMA)- Hyderabad.



Membership of the Federation

Members of the Federation are classified into two categories; manufacturers of primary glass articles are enrolled as **Ordinary Members** of the Federation and suppliers to glass industry viz., suppliers of machinery, raw materials, consultants and others connected with glass industry are enrolled as **Affiliate Members.**

Foreign Companies supplying machinery etc., to glass industry are also enrolled as **Affiliate Members**.

Membership forms can be downloaded from www.aigmf.com/membership.php

Members of the Federation are enrolled on the recommendation of Zonal Associations viz.:

- Eastern India Glass Manufacturers' Association (EIGMA)
- Northern India Glass Manufacturers' Association (NIGMA)
- South India Glass Manufacturers' Association (SIGMA)
- Uttar Pradesh Glass Manufacturers' Syndicate (UPGMS)
- Western India Glass Manufacturers' Association (WIGMA)

ADMISSION FEE / ANNUAL SUBSCRIPTION

Ordinary Members:

- Admission fee ₹ 5000/-
- Annual subscription: Single Unit: ₹ 27,500 + GST as applicable
- More than one Unit: ₹ 1,10,000 + GST as applicable

Affiliate Members:

- Admission fee ₹ 5000/-
- Annual subscription: ₹ 11,000 + GST as applicable
- Applicants for enrollment for a period of five years may pay a consolidated amount of ₹ 49,500 (including admission fee) + GST as applicable

Affiliate Members from countries other than India:

- Admission fee US $ 200
- Annual subscription: US $ 440 + GST as applicable
- Applicants for enrollment for a period of five years may pay a consolidated amount of US $ 1650 (including admission fee) + GST as applicable ■

Opportunities for Indian Glass Companies at Port of Duqm

(Dec 1, 2018)

Parallel to AIGMF Executive Committee Meeting held on Dec 1 at Novotel Hyderabad Airport, a special session was kept on the Opportunities for Indian Glass Companies at Port of Duqm Company S.A.O.C, Sultanate of Oman. Mr. Hilal Al Balushi of Port of Duqm Company S.A.O.C, Sultanate of Oman and their team gave a presentation on Creating a Hub- FOR THE FUTURE.

Around 45 members participated in the meeting at Hyderabad, which was hosted by AGI glasspac (HSIL's Packaging Products Division) and South India Glass Manufacturers' Association (SIGMA)- Hyderabad.

It was told that Port of Duqm is a new sea port situated on the south-eastern seaboard of Sultanate of Oman. The Port of Duqm Company SAOC (PDC) is a joint venture between the Government of Oman and a Belgian consortium comprised of Port of Antwerp (Europe's second largest sea-port) and Rent-A-Port (a company specialized in port development and management). Incentives Package include:

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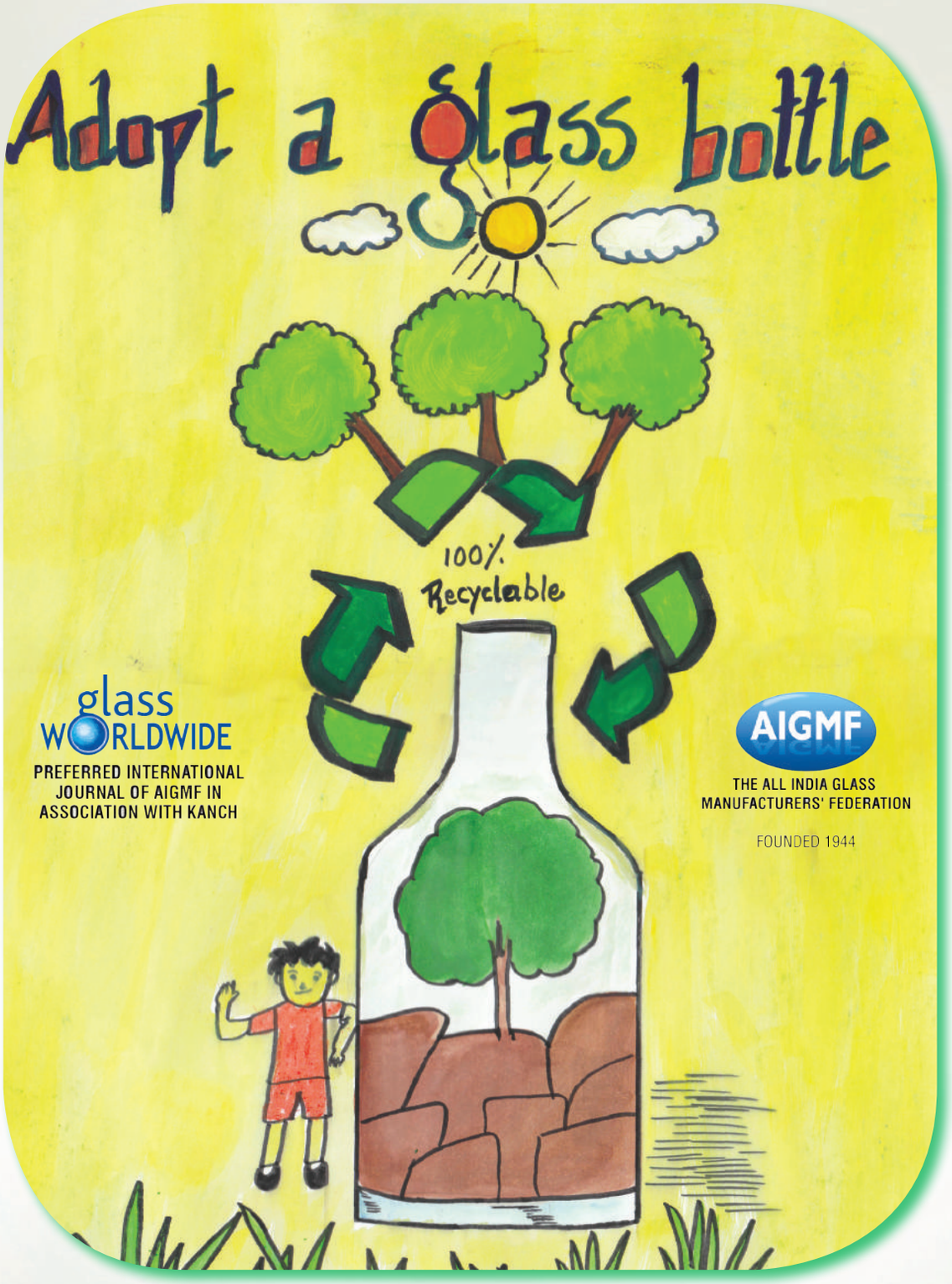
- No Currency Restriction

With the support of Port of Duqm, AIGMF will plan a visit comprising of prospective companies looking for such investment opportunities in Feb/ March 2019 ■

Select photos and presentations can be downloaded from https://aigmf.com/past-events.php ■



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GLASS News

SANDIP SOMANY TAKES OVER AS PRESIDENT OF FICCI FOR 2018-19

The Federation of Indian Chambers of Commerce and Industry (FICCI) has elected Mr. Sandip Somany, Vice Chairman and Managing Director, HSIL Limited as its President for 2018-19, after the conclusion of its 91st Annual General Meeting on December 14-15.

With this coveted industry acknowledgment, Mr. Somany will be working closely with Government and business leaders towards spearheading the country's economic growth and promote inclusiveness. He was previously working as the Senior Vice President, FICCI.

In the past, FICCI President Mr. Somany has held many industry leadership positions, including that of President of PHD Chamber of Commerce and Industry and President of International Chamber of Commerce India chapter (headquartered in Paris). He was also the Chairman of Indian Council of Sanitaryware Manufacturers (INCOSAMA) and a member of the Executive Committee of Governing Council of The All India Glass Manufacturers Federation.

Mr. Somany is widely recognized as a pioneer of the Indian ceramic industry and has played an instrumental role in making it an organized industry. With more than three decades of industry experience, a penchant for anticipating market needs and a constant thrust on innovation, Mr. Somany has led HSIL's evolution from an Indian sanitaryware maker to a diversified home solutions company.

Expressing gratitude and talking about his vision for the industry, Mr. Somany said, "I am thankful for FICCI's vote of confidence in appointing me as the President. This position is a great opportunity as it will allow me to continue to work within FICCI to meet its objectives aligned with industries at large, and our country. I look forward to engaging with industry stalwarts and leaders to foster an ecosystem of innovation and growth, together building consensus between industry and policy."

Mr. Somany holds a degree from the prestigious University of California, USA and has a Bachelor's degree from the University of Delhi. He is an avid reader, keeps abreast of world's political and economic news and is an adventure sports enthusiast.

Mr. Somany is also President of South India Glass Manufacturers' Association (SIGMA)- Hyderabad and owns glass manufacturing units in the name of 'AGI glaspac' under HSIL's Packaging Products Division (PPD).

NEW ICG PRESIDENT

The Council of the International Commission on Glass (ICG) elected Prof. Alicia Durán as its newest President for the period 2018-2021 at its meeting on Sept 25, 2018 in Yokohama, Japan.

Prof. Durán is a PhD in Physics and a Research Professor at CSIC, the Spanish Research Council. She has developed her entire professional career at the Institute of Ceramics and Glass (CSIC) being the leader of the Glass research group in the Department of Glass. She has also been Secretary of the Glass Section of the Spanish Ceramic and Glass Society for more than 25 years.

In 2002, she was appointed as Honorary Treasurer, which involved moving the ICG headquarters to Madrid. She continued in this position

ICG Ex-Presidents with the new President Prof. Alicia Duran (right)

until 2015, when she was elected Vice-President. Now she has become the President of the association. It is the first time that Spain has accessed this role in its 85 years, and Prof. Duran is the second woman to be awarded the role among the 25 Presidents of the association.

The new President has established as her main objectives: the promotion of Education through the ICG Summer School, ICG Winter School, and a new ICG North America School; continuing support for the initiative on Young Scientists and Technologists; and the reinforcement and promotion of the activities of the Technical Committees, accepted as the backbone of the ICG. As new objectives, she is promoting the ICG2030 project as the tool to adapt the structure of the association to the new challenges of the world of glass and will develop a new initiative for the Promotion of Women in the field of glass and in the ICG.

BOOST FOR MAKE IN INDIA! SCHOTT TUBING INDIA TO FURTHER INVEST 20 MILLION EUROS

SCHOTT AG, a global pioneer in manufacturing pharmaceutical glass and packaging, has announced the launch of a new glass tank in its Indian manufacturing plant at Jambusar, Gujarat. The German technology group is further growing its production capacity through this new tank facility with a total investment of more than 20 million euros (approximately INR 180 crores). The investment comes at a time when the company is celebrating 20 years of operations in India.

The expansion is in response to the increasing demand for high-quality pharmaceutical packaging material in the global market. Construction work on the new tank facility has already begun and is expected to be completed within 18 months. Production from the new tank is scheduled to begin by January 2020. The new glass tank facility will help fulfil the constantly growing demand of premium borosilicate glass tubing like FIOLAX® clear. It is used for high quality pharmaceutical packaging, especially vials and ampoules for India as well as for export markets.

Commenting on the role of India's growth in the pharma sector, in realizing SCHOTT Tubing's global ambitions *Dr. Patrick Markschlaeger, Executive Vice President, SCHOTT AG, Business Unit Tubing* shared, "The rapid development of the Indian pharmaceutical market requires a strong growth of high-end pharmaceutical packaging and in consequence high-end pharmaceutical tubing. We estimate a market growth for premium packaging and therefore for tubing to continue on a very strong level in the coming years. In addition to the supply of the domestic market, SCHOTT Tubing India will also serve the strong growing Asian market outside of India and will therefore be an important hub for the Asian market."

Speaking on the relevance of SCHOTT's investment and employment opportunities, *Mr. Georg Sparschuh: Managing Director, SCHOTT Glass India Pvt. India* said, "We feel proud that SCHOTT's manufacturing journey is a resounding success story of "Make in India" campaign wherein not only world class products are manufactured for domestic and export markets, but also new talents are nurtured in the process. The new facility will help us increase the production capacity by an additional 50%. I am excited to announce that our investment in the new tank will provide jobs for 70 additional local workers, bringing the total count to 425".

Dignitaries including Maharani Radhikaraje Gaekwad of Baroda, Dr. Jürgen Morhard, German Consul General, Mumbai, Ms. Radhieka Mehta, Director, Indo-German Training Centre and Mr. Parthesh Vyas, Head, CII Vadodara graced the ground-breaking ceremony of the new tank facility.

Dr. Jürgen Morhard also shared, "SCHOTT Tubing India is one of the finest examples of bringing together the expertise of German technology and Indian skill force. I would like to congratulate all the employees of this plant, as it is their excellent performance which is driving this expansion of the company. SCHOTT has well showcased how foreign

manufacturing companies can partner with India to take the 'Make in India' campaign to the next level. I am confident that its approach will be followed by similar German companies who want to pursue business in India and further establish the city of Vadodara as a German industrial hub."

SCHOTT's India plant functions as a production hub for SCHOTT pharmaceutical tubing in Asia and produces the branded FIOLAX® pharmaceutical tubing. FIOLAX® glass exists since 1911 and provides an unprecedented quality standard in the industry through SCHOTT's perfeXion® process since 2017. perfeXion® stands for the transition from statistical quality control to 100% automated inspection of each individual FIOLAX® tube – based on big data. Hence, it is introducing Germany's Industry 4.0 to its Indian factory in the most effective manner.

Besides new production hall for the tank, SCHOTT will also build new construction for energy supply, workshops and warehouse. Additionally, there will be an expansion of storage for energy, engineering and logistics infrastructure within the plant. As part of the production network within SCHOTT's Tubing business unit, the new tank will be built and equipped with all latest state-of-the art machinery as used in all other tubing factories worldwide.

GLASS INDUSTRY ATTENDS ICG CONFERENCE IN JAPAN

The ICG 2018 Conference in Yokohama, Japan had the theme of Innovations in Glass and Glass Technologies wherein 588 delegates from 29 countries attended the four-day event held from September 23-26, 2018.

The ICG Conference was run in conjunction with the 59th Meeting on Glass and Photonic Materials together with the 14th Symposium of the Glass Industry Conference of Japan.

The first morning included two Plenary talks. Prof Akio Makashima spoke on the subject 'Scientifically really important or Technologically really important?' while Takuya Shimamura of AGC Inc., Japan spoke on 'The Past, Present and Future of Japan's Glass Industry – Its contribution to our Sustainable Society.'

The opening session was concluded by a talk from the winner of last year's Gottardi Award, Dr. Ashutosh Goel, of Rutgers University. This year's winner, Prof Shifeng Zhou of South China University of Technology, was unable to attend.

They were followed in turn by some 200 oral and 100 poster presentations.

The conference theme defined during the opening ceremony was further developed by four keynote speakers.

For the main programme, 60 invited speakers spoke on one of six sub-themes: Glass Production Technology; Radioactive Waste; Glasses for Photonic Technologies; Electric and Magnetic Functions; Crystallisation and Glass Ceramics and Atomistic Views of Glass.

The short talk by a different younger glass technologist each day gave a feel for available career paths and how to approach job hunting. Students then gathered in groups around an allocated table to discuss their thoughts and questions at a more personal level with an allocated mentor.

Of the delegates 376 were from Japan with 29 from China. Germany and the USA were close behind with 24 delegates each. A further 95 came from 17 European countries and 30 from other Asian countries while six were from Russia and four from Brazil.

ICG also held meetings of several of its committees and at the Council Meeting Prof. Alicia Duran was elected as its 25th President. The previous incumbent, Prof. Manoj Choudhary, had completed his term of office.

The final act of the conference was for the representatives of the American Ceramic Society to issue an invitation to all those present to participate in the 25th Triennial ICG Congress in Boston, USA, from June 9-14, 2019.

ENVIROGLASS BATCH REFORMULATION PRESENTS SIGNIFICANT COST SAVINGS AND ENVIRONMENTAL BENEFITS

Leading specialists in glass, Glass Technology Services Ltd., have demonstrated that reductions in CO_2 emissions, combined with significant cost savings, may be possible for glass manufacturers through batch reformulation.

Carried out in partnership with Sheffield Hallam University, the EnviroGlass project proposed that substantial savings may be possible and has successfully demonstrated proof of concept for the substitution of raw materials with waste streams from other sectors - reducing energy demands, emissions and waste and contributing towards the circular economy.

In one amber glass example these waste streams could replace raw materials at up to 8 wt % while reducing furnace temperatures by up to 39°C. Further benefits included a reduction in NO_x emissions, refractory wear, landfill and transportation as well as a faster melting rate due to the form of elements in the wastes studied.

Across the wider float and container glass industry, potential benefits could amount to a reduction of more than 1,50,000 tonnes of CO_2 emissions and £5 million in energy costs in the UK alone.

In UK amber glass production this could equate to annual savings of over £5,00,000 in energy costs, combined with a 35 GWh/year reduction in energy demand and a 42kT/year reduction in CO_2 emissions. Across the wider float and container glass industry, potential benefits could amount to a reduction of more than 1,50,000 tonnes of CO_2 emissions and £5 million in energy costs in the UK alone.

Glass Technology Services routinely work with manufacturers to troubleshoot and optimise batch and melting operations, but the EnviroGlass project set out specifically to investigate the challenges identified within the glass industry's 2050 decarbonisation road map and identify cost-effective routes to achieving decarbonisation.

In partnership with Sheffield Hallam University (SHU), Glass Technology Services secured a grant of £1,56,645 for this work under the Energy Catalyst Initiative from Innovate UK - the UK government's innovation agency. The British Glass Environmental Steering Group awarded a further £30k to support the project and to cover some of the additional costs incurred in carrying out the project.

If you are working in the glass, energy from waste or combustion technology sectors and would like to be involved in the next phase of the project, EnviroGlass 2, please contact Glass Technology Services Ltd., on enquiries@glass-ts.com

For further details of this project, please visit www.glass-ts.com/projects/enviroglass-decarbonisation-and-batch-reformulation

VISITORS STUNNED BY WORLD'S LARGEST GLASS PANEL AT GLASSTEC 2018 IN DÜSSELDORF, GERMANY

Oversized glass was taken to the next level at the Eastman exhibit during the 25th anniversary of glasstec, the largest international glass trade fair that ran from October 23-26, 2018 in Düsseldorf, Germany. Eastman Chemical Company, manufacturer of Saflex® product glazing solutions for architectural and automotive applications and the Vanceva® Color System for laminated glass, offered visitors a real showstopper with the world's largest laminated heat-strengthened glass panel made with Saflex Structural PVB interlayer at 18m long and 3.22m high.

The glass panel was so large a special truck from Saint-Gobain was required for transport from eastern Germany and installation at the Messe Düsseldorf. With the help of two cranes and numerous suction cups, the oversized pane was secured into place with dowels. The glass, together with its steel base, weighs nearly four tons.

Due to its show-stopping popularity, Eastman plans to install the glass at its Ghent South Production Plant (Eastman, Ottergemsesteenweg-Zuid 707, 9000 Ghent, Belgium) before the end of the year. It will be placed next to the Customer Service Lab, easily accessible for customer visits.

"We hope that this installation inspired our visitors," says Mr. Kevin Moens, Global Commercial Director Architecture – Advanced Interlayers at Eastman. "Since this type of glass can be used to achieve an open, airy aesthetic and a smooth transition between interior and exterior spaces, architects at the show were imagining all sorts of design possibilities."

Eastman's enormous laminate pane is comprised of two 12mm high-quality, heat-strengthened, low-iron glass panes laminated with 1.52 Saflex Structural PVB interlayer. It is 40 percent larger than a glass panel made with conventional PVB*.

**When calculated to DIN 18008, wind load 0,5 kN/m2, line load 0,5 kN/m.*

The spectrum of construction applications where glass panes can be used is extensive including commercial and office buildings, museums, exhibition halls and conference centers, hotels, restaurants, as well as residential buildings.

With such a large format, there can be time and cost efficiencies with the production and assembly of one oversized panel versus multiple smaller panels. Architects and designers have unlimited design flexibility, especially when paired with Vanceva Illusion White or VancevaColor Interlayers.

FEVE, FERVER, EXPRA AND EURIC JOIN FORCES FOR AN AMBITIOUS AND COMPARABLE MEASUREMENT POINT FOR GLASS RECYCLING

FEVE, FERVER, EXPRA and EuRIC are committed to increasing the quality and efficiency of the glass recycling value chain through separate collection, quality recycling and closed loop manufacturing of glass. To help achieve this, a single, harmonised, ambitious and enforceable calculation methodology for the reporting of glass recycling in all Member States is needed.

All material streams should have an equal level of ambition when reporting recycling rates, regardless of the complexity of different recycling value chains. In the case of glass, FEVE, FERVER, EXPRA and EuRIC have a common understanding that the measurement point is at the input to the cullet treatment plant, as this is the "recycling operation" where waste is "actually reprocessed into products". They also take the ambition further and propose that non-glass losses and non-targeted materials should be deducted.

"We are delighted to have such a strong partnership calling for comparable and ambitious reporting on glass recycling" stated Ms. Adeline Farrelly, Secretary General of FEVE. "Measuring real recycling will drive local implementation of high quality separate collection for glass".

FEVE, FERVER, EXPRA and EuRIC also recommend maintaining a clear and consistent legal framework between the End-of-Waste Regulation, the EU Waste Framework Directive and the EU Packaging and Packaging Waste Directive, which supports an ambitious and comparable implementation of the reporting.

"The measurement point for reporting on recycling rates in the Directive clearly refers to the actual reprocessing into products, materials and substances and must therefore be consistent with the EU end-of-waste criteria established for glass" insisted Mr. Baudouin Ska, Secretary General of FERVER. Mr. Emmanuel Katrakis, EuRIC Secretary General, further emphasized that "it is key to show that the entire glass sector agrees on a single, robust and harmonised point of measurement for glass recycling which supports end-of-waste criteria and will further drive quality along the value chain".

The European Commission is still to finalise implementing legislation establishing rules for the calculation, verification and reporting of data for verifying compliance with the recycling targets set in the Waste Framework Directive and in the Packaging & Packaging Waste Directive. EXPRA's Managing Director, Mr. Joachim Quoden, commented: "We strongly welcome a uniform definition for the measurement of recycling and believe that recycled waste should be measured at the gate of the recycling plant as the data can only be ascertained until the plant's gate, in order to deliver fair and reliable statistics. We welcome the initiative by the glass sector to agree on the "recycling operation", which is crucial in this respect".

FERVER is the association of glass recycling companies in Europe, its members are spread over 19 countries and recycle more than 70% of the glass collected in Europe. www.ferver.eu

FEVE is the Federation of European manufacturers of glass containers and machine-made glass tableware. Its members produce over 20 million tonnes of glass per year. The association has some 60 corporate members belonging to approximately 20 independent corporate groups. Manufacturing plants are located across 23 European States and include global blue chip and major companies working for the world's biggest consumer brands. www.feve.org

EXPRA (The Extended Producer Responsibility Alliance) is the organisation for packaging and packaging waste recovery and recycling systems which are owned by the obliged industry and work on a not-for-profit or profit not for distribution basis. EXPRA acts as the authoritative voice and common policy platform representing the interests of its members, which are all founded and run by or on behalf of the obliged industry. www.expra.eu

EuRIC: Through its Member Recycling Federations from 20 EU and EFTA countries, EuRIC represents today over: 5,500+ companies generating an aggregated annual turnover of about 95 billion €, including large companies and SMEs, involved in the recycling and trade of various resource streams; 300,000 local jobs which cannot be outsourced to third EU countries; An average of 150 million tons of waste recycled per year (metals, paper, plastics, glass and beyond). www.euric-aisbl.eu/

SUPPORTING INNOVATION IN GLASS – CONGRATULATIONS TO PILKINGTON UK

Leading independent specialists in glass, Glass Technology Services Ltd., (GTS), are proud to support research and development across the glass industry and its supply chain and were honoured to sponsor the 'Innovative Solution' category of the glass industry's Glass Focus 2018 awards.

Congratulations to Pilkington UK, who were announced as the winners of the 'Innovative Solution' award at the Glass Focus 2018 dinner and awards ceremony organised by British Glass on Nov 22, 2018. Pilkington UK received the award for their Pilkington AviSafe™ development - an

innovative coated glass which aims to prevent occurrence of bird/window strikes.

Developed by Pilkington's UK-based research and development technology centre, Pilkington AviSafe™ utilises a patterned UV-enhanced coating to make the glass visible to birds while maintaining the optical transmission of the glass.

Mr. Simon Slade, a keen ornithologist based at the R&D Technical Centre, was a key driving force behind the project and described the issue:

"Millions of birds die each year when they fly into glass in homes, offices, and bus shelters. This is a growing challenge for the glass industry, architects and specifiers.

Reflection strikes, when birds fly toward something reflected by the glass such as the sky or vegetation, are the main cause of the problem: some existing products are effective, but reduce the transmission of the glass and the view from inside the building."

Although Pilkington AviSafe™ has not yet been commercially released, it has been tested on jumbo plates of glass and Pilkington expects the coating to be applied in other applications including solar control, safety and security, and noise control.

Mr. Philip Marsh, Business Development Manager at Glass Technology Services Ltd., presented the award on the night and said:

"As a partner across a wide range of glass R&D, we were delighted to sponsor this award and recognise the importance that continual innovation in glass plays in the modern world - from architecture, eco-design and packaging to medical devices, technology and energy.

Congratulations to Pilkington UK on this innovation, which through research comparing human and avian vision in the visible and ultraviolet spectrum enabled a patterned coating to be developed and applied to the glass that is visible to birds without any significant detriment to the aesthetic properties of facades and glazing."

Glass Technology Services Ltd., (GTS) is a leading provider of analysis, mechanical and performance testing, quality assessment, failure analysis, glass research and development and a range of consultancy services - specialising in glass, raw materials and glass products. Accredited to ISO/IEC 17025 and ISO 9001 quality standards, Glass Technology Services has an established reputation for specialist knowledge in glass and technical support. Please see www.glass-ts.com

GTS provide regular updates and research news through its website, social media and newsletter – to receive updates or interact through social media, please see www.glass-ts.com/newsletter

PIRAMAL GLASS IMPROVES EFFICIENCY WITH REAL-TIME INSIGHTS; LOWERING TCO BY 70% WITH MICROSOFT AZURE IOT

Piramal Glass, a global specialist in design, production, and decoration of glass packaging (flaconnage) solutions for Pharmaceutical, Cosmetics & Perfumery, and Specialty Food & Beverage industries, has deployed Microsoft's Azure IoT platform to digitally transform its manufacturing operations. An early adopter of the technology, Piramal Glass has currently implemented the solution, Real-Time Manufacturing Insights (RTMI), on 46 production lines across their four plants at Kosamba and Jambusar in Gujarat, India, Sri Lanka and the United States of America. The plants have an overall capacity of 1375 tons per day, with 12 furnaces and 60 production lines, all of which run on a 24/7 basis.

Piramal Glass has leveraged IoT to get real-time visibility into its line manufacturing operations and to analyze production line losses at various stages. Using Azure IoT Hub, Microsoft helped Piramal Glass acquire data from sensors on production lines to identify quality parameters at each stage and get insights on line efficiencies in real-time. This resulted in improved production efficiency and cost reduction up to 70% as compared to a glass industry manufacturing execution system (MES).

Mr. Vijay Shah, Director – Piramal Glass & Executive Director – Piramal Enterprises Ltd., said, "As the world's most preferred supplier of glass packaging solutions, Piramal Glass is committed to continuously adding value to its customers. We are happy to have collaborated with Microsoft on our journey towards digital transformation and business critical future readiness. Glass manufacturing is a complex process with many interactive variables. Combining digital technologies with precision high-quality glass manufacturing, has helped us fortify our accelerated growth path."

The Azure IoT platform enabled Piramal Glass to connect and monitor their equipment to gain real-time visibility into operational data that was previously unavailable. The technology integration was designed for fast and easy set-up to rapidly showcase the results and build on its existing sensors, equipment, systems, and data.

Mr. Sashi Sreedharan, Managing Director, Microsoft India, said, "Microsoft is committed towards the technological advancement of the manufacturing sector in India. We are excited to partner with Piramal Glass as they create a strong foundation for driving transformational change. It is significant that Microsoft technology enabled plant operations to continue as usual during the rollout of the Azure IoT solution, ensuring no disruption to the core manufacturing and deep integration with critical business processes."

To facilitate this transformation, Precimetrix, a Microsoft partner, brought in its Plant Monitoring System hosted on Microsoft Azure. The sensors on high speed conveyor lines were interfaced with data acquisition devices that record the key metrics, as the bottles move along the production line. This data is aggregated on an edge gateway and then pushed to Precimetrix's Plant Monitoring System on the cloud.

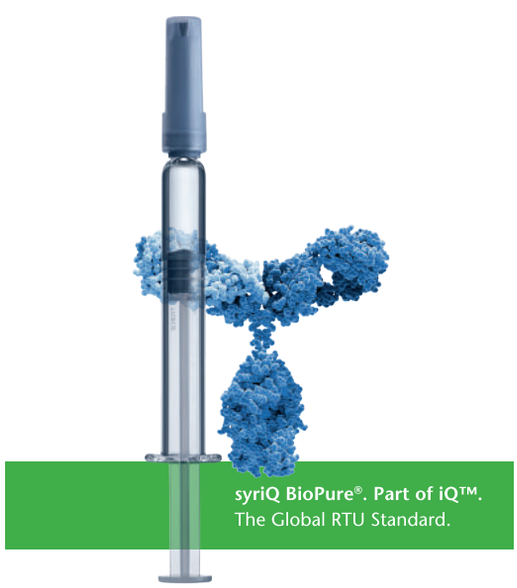
A custom solution was developed on top of this platform to provide stage-wise losses, production reports, quality control workflows as well as role-specific KPIs on PCs and smartphones of plant personnel. Actionable alerts are sent through SMS, email and push notifications whenever there is an anomaly detected or the production efficiency drops. In summary, RTMI has democratized real-time information availability to all plant stakeholders, enabling them to take faster decisions.

Piramal Glass is the largest specialty glass player in Asia and has been the fastest growing glass company in the world for over a decade. The company is the only significant player from Asia with a strong presence in the premium segment. It has progressed rapidly on its Digital Transformation journey and has made substantial investments in IoT as well as other digital technologies. While many of its digital initiatives started as experiments, a number of these have been scaled up, namely, computer vision to improve worker effectiveness, persuasive technologies to drive innovation, bots to enhance employee productivity & AI to create a manufacturing process Digital Twin.

IoT has reached an inflection point and is helping businesses improve operational efficiency and generate new business models from their existing assets and equipment. Microsoft believes that in the coming years, this will be the new normal across all industries and that companies will need to leverage IoT to maintain competitive advantage. Piramal Glass is committed to fast tracking its journey towards Industry 4.0 by leveraging Microsoft's end-to-end IoT platform & Cognitive Services.

SCHOTT KAISHA BRINGS NEW PORTFOLIO OF HIGHLY CUSTOMIZABLE PREFILLABLE GLASS SYRINGES TO INDIA

SCHOTT KAISHA has launched a highly specialized glass syringe portfolio in India, that further minimizes the risk of drug/container interactions for sensitive drugs. As part of its German partner SCHOTT's iQ™ platform, syriQBioPure® is a



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hugely customizable glass prefillable staked-needle syringe (PFS) specifically designed to keep sensitive drugs stable over shelf life and shorten time to market while making administration more convenient for patients.

Complex biotech drugs always face a threat of interacting with their container system. These interactions cannot be predicted and can lead to unintentional aggregation or deterioration of the drug which may eventually compromise the total cost of ownership, shelf life of the drug and treatment efficiency.

Mr. Rishad Dadachanji, Director, SCHOTT KAISHA shares, "The syriQBioPure® syringes, manufactured in St. Gallen, Switzerland, combine features to ensure stability and safe administration of sensitive drugs. Our clients often work with complex biologicals that require an extremely reliable PFS solution. We are happy with the response that this offering is receiving from our existing and potential clients."

A Quality by Design approach, benchmark manufacturing and quality control processes using breakthrough inspection technology, combined with best-in-class components has established syriQBioPure® as a preferred container solution globally. Its application has proven to be beneficial in achieving:

- Ultra-low tungsten residuals (ICP-MS certificate available)
- Uniform silicon layer
- Low adhesive residuals
- Low E&L from latest high-quality elastomer formulations

The new glass syringes work with leading safety and autoinjector devices, meeting market demand for products that can be administered at home for seamless patient comfort.

HSIL TO SET UP RS 350CR GLASS CONTAINER UNIT IN CUTTACK

HSIL Ltd., has proposed to set up a Rs. 350 crore manufacturing unit for glass containers at Cuttack.

The plant would have a capacity of 1,30,000 tonnes per annum and is expected to create direct and indirect employment for over 1,200 people.

Odisha's State Level Facilitation Cell has already recommended the proposal to State Level Single Window Clearance Authority for approval, the official said.

For Odisha government's Single Window for Investor Facilitation and Tracking (GO-SWIFT), a web portal for doing business in the state, it was the 500th investment proposal.

"It is encouraging to note that within a short span of one year, GO-SWIFT has received the 500th investment proposal," said Industries Secretary Mr. Sanjeev Chopra.

घर बैठे 59 मिनट में मिलेगा एक करोड़ तक ऋण

फिरोज़ाबाद–एमएसएमई योजना के तहत केंद्रीय ग्रामीण एवं किसान कल्याण मंत्री कृष्णा राज, विशिष्ट अतिथि; सूबे में कैबिनेट मंत्री प्रो. एसपी सिंह बघेल; प्रभारी मंत्री नीलकंठ तिवारी ने सीएलपी (कांट्रेक्ट लैस लेडिंग प्लेटफार्म) योजना का शुभारंभ किया।

भारतीय स्टेट बैंक की अग्रणी बैंक शाखा द्वारा आयोजित कार्यक्रम में मुख्य अतिथि केंद्रीय ग्रामीण एवं किसान कल्याण मंत्री कृष्णा राज ने कहा देश के प्रधानमंत्री 100 शहरों में एमएसएमई का शुभारंभ करने जा रहे हैं। पहले उद्यमियों को ऋण लेने के लिए बैंकों के चक्कर काटने पड़ते थे। अब सीएलपी योजना में ऑनलाइन आवेदन करने के मात्र 59 मिनट में ऋण स्वीकृत हो जाएगा।

उन्होंने कहा कि फिरोज़ाबाद का कांच उद्योग लगातार तरक्की करे, इसके लिए भी सरकार कार्य कर रही है।

कार्यक्रम में सदर विधायक मनीष असीजा, शिकोहाबाद डा. मुकेश वर्मा, डीएम नेहा शर्मा, सीडीओ नेहा जैन, एडीएम अतुल सिंह, एसडीएम सदर देवेंद्र सिंह, सीएमओ डा. एसके दीक्षित, एसबीआई के महाप्रबंधक प्रभात कुमार मिश्रा, एलडीएम एसके खंडलेवाल, उपायुक्त उद्योग शरद टंडन, सहायक श्रमायुक्त राजीव कुमार सिंह, प्रदूषण बोर्ड के प्रभारी अधिकारी पीपी श्रीवास्तव, **उद्यमी देवीचरन अग्रवाल, हेमंत अग्रवाल, राजकुमार शर्मा, राजीव अग्रवाल, दीपक जैन मुख्य रुप से उपस्थित थे।**

एचएसआईएल की कटक में 350 करोड़ रुपये निवेश से शीशे के कंटेनर बनाने का संयंत्र लगाने का प्रस्ताव

एचएसआईएल लिमिटेड ने ओडिशा के कटक में शीशे के कंटेनर बनाने के लिये 350 करोड़ रुपये के निवेश से विनिर्माण संयंत्र बनाने का प्रस्ताव दिया है। राज्य सरकार के सूत्रों ने इसकी जानकारी दी। इस संयंत्र की क्षमता सालाना 130000 टन की होगी और इससे 1200 लोगों को प्रत्यक्ष एवं अप्रत्यक्ष रोजगार मिलेगा। अधिकारी ने कहा कि ओडिशा के राज्य स्तरीय सुविधा प्रदाता प्रकोष्ठ ने राज्य स्तरीय एकल खिड़की स्वीकृति प्राधिकरण को इस प्रस्ताव की सिफारिश की है ■

(News Source: AIGMF Research Team/World Wide Web)

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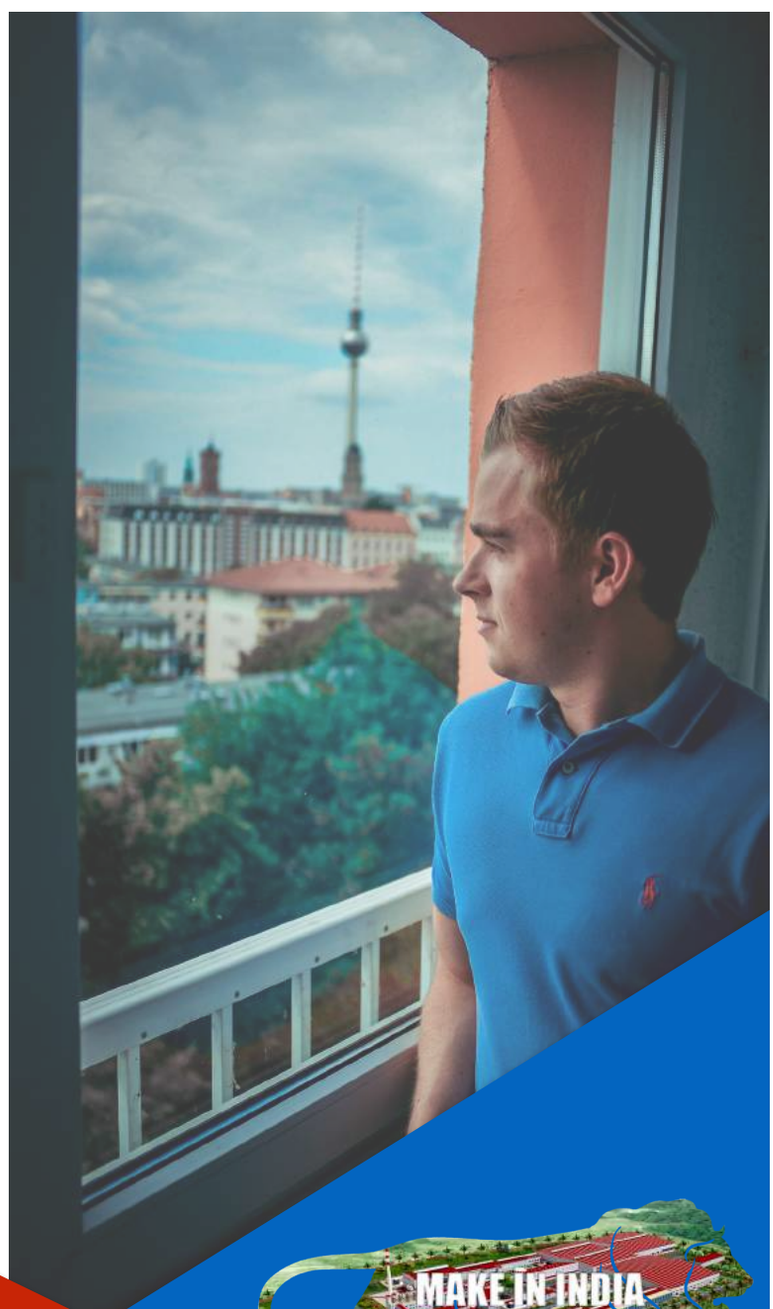

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How can India become Glass Capital of the World?

and **Executive Committee Meeting** to be held on Feb 22, 2019

at

Marigold Conference Room, The Gateway Hotel Vadodara, Akota Gardens, Akota, Vadodara - 390 020

(Meeting is hosted by Piramal Glass Ltd.)

1100 hrs	Tea/Coffee
1120 hrs	Welcome address by: - Mr. Sanjay Tiwari (Ex Com Member; Chief Operating Officer - Piramal Glass Pvt. Ltd., India and CEO & Managing Director - Piramal Glass Ceylon Plc, Sri Lanka) - Mr. Raj Kumar Mittal (President AIGMF)
1130 hrs	**How can India become Glass Capital of the World?** - PPT by Mr. Rajesh Khosla (Ex Com Member and President AGI glasspac) - PPT by other speakers - Open Discussion - Q & A - Way forward
1330 hrs	Lunch
1430 hrs	**AIGMF Executive Meeting** *(for AIGMF members only)*
1600 hrs	Wrap-up

- Participation is free but pre-registration is must for non-members
- Interested stakeholders may send their consent of participation at info@aigmf.com

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THE 11th WORKSHOP FOR NEW RESEARCHERS IN GLASS SCIENCE AND APPLICATION

ICG International Commission on Glass

GLASS FORMATION, STRUCTURE, AND PROPERTIES & HAZARDOUS WASTE VITRIFICATION

MONTPELLIER (France), 8th-12th JULY 2019

The workshop will be composed of two interwoven threads.

The first thread will overview fundamentals in glass science emphasising structure-property relationships, experimental techniques, material simulations and tools that probe structure. Specific properties and applications will be discussed e.g. optical behaviour, transport phenomena, nucleation and crystallisation, and strength.

The second thread this year will focus on glasses for hazardous waste immobilization, to echo the importance of the nuclear industry and other significant areas of waste disposal. Attention will be given to glass formulation and structure, long-term corrosion behavior, as well as melting technologies for nuclear waste glasses.

The lecturers will be world experts in their fields. A significant aspect of the workshop will be student-centred projects that will help participants to develop their understanding by applying what they know to specific issues.

Organization: **Prof. J. M. Parker,** University of Sheffield, UK
Prof. B. Hehlen, University of Montpellier, France
Prof. R. Conradt , uniglassAC GmbH Co., Germany
Dr. O. Pinet, CEA-Marcoule, Bagnols-sur-Cèze, France

Is this for you ?

If you are a new PhD or Masters student or have recently started research in the glass industry then the answer is yes.

- Normal fee: 900 €
- Reduced fee: 350 € for students and academic staff.

The fee includes 2 coffee breaks and a lunch per day, a welcome reception and conference dinner.

- Lodging and meals : 250 €

The fee includes 6 nights lodging with breakfast in a student residence at the University. Final date for lodging reservation is 15/05/2019.

- The textbook of the Montpellier summer school (recommended) : "*Teaching Glass Better*": 45 € (10% discount)

A more complete programme will appear soon on the ICG web site (www.icglass.org)

Pre-registration: **Deadline 15 / 04 / 2019**
By simple email to: **verres2019@mycema.fr**
Registration: **Deadline 15 / 05/ 2019**

Participants will be limited to:
30 (Glass Science)
& 20 (Glass Applications)

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Boron, Borates and Borosilicate Glasses: Part - I

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Abstract

Boron is a very important element that makes a range of interesting chemicals and a variety of compounds. In the form of boron trioxide, it is incorporated into silica to make boro-silicate glasses that have a very wide range of applications from high tech to our domestic usage. In the first Part-I of this article, some interesting applications will be described after giving a brief historical background on boron and its compounds. In the Part-II of this article, some of the newer applications of boro-silicate glass will be considered.

INTRODUCTION

At this moment, most probably, you are surrounded by glass, as it is a vital component of modern living: Mobile device screens, smart TV screens, smart windows, various glass fixtures in modern buildings, light bulbs and various types of lamps for our lighting needs including surgical lamps, solar arrays to create renewable energy that is environment-friendly, optical glass fibres for faster communication across the continents, optical glasses for our eyes and lenses for telescopes.

Apart from Medium to High Tech applications as described above, there are also bottles and jars for food and drink, drinking glasses and bottles of all shapes and sizes for a variety of drinks, cosmetics jars and small glass bottles for healthcare creams, microwave dishes and kitchen-wares for cooking at our home, test tubes and beakers for the chemical laboratories, and even well-designed tea and coffee pots … the list goes on and on **[1-4]**. A picture of a modern tea-pot made of boro-silicate glass is shown in Fig. 1 at the end of this article.

With four oxygen ions surrounding it, silicon forms silica-tetrahedron that is the basic 'building' unit of a silicate glass, which is the most common glass product. Similarly, if three oxygen ions are surrounding a boron atom, it forms a boron triangle that would be the basic unit of a simple borate glass, which is not very common, although both silica and boric oxides are the perfect "glass forming" oxides, i.e. they hold the main 'structural skeleton' of glass in place. However, due to many reasons, pure borate glasses are not common like pure silica glasses, which are generally used in the chemical laboratory (fused silica crucibles). With soda and lime, a majority of commercial glasses are usually fabricated involving silica, e.g. container glass, float glass, etc. **[1-3]**. In the same manner instead of pure borates, borosilicate glasses for kitchen-wares, boro-float glasses for buildings, boro-fluoride glasses for optical lenses, etc. are quite common.

Now, we have to understand why boron is used. Anhydrous Borax and Borax Penta-hydrate are the borate products most often preferred for borosilicate glass. Therefore, alkaline-free boric acid is used as the source of boron in flat panel glass, such as flat-screen TV sets, smart-phones, digital displays, etc. **[4]**. Boron is also used in very thin fibre glasses for optical communication that enables luminary photons to be transferred effectively in communication systems. Boron has utility in many tile glaze compositions as well - to reduce the melting temperature for better body-glaze

adhesion giving rise to better quality glazed tiles for the interior decoration of the buildings.

In the first part of the paper, interesting (common) applications will be described briefly with three more distinct (not-so-common) applications at the end of the article. But, first of all, let us give a historical background of such an important element like boron.

HISTORICAL BACKGROUND

Boron was simultaneously discovered by a Chemist in England: Sir Humphry Davy as well as by two French Chemists: Joseph L. Gay-Lussac and Louis J. Thenard. In 1909, the first 'nearly pure' boron was produced by an American Chemist: Ezekiel Weintraub. The name boron comes from the mineral, called borax, which gets its name from the Arabic word «burah».

Boron doesn't occur in nature in an elemental state, but it combines with oxygen and other elements to form boric acid, or inorganic salts called borates. According to the U.S. Geological Survey in 2017, boron compounds, mainly borates, are considered as commercially important, and boron products are priced and sold based on their boric oxide content (B2O3), varying by ore and compound and by the absence or presence of calcium and sodium. The four borate minerals — colemanite, kernite, tincal, and ulexite — make up 90% of the borate minerals used by industry worldwide.

Most borate is mined in Turkey, USA, and South America. In California (USA), US Borax, this is a part of famous mining giant: Rio Tinto group that operates the largest open-pit mine and the largest borax mine in the world, producing nearly half the world's borates **[5,6]**. Borate deposits were discovered in 1872. Originally, the ore was hauled out using twenty mule teams. The current open pit in the Mojave Desert began as an underground mine in 1927, and Boron Operations was converted to a surface mine in the late 1950s.

It is important to do Geochemical Analysis that can be easily obtained using portable X-ray fluorescence (XRF) analyzers, which are useful in a variety of applications including 'material science laboratory'. X-ray fluorescence (XRF) that is very useful for the glass industry is a non-destructive analytical technique used to determine the elemental composition of materials. XRF analyzers determine the chemistry of a sample by measuring the fluorescent (or secondary) X-ray emitted from a sample when it is excited by a primary X-ray source. Each of the elements present in a sample produces a set of characteristic fluorescent X-rays, i.e. "a fingerprint" which is unique for the specific element, which is why XRF spectroscopy is an excellent technology for qualitative and quantitative analysis of material composition.

Formed by the evaporation of seasonal salt lakes, the first deposits of borax were discovered in Tibet. Around the 8th century, traders brought borax along the Silk Road to the Arabian Peninsula where it was used in metallurgy. The quantities traded were small, its method of production was secret, and its source remained a mystery to those outside the trade. Although a precious and expensive commodity, borax became popular during the Middle Ages in Europe as a flux for soldering and in the refining of metals and assaying of ores.

The history of early borosilicate glass takes us to China, where Zhao Rukuo described glassmaking by Arabs and others in 1225: The reason is that borax is added so that the glass endures the most severe thermal extremes and will not crack. The earliest European mention of borax in glass occurs in a German work by Johann Kunckel in 1679, giving recipes for artificial gems that are important till today.

In 1739, another German, Johann Cramer, recommended this recipe for crystal glass: 60% of prepared flints (silica), 20% of purest alkaline salt (potash), and 20% of burnt borace (borax). British author Robert Dossie wrote in 1758 that the best looking glass plates contained 56% white sand, 23.5% pearl ashes (potash), 14% saltpeter, and 6.5% borax. He also noted that borax helps glass receive certain colors. In our recent paper **[7],** ligand field theory was discussed for coloration in mainly silicate glasses, whereas in borate glasses the coloration is little bit different due to the ligands (oxygen ions) associated with boron atom.

During the 18th century, glassmakers in many parts of the world began to understand the properties of borax, but its price—£750 a ton in London in 1750—remained far too high for general application. Then in the 19th century, technical developments in the industry coincided with new borate discoveries in Italy, Turkey, and the Americas, which led to substantial reductions in price. Borax cost less than £100 a ton in 1850, and less than £20 by the 1890s. For the first time in history, borax became viable for modestly priced, mass-produced goods **[5].** This is a classic example how price of a given commodity (or a chemical item) drives the application of a given component, and also how prices could be reduced by more and more production of the concerned item.

SOME APPLICATIONS

It should be pointed out that boron is not as flashy as gold (e.g. ornaments), nor as elusive as rare earth metals (various special usage), and not as well-known as copper (e.g. electrical wires), nonetheless it is an important industrial metal. Boron is very versatile because it easily accepts electrons from other elements to form many interesting compounds with both metals and non-metals. Boron is primarily used in glass and ceramics, but it is also used to make smart-phones, flat screen TVs **[4]**. Boron is also used to prepare detergents, buffer solution, insecticides, insulation and semiconductors. It is interesting to learn why researchers are investigating boron as a source of energy, as an energy carrier, and for heat conservation.

Apart from its use in different types of glasses, there are also various uses of boron. Amorphous boron is used as a rocket fuel igniter and in pyrotechnic flares. It gives the flares a distinctive green colour. The most important compounds of boron are boric or boracic acid (H3BO3), borax or sodium borate (Na2B2O7) and boric oxide (B2O3). These can be found in eye drops, mild antiseptics, washing powders, and a host of medicinal creams as skin-care products.

It is interesting to know that boron is quite a multipurpose element. It is a crucial nutrient for plants, an important component in the nuclear industry and the main ingredient of many fluids. In chemistry we take recourse to the periodic table where the position of any element is given with some details on atomic number, electronic configuration, etc. Boron is placed next to carbon on the Periodic Table of Elements. Boron is a metalloid, i.e. a substance with both metallic and non-metallic properties.

Apart from its intermediate position between metals and non-metals, boron exists in many polymorphs with different crystal lattice structures, some more metallic than others. Metallic boron is extremely hard and has a very high melting point. Due to some of these characteristics, boron mixed with its neighbour carbon forms very hard "boron carbide" that is used as cutting tools, and it is also an important ceramic material for special applications.

In the guise of domestic use, boron compound also arrives into the average home as a food preservative, especially for margarine and fish. However, boron is not present in nature in elemental form. It is found combined in borax, boric acid, etc. and as mentioned earlier it also exists in minerals called kernite, ulexite, and colemanite.

One of the most important items is Boric Oxide. This pure anhydrous form is ideal where boric acid is required without metals. A powerful tool in the production of specialty glasses, ceramics, enamels, and welding/soldering fluxes. Boron oxide – specifically pure boron trioxide – is needed for the production of certain types of glasses including optical and telescope lenses, medical glasses like ampoules, electronic glasses and glass-ceramic composites. Moreover, boron finds its place in some futuristic special applications, as described below:

1. Boron as a Source of Energy

Some scientists are examining whether we can get energy from boron using a technique called 'aneutronic fusion' – a form of fusion power in which negligible amounts of neutrons are released.

2. Boron as an Energy Carrier

Some compounds containing boron, nitrogen and hydrogen can effectively store and transfer hydrogen. This is important because hydrogen is an ideal candidate to store energy produced by wind farm and solar energy plants.

Sodium difluoro (oxalato) borate, on the other hand, can outperform some commercial compounds as an 'electrolytic salt' for emerging sodium-ion batteries, which could be a great candidate for large-scale energy storage.

3. Boron for Heat Conservation

Some solar water heating and solar power generation plants are using borosilicate collector tubes to harness reflected radiation from mirrors, so the steam turbines can be driven in a more efficient way. Moreover, in recent years, more stringent building standards with respect to heat conservation have been evoked

Fig. 1: A borosilicate glass Tea-pot with filtration system.

Fig. 2: A gorgeous borosilicate 'glass artisan bracelet' created by Xeno Glassworks. This has a wave design with blue, yellow and green colours that reminds us of the ocean.

thereby promoting the use of borates for fibre-glass insulation.

With all the above applications in mind, it is expected that boron will continue to be a star in our tech-driven society. From fertiliser to OLED screens, it is poised to have a big impact being in the spotlight.

Some of the unusual borosilicate glass items are shown in Fig. 1 and Fig. 2.

CONCLUSIONS

The importance of boron in the manufacture of different types of borate compounds as well as borosilicate glasses in a variety of shapes and sizes for a host of applications cannot be over-emphasized. After giving a historical background on how boron came into existence and the level of consumption increased with prices dropping with more production, various applications of boron in borosilicate glasses are depicted here. In the second part of the paper, some exotic applications, such as textile fibres and infrared absorption will be described to highlight the importance of boron in general and borosilicate glasses in particular.

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On the Spot... Sushil Jhunjhunwala

Announcing ambitious expansion plans for a new greenfield plant, Sushil Jhunjhunwala spoke exclusively to *Glass Worldwide* about La Opala's specialist production of opal and lead crystal tableware, as well as his pride at recently being awarded the AIGMF's inaugural C K Somany Glass Award.

GW: What are La Opala's plans for a new manufacturing facility?
In addition to our current operations in Uttaranchal and Madhupur, we have acquired significant land located close to our Uttaranchal plant and will construct a new greenfield plant, to open in 2021.

Sushil Jhunjhunwala is honoured to receive the first C K Somany Glass Award.

With three lines, we will be able to produce a lot more glass, similar to our existing product range but with the benefit of different shapes. We are already recruiting the workforce and our experience in the business means we can train the engineers and operators with great expertise.

GW: What is the motivation for such significant investment?
The new plant is a major investment and is being funded internally… but with increased production comes the benefit of partly reduced costs too. And the new plant will greatly assist us in continuing to innovate with new products, designs and marketing.

Investment in machinery and technology at the new plant will be with many of the same leading international suppliers we have worked with previously. If the quality is proven and the relationship has been maintained, our preference is to continue long-term partnerships. But there has to be constant development, because we are looking to improve all the time.

Having been the first company in India to convert to an electric furnace in 2008, we would not consider any other form of melting at the new plant. We are proud not to use oil or gas and we find real quality and environmental advantages with electric melting. Like our other plants with no chimneys and low pollution, the new plant will not look like a typical glass factory!


Manufacturing capacity has been increased to 18,000 tonnes at La Opala's Uttaranchal site since the addition of a fifth production line. Furthermore, the introduction of a press machine has permitted the addition of cups and mugs to the plant's product range

GW: Are market conditions in India demanding increased production?
In general, tableware is growing, becoming more affordable and better quality. Strength is also improving as we temper all our products. But demand for opal glass is not increasing. It's a difficult market and whatever we produce is not necessarily easy to sell. Demand has to be created and we have to find new ways to sell.

As well as cost advantages, opal has many benefits over porcelain, being tougher with no scratch marks, for example. It's also a real advantage and very important that opal glass is bone ash-free; with the big health agenda, there is a real opportunity to increase market share.

So these are both challenging and exciting times… but without challenge, there is no life!

GW: And how is the tableware market performing outside India?
Tableware is required everywhere, so the market should continue to grow… but there is competition across the world. La Opala's design, innovation and world class quality is key. And then it's about how you control costs when making a world class product.

Originally published in Glass Worldwide, preferred international journal of AIGMF

GW: What were the highlights of the investment programme at your Uttaranchal plant last year?
We added one more line to make five in total, increasing capacity to 18,000 tonnes. With the addition of a press machine, we have added cups and mugs to our product range in Uttaranchal, having only been manufactured at our original plant in Madhupur in the past. This expansion has been very successful, providing logistical advantages for domestic sales and exports.

Now we also have an in-house decal plant and are manufacturing our own decal sheets. This investment means an improvement in the quality of paper and printing, particularly beneficial to vases. It also further supports our very talented design team with their innovative and original ideas.

GW: What is the future for the Madhupur plant?
Our recent expansion at Uttaranchal and plans for the new plant are all in addition to the well-established activities in Madhupur. We completed the latest modernisation programme there last year, changing the electric furnace and converting to 80% automatic production (there will always be products that require some manual operation). We purchased new machines over a three year period and when future attention is required, we will invest accordingly.

GW: How has La Opala's management structure changed in recent times?

AIGMF dignitaries celebrate Sushil Jhunjhunwala's recent C K Somany Glass Award recognition, from left to right: K C Jain (HNG Float), Raj Kumar Mittal (AIGMF President), Bharat Somany (HNG), Sushil Jhunjhunwala (La Opala), Pradeep Kumar Gupta (Om Glass Works), Sanjay Somany (HNG) and Mukul Somany (HNG).

Succession plans are key to any business so earlier this year, my son Ajit took over as Managing Director and I am now Vice Chairman.

With my daughter-in-law co-ordinating design and advertising activities, there are many benefits of this being a family run business. We can make fast decisions and adapt quickly when necessary.

GW: Recognising your valuable contribution in the fields of technology, manufacturing, innovation, services and education, what did it mean to you recently to be awarded the AIGMF's inaugural C K Somany Glass Award, supported by *Glass Worldwide*?
La Opala has always been very active in the field of innovation and every year, the company is honoured to receive prestigious awards. However, to personally be the first winner of the C K Somany Glass Award is extra special for me. Mr Somany was like my guardian and was such a warm person. He was the Indian glass industry's figurehead and was always very open to offering technical assistance and advice. He is greatly missed. ●

Under Sushil Jhunjhunwala's management, La Opala produces a diverse range of opal and lead crystal tableware.

Sushil Jhunjhunwala and Sanjay Jain of Piramal Glass Pvt collected awards at the AIGMF ceremony last August.

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glass WORLDWIDE

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Good days for Indian architectural processed glass market

An extended slowdown of the Indian float glass market in recent years has failed to dampen the steady growth of the local processed glass market. Indian producers and downstream processors have steadily increased their installed capacity by adding new tempering, insulating, laminating and coated glass lines. On an aggregate basis, barring China, the country has more glass processing lines than most other Asian countries. Via discussions with key players, Sunder Singh tracked the sector's development for *Glass Worldwide,* preferred international AIGMF journal.

Comprising four primary producers/ processors, about a dozen mid-sized processors and 65 small-scale processors, the Indian processed glass industry has added significant capacity in recent years.

Currently, the nation has 223 tempering, 82 insulating and 63 laminating lines in operation. Estimated in the range of INR 17-19 billion, the processed glass market has grown at a rate of about one and a half times of the economy in the past five years. The Indian economy grew at 6.6% in FY 2017-18, with an expectation to grow by 7.4% in 2018-19. In early 2017, India was projected to be the fastest growing economy in Asia but higher crude oil prices and bumps from financial and fiscal measures lowered growth rates to 6.6% in 2017-18.

The processed glass industry was also impacted by a series of one-off events, such as the implementation of GST (July 2017) and a demonetisation of currency (November 2016), which had a dampening effect on growth.

However, the economic outlook for 2018-19 is expected to be more buoyant, with the IMF projecting the Indian economy to grow by 7.4% and further accelerate to 7.8% in 2020. This would make India the world's fastest growing economy in 2018 and 2019, the top ranking it briefly lost in 2017 to China.

Low usage in residential segment

Whereas the use of value added/processed glass has gained immense popularity in commercial buildings in recent times, residential buildings, which account for almost 62% of flat glass consumption, still heavily use plain float glass. In the last three years, however, some newer residential properties have started to use processed glass but these buildings are only a fraction of total residential constructions.

Leading glass processors are optimistic about future demand. Gaurav Bansal, CEO of Merrut-based Allied Glasses told the author: "Until a decade ago, there was hardly any usage of processed glass in the Indian residential sector. However, high end residential properties have started using processed glass in an increasing manner. We expect this segment to contribute higher volumes in the future."

Good days ahead

Although the Indian glass processing industry has enjoyed steady growth, most told Sunder Singh that the growth phase has only just started. Sharanjit Singh, CEO and Managing Director of one of the largest glass processors in the country, GSC commented: "There is an enormous potential for processed glass industry in the country. Hitherto, demand was confined to large-scale commercial constructions. Even in mid-sized commercial constructions, developers and builders were either using plain flat glass or at most, ▸

Newer residential properties have started to use processed glass but these buildings are only a fraction of total residential constructions.

Company	Manufacturing location(s)	Installed capacity	Technology suppliers
Sezal Glass	Silvassa	Four tempering lines, three insulating and three laminating lines	Glaston, Land Glass, LiSEC, Bystronic, HOAF, Scholz and Intermac
Gold Plus Glass	Sonipat and Kala Aamb	Six tempering lines, five laminating and four insulating glass lines	Glaston, LiSEC, Ekang Tech, Land Glass and Schiatti Angelo
GSC Glass	Greater Noida and Navi Mumbai	Six tempering lines, three laminating lines, three insulating lines, three ceramic printing lines and five ceramic fritting lines	Glasstech, North Glass, Scholz, Lenhardt, LiSEC, Rujkan, Diptech, Giardina and AG Engineering
Fuso Glass	Chennai, Hyderabad and Mumbai	Six tempering lines, four PVB laminating lines with autoclaves, five IG lines and three ceramic fritting lines	Glasstech, Land Glass and North Glass
FG Glass	Mumbai	Four tempering lines, four IG lines and three laminating lines	Uniglass, Hegla and Landglass
Kochhar Glass	Bhopal	Four tempering lines, three IG lines and two ceramic fritting lines	Glaston, North Glass, LiSEC and Land Glass

Major tier I glass processors in India.

Originally published in Glass Worldwide, preferred international journal of AIGMF

glass WORLDWIDE

tempered glass. But now, even small retail establishments have started using insulating glass, with one pane of coated glass to reduce heat gains. With the gradual decrease in the price of high quality processed glass, rising awareness among consumers and increasing purchasing power of the vast middle class, processed glass demand has started to gain momentum. We anticipate that growth in the local processed glass industry will be at least twice the industry growth for flat glass in the next three years."

Sharanjit Singh's company, GSC Glass is one of the largest glass processors in the country, with facilities in Greater Noida and Mumbai, spread over 12 acres of industrial land. The company has a covered area of 300,000ft^2, a subsidiary in Belgium and various resident representatives in different cities.

The General Secretary of the New Delhi-based Federation of Safety Glass (FOSG) explained that processed glass consumption in India is still not driven by mandatory regulations or standards, adding that there is huge user segment in commercial construction that uses glass merely as a cosmetic finish to buildings and generally compromises on other performance and safety characteristics. "There is an urgent need to frame rules and regulations that ensure minimum standards are followed in the industry for safety, security and most importantly from the point of view of energy efficiency. With 40% of energy consumed in India by buildings, it is imperative that standards ensure we save up to 30%-40% energy from current unregulated practices by the use of modern processed glass products and systems."

Ramesh Chouhan, CEO and Managing Director of Chennai-based Fuso Glass commented: "The Indian glass processing industry is in the initial phase of growth. However, ours is a unique country with different geographical and climate zones, so there cannot be standard products or performance criteria as in European markets. In these conditions, the role of processors becomes very crucial to deliver value added products for customised solutions. The performance of any high performance coated product depends on processing quality."

With glass processing facilities in Chennai, Hyderabad and Mumbai, Fuso Glass is among the industry's leaders. The company claims to have supplied glass for 18 airports in such cities as Delhi, Mumbai, Hyderabad and Bengaluru, as well as glazing for Infosys Technologies Campus, Hyderabad and Facade Glazing for Anna Centenary Library, Chennai. Meanwhile, Fuso has also supplied glasses to major IT parks of TCS and Infosys, as well as recently exporting 35,000m^2 of glass for the Vision Exchange project in Singapore.

Major players

A decade ago, glass processors were concentrated around the major metro cities of Delhi, Mumbai, Chennai, Kolkata, Bangalore and Hyderabad. Comprising approximately 80 companies, today however, the industry has spread to almost all corners of the country. As the use of processed glass has become more popular in tier II and tier III cities, a number of processors have set up establishments in these cities and towns. Most of these companies are still confined to processing tempering glass but they are expected to develop full-scale capabilities that embrace tempering, insulating and laminating glass in the future.

Tier I producers located in and around the major metro cities of Delhi, Mumbai, Chennai, Hyderabad and Bangalore lead the industry in terms of volume and value. These processors have been engaged in glass processing for more than two decades and have been able to establish state-of-the-art facilities.

With the emergence of a number of new glass processors in the last three years, the industry has become highly fragmented, with considerable emphasis on the acquisition of tempering capabilities. In the second half of 2018 alone, about 36 tempering lines are expected to commence commercial operations.

Anti-dumping duties for Chinese imports

In second half of 2017, the Indian government imposed anti-dumping duties on tempered glass imports from China for five years to protect the domestic industry from below cost imports.

The Indian revenue department has issued a notification imposing anti-dumping duty in the range of $52.85-$136.21 per tonne, a duty imposed on 'textured toughened (tempered) glass with a minimum of 90.5% transmission, having a thickness

not exceeding 4.2mm and where at least one dimension exceeds 1500mm, whether coated or uncoated. "The anti-dumping imposed shall be effective for a period of five years from the date of publication of this notification" according to the notification.

Investigations by the Directorate General of Anti-Dumping and Allied Duties (DGAD) had found that the tempered glass has been exported to India from China below its associated normal value. Also, it concluded that the domestic industry has suffered material injury, which was caused by the dumped imports of goods from China.

Primary producers and processors

Two of the largest float glass processors, Saint-Gobain and Asahi Glass India are also leading glass processors in India. Both companies have invested extensively in setting up state-of-the-art glass processing facilities at multiple locations in the country to cater to for steady demand for processed architectural glass.

Two other companies, Sezal Glass and Gold Plus Group were initially exclusively glass processing companies but both subsequently established their own float plants. Sezal Glass later sold its float glass operations to market leader Saint-Gobain India.

Asahi Glass

India's second largest float glass producer, Asahi Glass is also a major processor. The company operates architectural glass processing plants in Roorkkee, Chennai and Taloja. Its products include heat reflective glass, energy efficient reflective glass, solar control glass, upvc windows, tempered burglar-proof glass, lacquered glass, frosted glass, sound-resistant glass and impact-resistant glass. In addition to glass processing, the company has facilities for mirroring, as well as hard and soft reflective coatings. ▸

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Company	Location	Zone	Products
Allied Glasses	Meerut	North	Tempered, laminated and insulating glass
Hindustan Glass Works	Allahabad	North	Tempered and insulating glass
Gurind Glass India	Noida	North	Tempered glass
Mehr Image Pvt Ltd	Noida	North	Tempered and insulating glass
Nanda Glass Industries	Noida	North	Tempered glass
Birkan Engineering Industries	Ghaziabad	North	Tempered, insulating and laminating glass
Structural Glazing & Insulation	Lukhnow	North	Tempered and insulating glass
Art N Glass	Delhi	North	Tempered, laminated and insulating glass
Keenat Glass Works	Delhi	North	Tempered glass
Sheesh Mahal Tuff Glasses	Rohtak	North	Tempered and insulating glass
Dura Tuff Glasses	Bahadurgarh	North	Tempered glass
Chandra Lakshnmi Glasses	Rai, Sonepat	North	Tempered and insulating glass
Swastik Toughned Glass	Sonepat	North	Tempered glass
Mico Glass Industries	Gurugram	North	Tempered, laminated and insulating glass
Surbhi Glass	Gurugram	North	Tempered glass
TL Verma & Co	Baddi	North	Tempered and insulating glass
J K Toughened Glass	Jallandhar	North	Tempered, laminated and insulating glass
Ridhi Sidhi Glasses India	Jaipur	North	Tempered, insulating, laminating and ceramic coated glass
Jaipur Toughened Glass	Jaipur	North	Tempered glass
Shree Neelkamal Glasses	Jaipur	North	Tempered glass
Aaimaa Industries	Jodhpur	Central	Tempered glass
Wadhwa Glass	Raipur	Central	Tempered and insulating glass
Shree B K Glass	Raipur	Central	Tempered and insulating glass
Sahil Glass Industries	Indore	Central	Tempered glass
Jajoo Architectural Glass	Vadodara	West	Tempered and insulating glass
Bhatia Glasses	Thane	West	Tempered and insulating glass
Glasstech Industries Limited	Mumbai	West	Tempered, laminated and insulating glass
Tuffglaze India Pvt Ltd	Mumbai	West	Tempered and insulating glass
V Tuff Glasses	Mumbai	West	Tempered and insulating glass
Hard Glass Ltd	Mumbai	West	Tempered glass
Alpha Safety Glasses	Nasik	West	Tempered glass
Dadakrupa Glasses Pvt Ltd	Nagpur	West	Tempered glass
Veeral Safety Glasses	Pune	West	Tempered, laminated and insulating glass
Nanda Glass Industries	Pune	West	Tempered and insulating glass
Shree Rang Glass	Ahmedabad	West	Tempered, laminated and insulating glass
Gujarat Toughened Glass	Ahmedabad	West	Tempered glass
Rio Glass Ltd	Rajkot	West	Tempered glass
Impact Safety Glass Works	Bengaluru	South	Tempered, laminated and insulating glass
ABC Group of Companies	Bengaluru	South	Tempered, laminated and insulating glass
Balaji Safety Glasses	Bengaluru	South	Tempered and insulating glass
Toughglass India Pvt Limited	Bengaluru	South	Tempered and insulating glass
Arihant Safety Glass	Bengaluru	South	Tempered and insulating glass
Toughglass India Pvt Ltd	Bengaluru	South	Tempered glass
Prakash Glass & Rubber Works	Hyderabad	South	Tempered, laminated and insulating glass
N N Safety Glass	Hyderabad	South	Tempered and insulating glass
Nandi Tuff	Hyderabad	South	Tempered glass
Annex Glass Works	Hyderabad	South	Tempered glass
Galaxy Glass Works	Chennai	South	Tempered glass
Manchu Toughened Glass	Chennai	South	Tempered glass
Sure Safe Glass Works	Kolkata	East	Tempered, laminated and insulating glass
Saraf Glass Works	Kolkata	East	Tempered, laminated and insulating glass
Brite Glass Works	Kolkata	East	Tempered and insulating glass
Bharat Safety Glass	Jamshedpur	East	Tempered and insulating glass
Glass India	Guwhati	East	Tempered glass

Major tier II glass processors in India.

GlasXperts is the architectural arm of the company for glass design and installation services for the retail sector. According to Asahi India's management: "GlasXperts is a one-stop for 360 degree solutions, which integrate specialised glass knowledge in design, selection and installation of glass in homes, offices and other commercial establishments. GlasXperts leads the way in providing innovative concepts and cutting edge solutions in living glass. It meets the needs of consumers for modern, eco-sensitive aesthetics with a full spectrum of world class, high quality branded glass products, fittings and systems, with assured safety and its hassle-free services."

Saint-Gobain India

The country's largest float glass producer, Saint-Gobain India too has invested heavily in glass processing facilities. The company operates state-of-the-art processing facilities at its Chennai and Biwadi plants. ●

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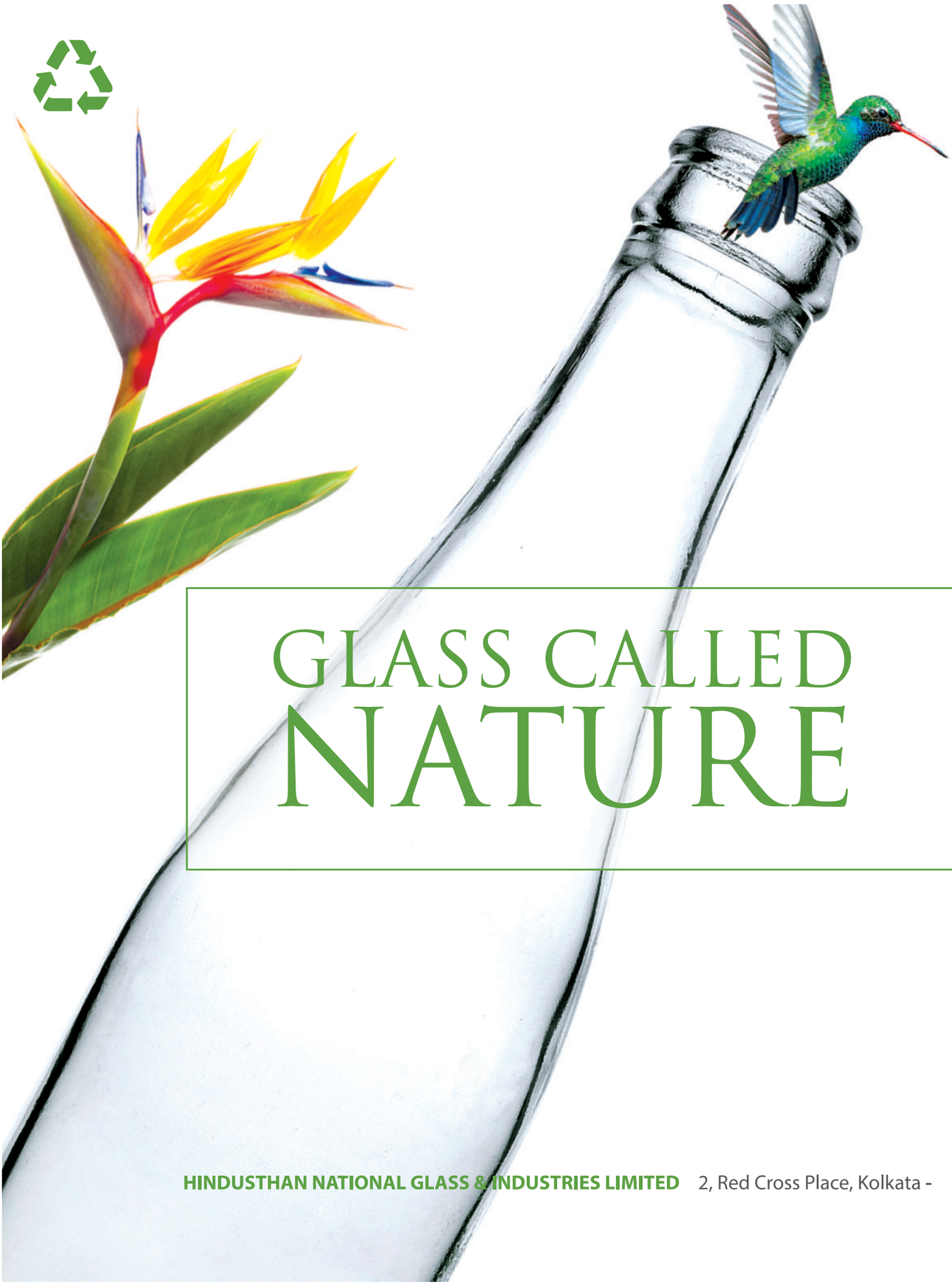

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AIGMF participated at the 25th anniversary event, the glass industry presented itself in high spirits and top investment shape thereby impressively confirming the position of glasstec as a leading trade fair and premiere platform for the international glass sector.

On the four trade fair days from October 23-26, 2018 more than 42,000 visitors from over 120 countries came to Düsseldorf to convince themselves of the innovative power of this industry.

1,280 exhibitors from 50 countries showcased their product highlights in nine halls. Exhibitors unanimously reported promising new contacts and concluding good to very good business deals. The favourable situation in the industry was also reflected by the positive atmosphere in the halls.

"glasstec remains the leading international platform for global launches in the glass industry, that the whole glass cosmos follows. The industry works in sync with the two-year cycle of glasstec and gears its innovations to precisely this moment in time. No other trade event can present such a plethora of forward-looking solutions, products and applications. This is also appreciated by the constantly rising proportion of international visitors," commented Mr. Wolfram N. Diener, Operative Managing Director at Messe Düsseldorf.

The VDMA member companies are also highly satisfied with the fair as a whole. "Many high-level specialist discussions that look likely to lead to orders were held with visitors to the fair. Machine manufacturers were clearly focused on the issues of digitisation and networked production. Digitisation has reached the glass industry," he said. "Many exhibitors are working intensively at developing future-proof products. And they showcased their solutions at their stands", confirms Mr. Egbert Wenninger, Chairman of the Board of VDMA's Glass Technology Forum and Chairman of the glasstec Advisory board.

"Glass is a trend and this year's glasstec has made this perfectly clear again! The industry keeps moving and the current upswing evidences that the millennia-old history of the material that is glass continues with amazing innovations. As the trade association of the glass industry and conceptual sponsor of glasstec we can look back on an exciting trade fair week. It never ceases to inspire me to see glass in all its diverse applications," says Dr. Johann Overath, Director General of BundesverbandGlasindustriee.V.

GLASS TECHNOLOGY LIVE AND THE GLASSTEC CONFERENCE LINK THEORY AND PRACTICE

The special show glass technology live once again proved the central point of contact for all glasstec visitors presenting itself in a fresh new look for the anniversary event. By extending the team of conceptual partners to include not one but four Technical Universities (Darmstadt, Dresden, Delft and Dortmund) the organisers placed a stronger focus on scientific glass research that put exciting glass products and applications on display. The focal themes staged by glass technology live included interactive façades and display glass, energy and performance, structural glass (solid glass, thin glass and hollow glass) as well as new technologies.

For the first time, the glasstec conference pooled the various conferences at one location under a common umbrella brand. This brought theory closer to what was happening in the halls, at the same time deepening the background knowledge of the experts on the trend topics of the industry and skillfully linking up with the exhibits on display.

CONFERENCES INCLUDED

The technology conference function meets glass, which addresses the challenges of, and solutions for, producing and finishing functional glass and functional glass applications, brought together in excess of 100 participants and experts from the fields of mechanical engineering, production and their users over two days.

Under the heading "Perspectives – New Architecture in Glass" the International Architecture Congress introduced to 200 participants the diversity of applications for glass in architecture. Here both the design and functional potential resulting from the innovative use of glass were highlighted.

Current developments and scientific research results in structural glass construction and façade technology were discussed at the scientific conference engineered transparency. In addition to the constructive aspects, contributions here focused on energy efficiency and resource conservation in façade construction. 210 participants attended the event.

CONFERENCES ORGANISED BY CONCEPTUAL PARTNERS

The topics of glass melting and emissions were dealt with by the partners HVG-DGG (Hüttentechnische Vereinigung der deutschen Glasindustriee. V. and Deutsche Glastechnische Gesellschaft e.V.) (DGG). For the first time this year, the Bundesverband Glasindustriee.V. (BV Glas) (Federal Association of the German Glass Industry) addressed the topic of environmental and climate policy in Germany and the EU (BV Glas). Connected production and new technologies formed the thematic focus of the presentations of the forum organised by the

Verband Deutscher Maschinen und Anlagenbauere. V. (VDMA). For the first time, the new event "Daylight by EuroWindoor" took place. It covered the latest news on legislative frameworks and planning aspects of daylighting in buildings.

START UP-ZONE OPENS THE DOOR TO THE GLASS INDUSTRY

glasstec is the central ideas and contact platform for new business models and connections. The new START-UP-ZONE in Hall 10 offered 15 young, international companies the opportunity to present their ideas and products to an expert audience, make contacts, build networks and meet a large number of decision-makers. Participants from ten countries (Norway, Finland, **India,** Italy, Switzerland, Lithuania, Austria, Netherlands, Germany, Taiwan) took advantage of this opportunity. "In the glass industry start ups find it especially difficult to make contact with companies although these could clearly benefit from innovative technologies. The START UP-ZONE has allowed us to obtain valuable feedback and take concrete steps for installations. This is exactly what the industry needs," noted Mr. Daniel Valenzuela, Business Development Manager at Actyx AG.

FEDERAL GUILD ASSOCIATION OF THE GLAZIER TRADE SHOWS THE CRAFTS OF TOMORROW

This year, the Federal Guild Association of the Glazier Trade presented its vision of the craft to trade visitors. In addition to numerous innovative applications, which will expand the glazier's product range, the glass schools exhibited their masterpieces. The special show "Handwerk LIVE" (Crafts LIVE) presented the topic

"Finishing Glass: from Warehousing to Finished Products". Visitors from the glass processing trade were able to find out here which requirements, processes and products facilitate the processing and transportation of glass.

"The glass industry once again impressively demonstrated its many facets and its potential in Düsseldorf. Visitors here could experience an innovative craft in Hall 9, as well as a versatile, innovative industry in the other exhibition halls. Even in times of political turbulence and quarrels that cannot be overlooked, we have every reason to look to the future with optimism. The glazier trade does not need any "retrofitting" in order to be able to survive in the future," said Federal Guild Master Mr. Martin Gutmann, President of glasstec 2018 with optimism.

"GLASSTEC CHALLENGE" – NEW COMPETITION FOR YOUNG PROFESSIONALS

Another new highlight on the programme was the "glasstec Challenge". The three large glass schools from Vilshofen, Hadamar and Rheinbach sent teams of two – consisting of students from their 3rd year of training – to Düsseldorf. The students were able to demonstrate their specialist knowledge and skills under competitive conditions. A wide variety of glass products were produced at various hands-on stations. In addition to the quality of the exhibits, the time of implementation, preparation and use of personal protective equipment and workwear was also evaluated. The winners received attractive prizes such as training vouchers and free participation in seminars.

GLASS ART – THE ARTISTIC SIDE TO GLASSTEC 2018

The special exhibition "glass art" in Hall 9 showed the artistic side of the glass industry. The spectrum of exhibits showcased by artists from internationally renowned galleries and ranged from glass vessels and sculptural objects to glass painting.

AIGMF put up its stall # 13A42 jointly with its international partner 'Glass Worldwide' to promote activities of the Federation by distributing complimentary copies of Kanch, Glass News, Guidelines on use of Glass in Buildings – Human Safety, Book on Glass: A Sustainable Building and Packaging Material.

THE NEXT GLASSTEC WILL BE HELD IN LINE WITH THE REGULAR CYCLE IN TWO YEARS FROM OCTOBER 20-23, 2020 IN DÜSSELDORF

About

The All India Glass Manufacturers' Federation

The All India Glass Manufacturers' Federation was founded in 1944. The Federation is made up of five Regional Associations viz.

Eastern India Glass Manufacturers' Association **(EIGMA)**-Kolkata

Northern India Glass Manufacturers' Association **(NIGMA)**-Haryana

South India Glass Manufacturers' Association **(SIGMA)**-Hyderabad

Uttar Pradesh Glass Manufacturers' Syndicate **(UPGMS)**-Firozabad and

Western India Glass Manufacturers' Association **(WIGMA)**-Mumbai

The Federation was incorporated under the Companies Act, 1956 (No. 1 of 1956) as a Limited Company on 15-6-1970.

The main aims & objectives of the Federation are:-

- To encourage, promote and develop the manufacture of glass articles of all kinds and to safeguard and protect the interests of glass industry and glassware business in India.
- To form a common link amongst Glass Manufacturers' in India and thus develop a spirit of mutual help and cooperation with one another.
- To promote the study and research in Glass Technology.
- To consider all matters relating to the manufacture and marketing of glass articles in India and the question of export and import thereof.
- To devise ways and means for securing necessary supply of raw materials required for the manufacture of glass articles at comparatively lower prices and thus to decrease the cost of production and increase the national wealth.
- To collect necessary information and data and propagate it for the benefit of Glass Industry and trade in India.
- To make representations whenever necessary to the Union Government or any unit of the Union of India for the removal of difficulties that might hamper the trade of glass articles or for grant of special facilities for the Glass Industry.
- To draw Government or public attention to the difficulties in the way of Glass Industry and to solve other problems confronting it and to solicit their help and support through concerted action.
- To organise a united front on behalf of all glass manufacturers and thus strive to gain all those advantages which may not be possible through individual effort.

All those engaged in the manufacture of glass and glass articles are enrolled as **Ordinary Members** of the AIGMF and those associated with the Glass Industry are enrolled as **Affiliate Members** of the Federation.

Almost all glass manufacturers including many in the small scale sector are 'Ordinary' Members of the Federation.

Articles of Association of the AIGMF were amended in September 1992 to enroll foreign companies as Affiliate Members of the Federation ■

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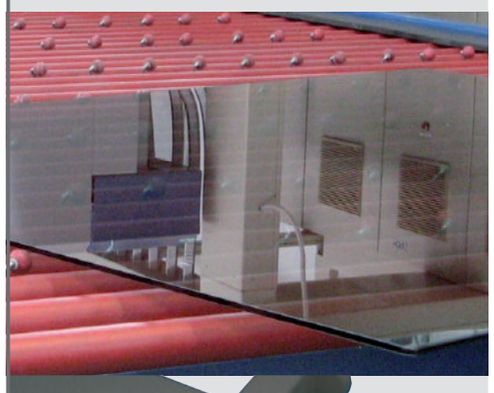

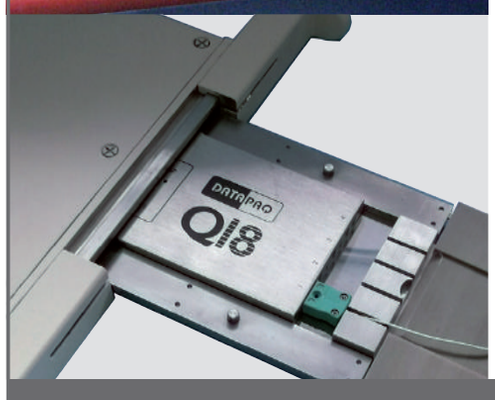

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3rd Global Container Glass Meeting

(October 25, 2018)

AIGMF participated in the 3rd Global Container Glass Forum held parallelly with glasstec on Oct 25th which was organised by FEVE (FEVE is the association of European manufacturers of glass packaging containers and machine-made glass tableware) at Deutsche Messe Board Room, Messe Dusseldorf Headquarters.

Participants included from Brazilian Glass Association, FEVE (The European Container Glass Federation), The All India Glass Manufacturers Federation (AIGMF), Japan Glass Bottle Association and Russian Container Glass Association.

Mr. Jean-Paul Judson of FEVE welcomed participants, which was followed 'Tour de Table". The different delegations presented activities from their associations on policy & legislative developments, and industry promotion.

Once the tour-de-table was completed, participants discussed at length the issue of plastics pollution and how this was affecting the development of the packaging market in the different constituencies. All regions agreed that it would be useful to develop a common platform to exchange information and experience on Extended Producer Responsibility schemes, in order to increase glass collection & recycling, consumer awareness and municipal waste management infrastructure.

Mr. Judson gave presentation on the implications of the EU Plastics Strategy for plastics… and for glass. His presentation covered EU Plastics Strategy and Plastics Litter in the Global Context, Is EU policy on plastics showing leadership across the world? and How do other regions view the developments in Europe?

Mr. Judson further presented FEVE's views on Food Contact Material Legislation. Discussions were carried on different rules and regulations apply to food contact materials.

Meeting ended with an Agreement on follow up and holding of 4th Global Container Glass Meeting at glasstec in 2020 ■

Boron, Borates and Borosilicate Glasses: Part - II

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Abstract

It is known that one of very important elements is boron next to carbon in the Periodic Table that makes a range of interesting chemicals and a variety of compounds. As boron trioxide, if added into a silicate matrix, it gives rise to borosilicate glasses with a very wide range of applications from high tech to our domestic usage. There are various other types of borate glasses, such as alkali-borates, alkaline-earth-borates, borophosphates, alumino phosphates, boro-aluminophosphates, etc., for different types of applications requiring special types of properties. Among all these glasses encompassing a wider composition base, the borosilicate glasses stand apart in terms of impressive list of domestic applications as well as in the scientific and industrial fields. In the Part-I of this article, some interesting applications of borosilicate glasses have already been described after giving a brief historical background on boron and its compounds. In the Part-II of this article, some of the newer applications, such as textile fibre and infrared absorption of borosilicate glass will be considered.

INTRODUCTION

Silicate glasses including those of commercial glasses with soda-lime-silica variety have SiO4 tetrahedra as the main building block, whereas for boron containing glasses, e.g. borosilicate, alkali and alkali-earth borate glasses, boron triangles are the fundamental building blocks. It makes a structure quite compact but with low thermal expansion to give rise to a variety of applications that requires a high thermal shock resistance.

Sometimes we should wonder why some glass can go from our freezer to hot oven and back again while normal silicate glasses can't? To answer this question, we need simple physics in terms of relation between density i.e. structural stability and coefficients of thermal expansion. However, we could give a short but simple answer that lies in its composition, i.e. by simple composition engineering with respect to throwing some boron into a normal 'soda-lime silica' glass with minor adjustment. Here, the trick lies in the addition of boron in the form of boron trioxide – making it a borosilicate glass **[1-3]**.

Borosilicate glass is resistant to temperature change because it does not expand like an ordinary glass. It has a smoother transition between temperatures, and can even withstand different temperatures at the same time. This is the reason why a glass tray with cold casserole leftovers can go straight into a hot oven and does not shatter when dropped into a sink full of cold water. A +5% infusion of boron provides a less dense product, i.e. structural flexibility and a higher melting point, making it useful for lot of applications more than kitchen cooking **[4,5]**.

Borosilicate glass is a type of glass with the main glass-forming constituents as silica and boron trioxide. These glasses are known to have very low coefficients of thermal expansion (~3 $\times 10^{-6}$ /°C at 20°C), which gives them a high resistance to thermal shock; more so than any other common glass. Such glass is less subject to thermal stress and is commonly used for making 'reagent' bottles in the

chemical laboratories. It has been made possible due to boron and its compounds **[6-8]**.

Borosilicate glass is sold under a variety of trade names, most notably Borosil and Pyrex, but there are many others in the market such as Simax, Borcam, Suprax, Kimax, Heatex, Endural, Schott, or Refmex. The market potential is huge for such glasses in the chemical labs of different schools and colleges as well as in various research organizations. As the Govt., budget and also private investment increase with the new schools and colleges, the demand for such glass products keep on increasing with time. However, in a smaller part of this market segment, there is some competition from the porcelain wares that are chemically resistance as there is a glass coating (i.e. glazing) on the inner surface.

Without going into the details of competition between borosilicate glass-wares and porcelain-wares, it could be safely said that even if the chemical stability being the same in both cases, the former is definitely more thermal-shock resistant than the latter. Hence, for the experiments with harsh thermo-chemical reactions, borosilicate glasses stand apart much more than any other products including plastics, although thermally resistant plastics are available in the market with innovative compositions. Another important property of borosilicate glasses makes them unique in the sense that they are completely transparent so that many chemical reactions could be directly visualized in the open eyes, when needed.

In a brief historical perspective, it should be mentioned that Otto Schott (Schott Glasswerke) was a famous glass company in Germany in the 19th century. Borosilicate glass was first developed by this German glassmaker that was sold under the brand name "Duran" in 1893 **[7]**. Corning Glass Works is also a famous company in the USA, and 22 years later, they introduced Pyrex in 1915. This name became a synonym for borosilicate glass in the entire western world.

COMMON APPLICATIONS

Many scientific lenses require a glass that remains both clear and strong when exposed to heat. Borosilicate microscope lenses and microscope slides allow scientists to analyze tiny organism right under their nose and astronomers use it in telescopes that bring far off galaxies much closer to home. Similarly, the late Space Shuttle Discovery flew 39 missions with borosilicate thermal insulation tiles to protect it from extreme low temperatures during orbital motion in space and extreme high temperatures due to tremendous 'friction' upon re-entry to the earth.

It even has a leading role in the arts. Stage lights can reach high temperatures during a three-hour show. Borosilicate glass is used in both the spotlights that keep performers lit onstage and the flashlights. It is also popular for art construction. Also, 'glass sculptors' and 'lamp-workers' use this "hard glass" to create everything from little artisan beads to huge museum exhibits.

Most of the borosilicate glassware can be used for scientific purpose. Borosilicate glass sample "vials" assures the contents' integrity. Vials are ideal for storing and sampling small amounts of liquid and powders. Normally there are choices for maximum visibility or amber, cobalt blue or green for protection from UV rays. Cobalt blue and green vials are commonly used for aromatherapy and essential oil packaging.

Some of the other important applications of borosilicate glass are listed as: (a) Display screens in cell phones, tablets, and TVs. (b) Ovenware, tableware, and microwave dishes, (c) Laboratory glass. (d) Pharmaceutical and cosmetics packaging, (e) Lighting glass, (f) Glass microspheres. (g) Boats, cars, trucks, trains, and aircraft, (h) Wind turbine blades, (i) Printed circuit boards (PCBs), (j) Aero space applications, (k) Fibreglass pipes and tanks, (l) Glass beads, (m) Glass-to-metal sealing, such as in radio valves **[8]**.

Therefore, it is seen that boron is bringing strength to "life" right from touchscreens without which we cannot almost live our modern life today to some very important equipment in the renewable energy sector, i.e. wind turbine. As a component of borosilicate glass, borates improve resistance to thermal shock, increase aqueous durability and mechanical strength, imbue electrical neutrality, and structurally modify the glass to make it resistant to heat and chemicals.

If one is viewing something on a tablet or mobile phone – think of a plate of borosilicate glass. Alkali-free borosilicate glass is used in all thin film transistor liquid crystal display (TFT LCD) substrate of glass and some types of scratch-resistant, protective outer layers, for touchscreens.

Moreover, in sealed headlights, lamp covers, halogen bulbs, and fluorescent tubes, borosilicate glass provides high electrical resistance, strength, and durability. Ampoules and vials for medicine, as well as vacuum flasks, rely on borates for increased chemical resistance and aqueous durability. Pharmaceutical (or neutral) glass can be engineered so that, in contact with aqueous solutions, it creates the same pH as is found in the human body. Also borosilicate glass maintains

optimum brilliance. Along with its low coefficient of thermal expansion, it makes the material suitable for optics such as astronomical reflecting telescopes and eyeglasses.

There are also specialized applications, e.g. (a) Borate-containing glass beads are used in plastics as reinforcement-extenders, and (b) Hollow microspheres are used to manufacture automotive parts and patching compounds. The "light-weight fillers for polymeric materials" have been possible to be made due to their low-density, high-compressive strength and insulation from heat and sound. Also cover glass and substrate glass for flat photovoltaic cells have specific quality and performance requirements that sometimes need to be met by specialized borosilicate glasses: high strength-to-weight ratio, impact resistance, and surface compatibility with electronics materials.

Finally, it is worth mentioning that "nano particles" of borosilicate glass of 100 to 500 nm were prepared in Switzerland for a range of important applications via gel route and drying to give rise to powders **[9]**. Those who say that 'glass is everywhere' should be interested to know that for "immobilisation and disposal of radioactive wastes", borosilicate glass has found its great use in the nuclear industry **[10]**.

It is known that there are a variety of container and float glasses for a very wide range of applications starting with very technical usage to even our domestic needs **[1-3]**. Many of these items are made of borosilicate glass, prepared with silica and 5-20% boric oxide —specifically, boron trioxide. As already said, some of the above items are very common types.

Apart from the above non-so-exhaustive list of items, boric oxide is also used in the preparation of boron halides, sodium boro-hydride, metallic borates, and borate esters and as a catalyst in the conversion and synthesis of many organic compounds. Now, some descriptions are given for two important applications, such as textile fibreglass and infrared absorption.

TEXTILE FIBREGLASS

Boron is also a vital component in the manufacture of textile fibreglass. This is also known as continuous strand fibreglass (CSFG), or simply fibreglass. Produced in a variety of fibre types and forms, the majority of textile fibreglass is used in wind turbine blades, different types of vehicles, and more **[4,5]**.

In the glass and textile fibreglass manufacturing process, boric oxide functions as both a flux and network former. It significantly lowers melting temperature and inhibits crystallization of the glass, both of which greatly facilitate processing. Generally, boric oxide lowers viscosity, controls thermal expansion, and inhibits devitrification —increasing durability and chemical resistance, and also reducing susceptibility to mechanical or thermal shock.

The properties of the final product are positively affected by borates. For example, borates act as a powerful flux and lower glass batch melting temperatures during fibreglass manufacturing that aides the process of drawing fibres and improves durability in use. Borates also improve dielectric properties, and hence these glass fibres are used in electronics or aerospace applications, i.e. one reason textile fibreglass made with boric oxide is used in the manufacture of printed circuit boards, micro-electro-mechanical systems (MEMS), and thermal insulation tiles like those on the U.S. space shuttle.

Textile fibreglass comes in several types, named as A, C, E-CR, D, E, R, or S and forms, i.e. rovings, yarns, chopped strands, milled fibres, or woven and mat textiles. Most (90-95%) textile fibreglass products are e-glass (i.e. electronic glass). Originally aimed at electrical applications, e-glass is now primarily used to reinforce thermo-set and thermoplastic polymer composite structures that is known as fibre-reinforced plastic (FRP) or glass fibre-reinforced plastic (GFRP).

In the textile industry, e-glass used for printed circuit boards (PCB) and aerospace applications must contain 5-10% boric oxide (B_2O_3). e-glass for general reinforcement purposes can vary from 0-10% B_2O_3. "Low-dielectric constant" textile glass fibres that is used in high-frequency electronics applications have a higher B_2O_3 content than e-glass, reducing the dielectric constant.

With a diameter of a few microns and coated in an inorganic compound called silane to improve compatibility with matrix material, continuous strand textile glass fibres provide a powerful reinforcement for applications including boats, wind turbine blades, pipes, and lightweight composite structural components in cars, trucks, trains, and aircraft. A typical picture of textile fibre glass is shown here.

Fig. 1: A typical picture of a large piece of textile fibre glass [6]

HEAT RESISTANCE AND INFRARED ABSORPTION

It is known that borates absorb infrared light in the electromagnetic spectrum. In domestic solar thermal heating systems, borosilicate glass tubes contain a solar collector that captures solar energy. The industrial version, also known as concentrated solar power, uses large-diameter borosilicate glass tubes that carry a heat-transfer fluid onto which mirrors focus sunlight. For solar water heating system, the evacuated solar collector tubes rely on the following: (a) tight control of thermal expansion, (b) the ease of formability, and (c) the durability and impact resistance of borosilicate glass. Some concentrated solar power generation stations in hot countries use large arrays of borosilicate collector tubes to gather reflected radiation from parabolic mirrors for the generation of electricity in steam-driven turbines. These tubes require careful matching of glass and metal thermal expansion and extreme durability in the demanding and remote conditions in which they are installed **[4,5]**. A typical array of borosilicate glass tubes is shown here.

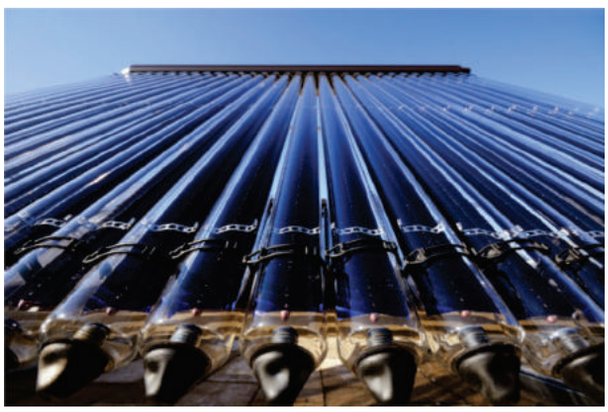

Fig. 2: A typical array of borosilicate glass tubes with Increased Strength and Chemical Resistance for this application [5].

CONCLUSIONS

Important properties of borosilicate glass, such as low thermal expansion and high chemical durability, have been highlighted. The use of boron that was quite expensive - restricting its use in borate compositions - has finally been very fruitful driving down its prices for the glass industry opening up the possibility for a host of new applications. Apart from its common use in a variety of application from medium to high tech domains, its specific use as textile fibreglass and as infrared absorption have also been presented here in the second part of this article on boron, borates and borosilicate glasses. In the future, some more modern applications will be described for borosilicate glasses.

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On the Spot... Sanjay Somany

Describing the company's move away from the float glass sector to focus on core hollow glass activities, HNG's Chairman and Managing Director, Sanjay Somany, spoke exclusively to *Glass Worldwide,* preferred international journal of the AIGMF.

GW: What was the motivation to recently sell the company's shares in HNG Float Glass to your joint venture partner, Sisecam?
The partnership with Sisecam was very successful. They are good people and it was a pleasure to work with them. We wanted HNG Float Glass to grow and I am now very confident that it will go from strength to strength, because that is the backbone of the deal agreed.

It was a similar situation to selling the HNG Global plant in Germany to BA Glass in 2016. At both points of time, we felt that we had good value for our equity and it was a sensible option for all parties. Our family believes it must always be a win-win situation for us to move away. For us, continuity of business is a prime mover, so if we were not completely sure that the partner would progress the business and sustain the people, we would not consider selling.

We have great pride in what was achieved at HNG Float Glass and the company will continue to do well.

GW: Are there any plans for HNG to return to the float sector in the future?

HNGIL recently the completed the sale of its shareholding in HNG Float Glass to joint venture partner Sisecam.

We have not even considered this but if we did, we would ideally go back to Sisecam because they were great business partners and I enjoyed working with them.

GW: So HNG is now focusing on its core business in the Indian glass container sector?
Container glass is obviously our primary business and will continue to be so. Despite the big challenges in the market, we are now at least able to get higher volumes out of the door, even though the bottom and top lines are still under pressure. In my interview with *Glass Worldwide* two years ago when I described the difficult market conditions as a 'blip', we subsequently encountered many additional factors such as, for example, 'demonetisation', currency availability and the liquor ban within 500m of the highway. Recent transport strikes have also hampered getting raw materials to our factories.

These factors made irreparable holes in the business at that time; industry in general suffered and everybody in the glass industry had their fair share of worries.

GW: How is HNG adapting its business to meet such challenges?
Our main priority currently is to maximise the situation and make sure that the prices are remunerative. The price increase in energy, for example, has been more than 40% but it's basically impossible for us to pass that on of course. ▸

Sanjay Somany describes Glass Equipment as HNG's backbone.

According to Sanjay Somany, HNG remains committed to improving fuel efficiency, as well as reducing emissions, NO_x, SO_x and water disposal costs etc.

Originally published in Glass Worldwide, preferred international journal of AIGMF

Speakers at last July's Central Glass & Ceramic Research interactive conference session, covering the 'Role of Publications in Brand Promotion', together with AIGMF and CGCRI dignitaries.

The Indian container glass industry has not been easy for eight years and going forward, there will be more challenges. It will take time for rapid improvement but the industry will recover because we can see the perils of plastic all around us and things are moving dynamically in that respect.

GW: How are your suppliers of machinery and technology assisting you with improving efficiency in the glass container manufacturing process?
To help cut costs of production, maximise yields and produce better glass at a lower cost, we are constantly looking for not only advanced products and services but also knowledge and expertise from suppliers. At this point of time especially, such offerings are very important and many suppliers are stepping up to the mark. We have to look at the whole bandwidth of the process, starting with raw materials, all the way through to packaging and shipping. Everything can be improved.

Cost efficiency is something that drives every business and we have to work harder and harder on it in the current environment. In areas such as maintenance, we are also investing in multiple ways to ensure the business could not do any better, considering the market conditions. There is a lot of innovation behind the scenes.

Quality can never be cut. We have to keep improving the top quality that HNG is already renowned for; our customers still take that for granted and that's a really important perspective.

Sanjay Somany was among the speakers at a recent Central Glass & Ceramic Research interactive conference session, covering the 'Role of Publications in Brand Promotion'.

Sanjay Somany congratulates Sushil Jhunjhunwala on winning the inaugural C K Somany Glass Award.

GW: During these challenging market conditions, are you able to continue dedicating significant resources to reducing HNG's carbon footprint?
Very much so. In terms of fuel efficiency, emissions, NO_x, SO_x, water disposal etc, we look into every item in great detail to see exactly how it can be lowered. Even though we are already better than industry standard, that doesn't mean we can't improve further.

My late father, C K Somany, always said you have to commit to leaving the planet in at least the same condition as when you arrived! That's our challenge, because the world is not currently running on a sustainable situation.

GW: Are you particularly pleased with any recent product launches?
A recent launch of a new Pepsi bottle was very successful and I entirely credit one of our students with that. She designed the bottle and discussed how it should be launched. Ultimately, it was produced and tested in front of her and that's a great example to others. She is one of my best students.

GW: Providing services from design to manufacture of fully automatic glass forming machines and related engineering products, what are the latest developments at subsidiary company, Glass Equipment?
Having been successfully rebuilt from the ground up, Glass Equipment is now HNG's backbone. The company will guide us through to tomorrow and in the long-term, it will stand us apart. With our specialisation, we can already compete with the best in the world.

With a powerhouse of knowledge, our team has worked ceaselessly on not only upgrading equipment but offering expertise in all areas of the glass manufacturing process. The pride in the team is phenomenal and there is a real perfectionist attitude throughout, instilled by the company's Vice President, Bharat Somany. Every member of the team is a specialist by himself.

Throughout the world, there is a realisation that machinery can make a real difference in the whole production process, never more so than when encountering the current cost pressures. The capabilities of Glass Equipment can be huge and the whole world is potentially a market for this business. ●

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Originally published in Glass Worldwide, preferred international journal of AIGMF

Indian refractories industry update

Including exclusive interaction with a number of leading players, Sunder Singh presented an overview of the Indian refractories industry in *Glass Worldwide,* preferred international AIGMF journal.

In the constantly changing world of glass manufacture, to say that refractories play an important role would be an understatement. In fact, refractories are one of the most vital components in glass production. Glass furnace refractories have to endure severe environmental conditions throughout a campaign and proper selection is vital for the quality of glass and the length of campaign. Thermal shock, physical wear, high temperature and corrosive chemicals are parameters affecting the refractory and hence, furnace performance.

Much like the global refractories industry for glass, Indian suppliers have undergone a number of changes in recent years. Reducing specific consumption, the entrance of specilised producers and wider ranges of refractories available from leading producers have made the industry very competitive.

The improvement of refractory materials has played an important role in reducing specific refractory consumption per ton of glass produced and increased furnace performance. The latter factor has also led to much higher melting temperatures and allowed a much higher throughput of molten glass.

India is also following the global trend of falling specific refractory consumption in the glass industry. A figure of 5.4kg per ton of glass produced is still significantly higher than the global average of 3.8kg per ton but a huge reduction of nearly 3kg per ton has been made since 2009-10, when *Glass Worldwide* presented its last overview of India's refractories industry.

Conventional products are losing ground, while customer-driven product designs are gaining importance. Furthermore, there is increasing demand for total refractories solutions.

"Consumption of refractories in the glass industry is generally decreasing with an increase of campaign life expectation" confirmed Carlo Ratto, CEO of Fused Cast Technologist, one of the leading stakeholders in glass industry refractories. "Modern float glass furnaces are projected to last about 15 years and technology increases could potentially increase that lifespan again. But with the possibility of furnace technology becoming obsolete, there is little minor interest in increasing that lifespan.

Application	Requirements	Recommended refractories
Crown	Volume stability, low permeability and high refractoriness	Super duty silica bricks
Superstructure	High thermal shock resistance, corrosion and erosion resistance	Zirconia-mullite bricks, mullite bricks
Lower sidewalls	Corrosion resistance	Zirconia-mullite bricks
Bottom paving	High refractoriness under load, corrosion resistance	Fused cast AZS refractories
Insulation	Low thermal conductivity, robust mechanical strength	Silica insulating bricks
Safety layer	High refractoriness under load	High alumina bricks
Repair	Good thermal shock, corrosion resistance	Fused silica bricks, ramming and patching masses

Refractories for different parts of the glass furnace.

Application	Requirements	Recommended refractories
Port lining	Erosion resistance	Fused cast AZS refractories
Chamber crown	Volume stability, low permeability, high refractoriness	Super duty silica bricks, fused mullite bricks
Chamber wall	Alkali resistance	96-98% magnesite bricks
Ride arch, lower wall	Alkali resistance	Andalusite bricks

Refractories for a regenerator.

	2016-17	2015-16	2014-15	2013-14	2012-13	2011-12	2010-11
Production (tons)	NA	1,136,289	1,199,871	1,159,467	1,284,654	1,415,081	1,346,159
Volume growth	NA	- 5.29%	3.48%	- 9.77%	- 9.21%	5.11%	6.23%
Sales turnover (in 000,000s)	NA	667,186	654,007	607,570	569,559	545,822	485,966
Value growth	NA	2.01%	7.64%	6.67%	4.34%	12.31%	26.09%

Refractory production in India over the years. Source: Indian Refractory Manufacturers Association (IRMA).

Originally published in Glass Worldwide, preferred international journal of AIGMF

glass WORLDWIDE

Modern glass container furnaces have a life expectation of about 12 years. This is slowly growing in a global glass market segment showing a very moderate growth (less than float). In general terms, as a result the fused cast refractories market is stagnant, with very moderate or no growth."

A key executive from the country's largest refractories producer, TRL Krosaki Refractories Ltd, confirmed that the Indian glass industry is going through number of key challenges. "In addition to a slowdown in the domestic market, glass producers are under pressure to enhance furnace life, achieve high productivity and energy efficiency. In such a scenario, refractory suppliers need to accelerate the development of higher technology and improve product quality. We (refractory producers) need to have closer association with technology providers in the glass industry to render complete refractory solutions to meet these demands."

Fused cast refractories in particular have gained a significant market share in recent years. "The global volume is around 100,000 tons per year" Carlo Ratto confirmed. "It sounds a very small amount if you compare with general refractories but there is a very opaque area in China where assumptions might be a bit conservative and again for China, the capacity of fused cast manufacturers is overwhelming if you compare with actual manufacturing levels. After China, the major utilisation is possibly the EU, then North America, non-China Far East and South Asia. Absolute numbers are relatively confusing, since consolidation has affected the global glass and refractories multi-nationals."

Saint-Gobain SEFPRO

Among the glass industry's major suppliers, Saint-Gobain SEFPRO is a pioneer in the manufacture of fused cast and sintered refractories. With seven worldwide manufacturing locations, the company is one of the largest producers of refractories for various types of glass melting furnaces.

SEPR Refractories India, a 100% subsidiary of Saint-Gobain SEFPRO, came into being in April 2002, when it acquired the Palakkad, Kerala refractory manufacturing unit from CUMI. The company added a new manufacturing unit at Palakkad in 2009, followed by the addition of a plant at Perundurai in Tamil Nadu. This plant was set up in a 'Special Economic Zone' to cater mainly for export orders. It has an installed capacity of 8000 tonnes for alumina and AZS products.

The company's manufacturing capacity for fused cast refractories is 10,000 tonnes/year and 3500 tonnes/year for sintered refractories. The combined capacities of the Perundurai and Palakkad plants makes SEPR Refractories India one of the world's largest producers of fused-cast refractories at one location. Serving a wide range of glass industry markets, including container, flat, specialty, tableware and fibre, the company says its Indian refractories plants follow universal SEFPRO standards, with the sintered product plant's technology modeled directly on the Savoie Refractaires sintered plant in France.

"In India, fused cast refractory products are only produced at SEPR India plants" Mr R A Rathod from the SEFPRO India sales team confirmed. "The quality of refractory products from our Indian plant is close to the SEFPRO European standard." Only about 10% of total output from Indian operations goes to domestic glass producers, with the rest exported to the EU and USA.

RHI AG

Global refractories major, RHI entered the Indian market by acquiring a majority stake in leading Indian refractory producer, Orient Refractory Ltd. In January 2013, RHI purchased 43.6% of the total share capital of ORL and a further 26% by the end of April 2013 via an open offer through its subsidiary Dutch US Holding BV in the Netherlands. The transaction value for 69.62% totaled approximately €50 million.

RHI produces refractories for the glass industry under the Monofrax and Refel brands and has served the refractory needs of leading glassmakers in Europe and the Americas for many years. Although currently RHI does not produce refractories for the glass industry at its Indian plants, a future production facility dedicated to glass has not been ruled out.

TRL Krosaki Refractories Ltd

TRL Krosaki Refractories Ltd is a 51% subsidiary of Krosaki Harima Corp of Japan after Tata Steel Ltd, the erstwhile parent company, sold its majority stake in the business. Other shareholders include Tata Steel (~27%) and Steel Authority of India Ltd (~10%).

The company is the largest manufacturer of refractories in India. It offers a comprehensive range of products covering all grades and shapes for industries like glass, steel, copper, cement, aluminium, petrochemicals and other non-ferrous industries. Refractory engineering and management services are also available.

TRL is one of the world's largest manufacturers of dolomite refractories and is the leading supplier of silica refractories for glassmaking and for coke ovens. The company has strategically located manufacturing plants in Belpahar (Orissa), Salem (Tamil Nadu) and Jamshedpur (Jharkhand).

Industry	Percentage of refractory consumption
Steel	69.2%
Cement and lime	7%
Ceramics	6%
Glass	4.8%
Chemicals	4%
Non-ferrous metal	3%
Others	6%

Market segmentation of refractories by industry in India.

CUMI

Indian company, CUMI (Carborundum Universal Ltd) is an important player in the delivery of refractories for India's glass industry. Created in 1954 as a tripartite collaboration between the Murugappa Group, the Carborundum Co, USA and the UK's Universal Grinding Wheel Co Ltd, CUMI ventured into manufacturing refractories in 1965. The company has a cumulative installed capacity of 36,000 tons of refractory products (6000 tons/year of bonded refractories and 30,000 tons/year of monolithics).

In 2012, CUMI entered into a techno-commercial agreement with UK-based refractory producers Sheffield Refractories and Anderman Ceramics to manufacture, supply and install a range of high end refractory solutions for the glass industry. These products are manufactured at CUMI's plant at Ranipet. Sheffield Refractories is a leading producer of specialised refractories, while Anderman Ceramics is a leading international distributor of technical ceramic parts and components, with operations in the UK, USA and in France.

Dalmia OCL

The refractories business of Dalmia Bharat Group comprises two specialty companies – OCL Refractories and Dalmia Refractories Ltd. Established in 1954 as a unit of OCL India, OCL Refractories is a leading refractory supplier to domestic and export markets. Set up in 1959, Dalmia Refractories (previously Shri Nataraj Ceramics and Chemical Industries Ltd) is a pioneer in high alumina refractory bricks.

The group's refractories business has four manufacturing plants in India, one in China, a technology centre and sales representatives at strategic locations around the world. The business provides a wide range of refractory products and services to glass and other industries.

Imports

Despite significant local manufacturing capacity, imports account for about 15-18% of total refractory sales to the Indian glass industry. These products are imported mostly from China. ●

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glass WORLDWIDE

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Specialty glass and optical fibre R&D focus in India

The history and present-day activities of India's CSIR-Central Glass and Ceramic Research Institute are discussed in the following contribution that originally appeared in *Glass Worldwide,* preferred international AIGMF journal.

During the late 1940s, it was decided to create a national institute dedicated to glass science and technology for India, located in Calcutta. The Central Glass and Silicate Research Institute came into being in 1950 and was later renamed the Central Glass and Ceramic Research Institute (CGCRI).

CGCRI was one of the first four laboratories set up under the Council of Scientific & Industrial Research (CSIR), established in 1942 with leading industrial scientist Shanti Swarup Bhatnagar at its helm. The mandate of CSIR was to bolster competitiveness of the Indian industry and cater to the needs of the nation's manufacturing sector.

Initially, most of the work at CSIR-CGCRI was directed towards identifying suitable mineral resources within the country and their suitability for specific product development. Quality control aspects in glass and ceramics received attention, together with work on glass forming machines and glass-lined equipment. As a logical continuation of the work carried out in the 1950s, the organisation's development during the following decade marked a very important milestone in the history of economic development in India.

The development of various types of optical glasses brought CSIR-CGCRI into the limelight in the international arena.Years of technology denial to India's defence, space and atomic energy sectors served as an impetus to develop a core knowledge base in these sectors. Optical glasses for use in lenses and prisms for specialised strategic applications were among the earliest areas of focus. Emphasis was on evolving an indigenous process technology that enables import substitution.

Among the organisation's other major advances during this period were the creation and casting of radiation shielding glasses for atomic energy establishments. Eventually, the R&D efforts emerged as the key backward linkage for major technological missions in atomic energy, defence and space that accelerated the ingenuity of product/process development and import substitution for raw materials and components. This trend continues to the present day. Specialty glasses, optical fibres, lasers and functional materials are among the core domains that form the backbone of the institute.

With the establishment of an Academy of CSIR (AcSIR), tailored courses are offered in advanced glass science and technology, thereby paving the way for effective capacity strengthening.

Specialty glasses

Specialty glass development constitutes a major activity at CSIR-CGCRI, in view of the country's demand for various civil and strategic applications. A state-of-the-art facility exists within the institute for melting, forming and characterisation of specified properties of different glass varieties. Upscaling with pilot-scale production is also taken up to meet indigenous demand.

Nuclear installations use specialised glass windows for viewing the nuclear assembly lines while shielding radioactive exposure to the working areas. Such glasses, characterised by high density and radio opacity, known

Figure 1: Manufacturing specialty glass.

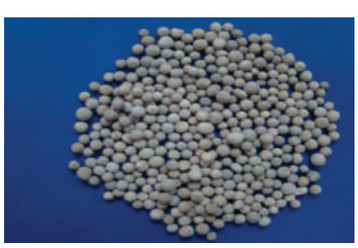
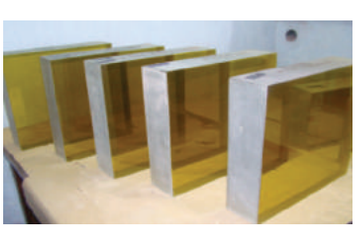


Figure 2: Specialty glass beads for nuclear waste immobilisation.



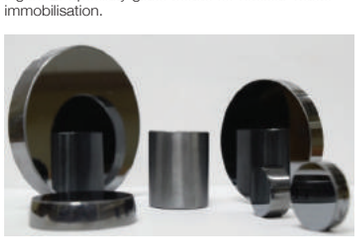
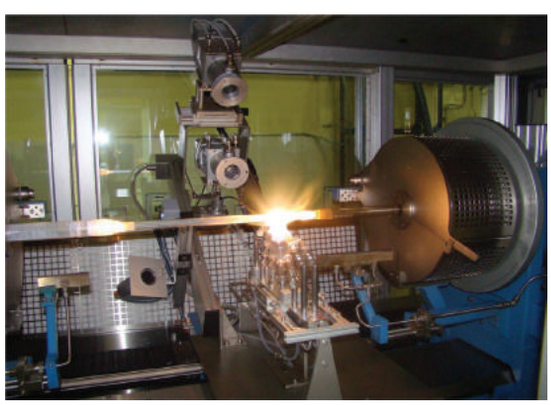
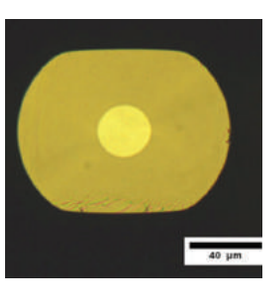
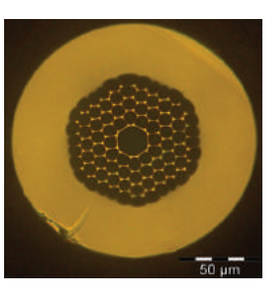
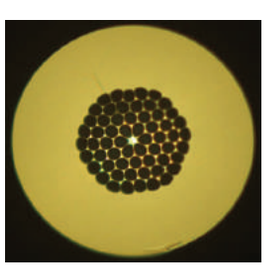


Figure 3: Finished RSW glass blocks and chalogenide glass blanks.









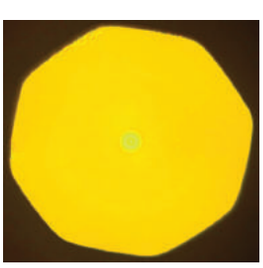


Figure 4: Specialty optical fibres produced in-house. The production facility (top) and a cross-section of specialty optical fibres.

Originally published in Glass Worldwide, preferred international journal of AIGMF

glass WORLDWIDE

Dave Fordham of Glass Worldwide, preferred international journal of the AIGMF, was greeted by CSIR-CGCRI dignitaries last July.

The CGCRI and AIGMF interactive session in Kolkata attracted figureheads and stalwarts from the Indian glass industry.

as radiation shielding window glasses represent important technological challenges in terms of their design, processing and manufacture. Starting from lab-scale development, over the years CSIR-CGCRI has perfected the process of development of blocks of desired sizes ad quality (figures 1 and 3). A pilot-scale facility exists that caters for special requirements. Indigenous development of the glass has been a notable contribution towards the country's self-capability building.

Radioactive waste in nuclear installations pose a significant health and environmental threat and warrant innovative containment techniques. CSIR-CGCRI has developed the process technology to make specialty glass nodules (frits) with specific properties using a borosilicate glass composition that can immobilise the wide spectrum of the fission elements by interring the elements into the structure of certain glass materials (figure 2). While the random network structure of the glass provides an ideal platform for the immobilisation process, the material used for this purpose has a special composition with stringent physical, mechanical and electrical properties. The materials are amenable to form nodules of desired sizes and flow properties and are endowed with properties to avoid corrosion of the melter during fixation of the waste. This flagship technology has been transferred for commercialisation.

CSIR-CGCRI has developed a moderate-scale production facility for chalcogenide glasses. These infra-red (IR) transmitting glass materials are formed from one or more chalcogen elements such as sulphur, selenium and tellurium in combination with other elements such as Ge, As, Ga, Sb, Si, P etc. Known for their extended infrared transmission up to 20µm, these glasses are indispensable for IR optical components, especially for thermal imaging applications. Conventional thermal cameras use lenses made of single-crystalline germanium or polycrystalline zinc selenide. The chalcogenide glasses are the best alternatives that are relatively cheaper and provide superior performance in terms of higher working temperature, wider IR window and lower thermal coefficient of refractive index (figure 3).

Different approaches to glass melting

Inherent challenges and technical bottlenecks associated with glass melting techniques have encouraged institutions to search from different approaches through innovative methods. While conventional melting techniques are increasingly perfected, the institute has embarked on developing capabilities for the microwave melting of glass. Shorter processing time (20-30 minutes compared to three-four hours in conventional processes) and significant energy saving are hallmarks of this process. This is also associated with maintaining a lower redox ratio for iron to enable low IR transmittance, which has led to the development of heat absorbing glasses.

Heat absorbing glasses effectively absorb wavelengths beyond the visible spectrum and are used mainly in illuminating equipment to absorb heat, which is emitted from a light source. CSIR-CGCRI has an established programme for the development of such glasses.

Anti-reflective coatings

CSIR-CGCRI has developed anti-reflective cum hydrophobic coatings on textured solar cover glass to obtain better light conversion efficiency. Field trials are ongoing, with a solar module built in-house to demonstrate the technology.

The institue has also developed refractive index (RI) controlled coatings on plastics, acrylics, ophthalmic glasses and sheets that have scratch-resistant properties. These coatings could have applications on solar panels, railway locomotive windscreens etc.

Specialty optical fibres

The Fibre Optics Laboratory at CSIR-CGCRI has a long history of research on the fabrication of silica-based optical fibre. The institute initiated R&D on fibre optics in the early 1980s towards establishing an indigenous capability of fabricating different fibre types.

With an initial funding from CSIR, a group of scientists, engineers and technicians came forward to build up a facility for fabricating preforms by the MCVD (modified chemical vapour deposition) technique and the subsequent drawing of fibres. The main focus was application-oriented research. With the growing application of optical fibres in several important areas, the activity has now been expanded in the field of specialty optical fibres, with particular emphasis on fibre-based components and devices.

Last July, CGCRI and AIGMF jointly organised an interactive session in Kolkata, covering the role of publications in brand promotion.

The interactive session covered the role of publications in brand promotion.

Fibre lasers

Fibre lasers, endowed with properties of output power stability and excellent beam quality at high output powers, have made them technologies of choice for a variety of sectors, replacing conventional laser systems. Despite high market demand, the product continues to be imported.

CSIR-CGCRI has been instrumental in establishing a comprehensive fibre laser facility that includes preform and fibre fabrication, laser design and characterisation and making packaged modules.The process technology of vapour phase doping has been successfully demonstrated for fabricating rare earth doped preforms/fibres, suitable for high power fibre laser application.

Indigenous technology development is in progress to build up fibre laser systems, both continuous wave and pulsed at 1μm and 2μm wavelengths for industrial and medical applications (figure 4). A number of patents have also been filed in this area.

Fibre Brag gratings

Optical fibre Brag grating-based sensors with high precision and reliability have been developed at CSIR-CGCRI for structural health monitoring and industrial process control. Smart pantographs for online health monitoring of overhead infrastructure of railways, FBG-based distributed temperature monitoring of air preheaters in thermal power plants and online temperature monitoring of moulds in billet casters during continuous casting of steel are some of the established applications.

A comprehensive facility exists for writing of the gratings in-house, including packaging for the targeted applications. The demand for such optical sensors is on a steady rise in India (figure 5).

Optical fibre amplifiers

CSIR-CGCRI has an array of patented technologies and products related to optical fibre amplifiers. Erbium doped fibre amplifers for cable television, C-band optical amplifiers and double-clad Erbium-ytterbium doped high power amplifier (EYDFA) are some of the key technologies and products developed under this initiative.

The mid to high power EYDFA modules are of great potential for LIDAR, CATV and free space communication. Such specialty fibres produced in-house are already in use for making products and devices in collaboration with industrial partners, in readiness for being exploited commercially.

Photonic crystal fibres

Photonic crystal fibres (PCFs) have extended the range of possibilities in optical fibres by improving already established properties, as well as introducing new features. CSIR-CGCRI has a state-of-the-art facility for fabricating both solid and hollow core PCFs following an indigenously developed (patented) PCF fabrication process.

Nonlinear PCFs designed and fabricated at CSIR-CGCRI have led to the development of completely packaged supercontinuum (SC) light sources in collaboration with an industrial partner for biomedical applications. The spectrum of the source extends from 500nm to 2200nm, thus spanning the entire visible and near-IR region.

Recently, hollow core PCFs are being developed for efficient high power infrared laser delivery, as well as mid-IR SC generation for exploiting exciting prospects in industrial and biomedical fields (figure 4).

As glass and optical fibre technologies continues to evolve, CSIR-CGCRI continues to reposition and sharpen its capabilities to remain competitive and relevant amidst the growing demands of globalisation. ●

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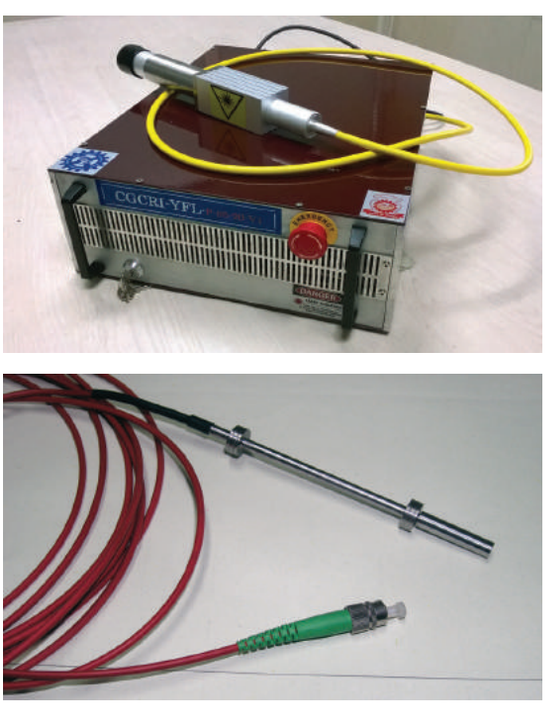

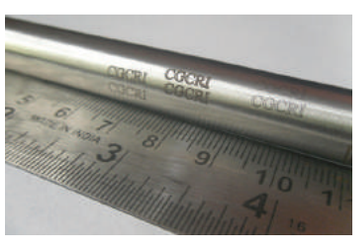

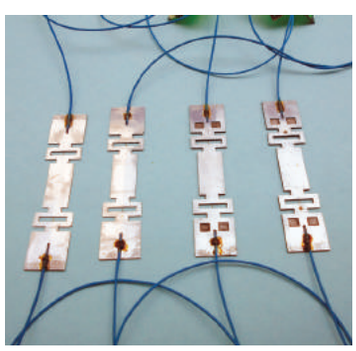

Figure 5: Pulsed fibre laser module for marking and engraving on metal, EDFA module for CATV application, instrumented pantograpgh with FBG sensors.

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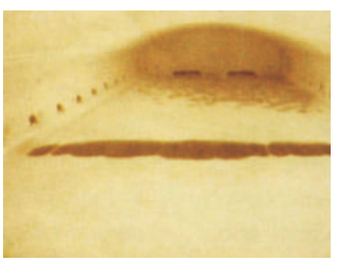







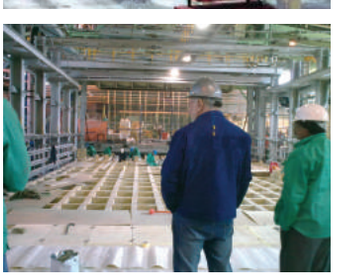

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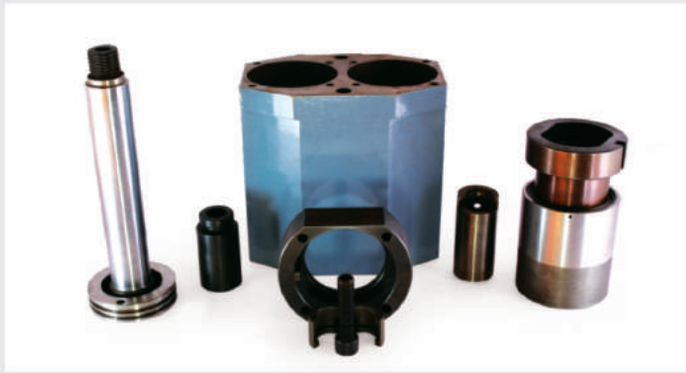

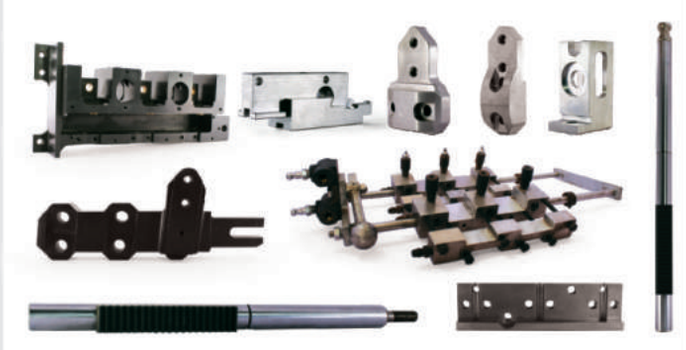


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Green Building Congress 2018 evokes excellent response

Focused on the theme- 'Green Built Environment for People & the Planet'

(Oct 31- Nov 1, 2018)

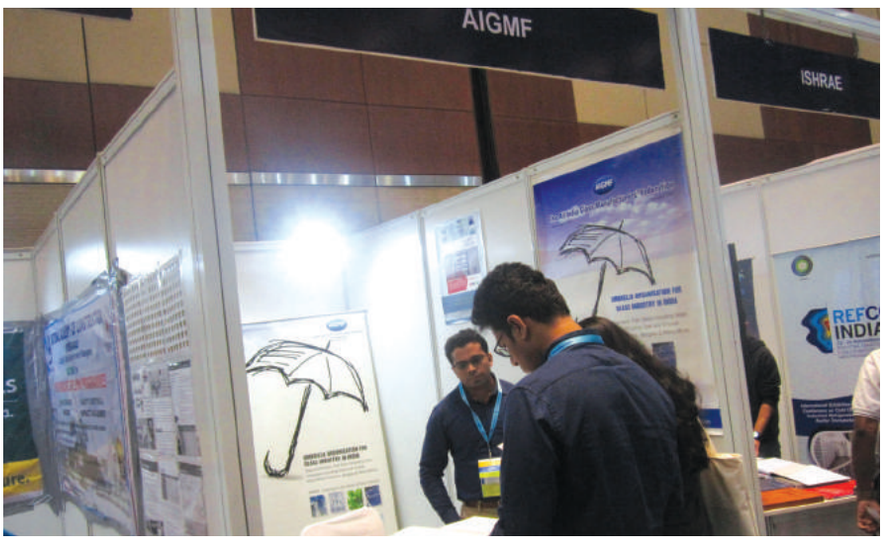
AIGMF participated as one of the Supporting Associations

Playing a catalytic role in accelerating green building movement in India is CII-IGBC's annual flagship event- 'Green Building Congress'. This is one such annual event where national and international stakeholders from the construction industry converge to share & learn the latest and emerging green building technologies and forge new partnerships. The event has grown significantly in terms of content, outreach and participation, etc.

The 16th edition of Green Building Congress 2018 which was organised on Oct 31 - Nov 1, 2018 at Hyderabad, evoked excellent response from the stakeholders and delegates. Broadly Green Building Congress 2018 featured- Conference and Exhibition and focused on the theme- Green Built Environment for People & the Planet'. Discussions, deliberations weaved around this theme. Green Building Congress 2018 had the honour of Mr. Hardeep Singh Puri, Hon'ble Minister of State (Independent Charge), Ministry of Housing and Urban Affairs, Government of India who gave address at the inaugural session on Nov 1, 2018.

Appended are the highlights of Green Building Congress 2018:

- Government of Telangana was the Partner State
- Participation of Mr. Shailendra Kumar Joshi, IAS Chief Secretary and other senior Government officials from Government of Telangana



- Hall of Fame award posthumously presented to Dr. Prem C Jain
- 2,750 National and International delegates
- 8,800 visitors to International exhibition
- 125 National and International speakers
- Concurrent sessions on green & smart cities, green hospitals, green landscapes & biodiversity, green homes & affordable housing, green products, materials & technologies
- Presence of Ms. Lisa Bate, Chair, WorldGBC; Ar. Tai Lee Siang, Immediate Past Chair, WorldGBC; Mr. Raymond Rufino, Chair, Philippine Green Building Council
- Launch of 3 IGBC green building rating systems- Net Zero Energy Buildings, Hill Habitat and Resorts- taking the total number of rating systems launched by IGBC to 25
- Launch of GreenPro Certification Standard for Lighting System
- Launch of Green Building in India- Coffee Table Publication: Vol: 3
- 158 projects awarded with IGBC green building rating. IGBC plaque and certificate presented
- Awards presented to winners of Green your school contest and IGBC green design contest
- Awards presented to winners of IGBC Green League quiz contest
- Screening of eco-films for architectural and engineering students
- Publishers corner for sale of books on environment ■

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Mr. M.D. Farooq, the founder of Umda Enginering, brings to the table more than 35 years of expertise in the manufacturing industry. Starting from humble beginnings, today more than 350 of Mr. Farooq's Lehr machines are successfully installed around the world.

Mr. Farooq is best recognised as one of the co-founders of TNF Engineering, a company known across the industry as not only the leading manufacturers of Metallic Wire Conveyor and Lehr belts but also of Glass Plant Equipment. This mantle of superior performance and expertise has now been passed on to Umda Enginering.

Belts

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Speed, reliability and flexibility in glass container inspection

Heye International presents the latest glass container inspection technology. SmartLine 2 generation starwheel inspection successfully combines speed, reliability and flexibility to deliver accurate results.

Smart Line 2 is the latest generation of Heye's star wheel inspection machine series. Developed and manufactured at Heye International's dedicated Cold End Centre in Nienburg, Germany, SmartLine2 glass container inspection equipment can be configured in several different ways, with up to six inspection stations available. The Nienburg facility employs a team of experts and features a modern production layout. Importantly, the centre is close to the Ardagh Group's Nienburg glassworks to undertake essential testing work.

IMPROVED JOB CHANGE TIMES

The application of servo technology results in a high degree of flexibility. Fast and easy changes to an item's indexing positions and optimal use of the servo torque for up to four rotation stations are possible. Optimised motion sequences allow faster reactions to changing process parameters. The equipment's innovative design and its large and easy-to-open hood provide more working space between the inspection stations. Job changes become much easier.

The maximum article height accommodated is 400 mm (up to 500 mm on request), with angular, oval and round containers processed. Thanks to the servo-driven star wheel, indexing positions from six to 48 are possible.

TOOLING COMPATIBILITY

The enlarged working radius guarantees a high compatibility with many existing tooling sets on the market. The tooling range includes a body star wheel, neck star wheel, out feed guide, centering piece, plug/gauge, stripper and infeed screw.

FLEXIBLE INSPECTION OPTIONS

Among the Smart Line 2's highlights are faster job changes, thanks to the equipment's improved design and accessibility, the potential to use existing tooling sets and its enhanced user interface. Full data connectivity to all plant information systems is possible, with easy integration into existing lines. As well as featuring the latest non-contact inspection innovations, the equipment benefits from outstanding control reliability to avoid downtime.

Depending on the customer's requirements, various container characteristics can be checked:

- Tightness
- Finish diameters
- Container height

- Finish and shoulder checks
- Bottom and heel checks
- Body checks
- Wall thickness inspection (non-contact)
- Defects on the finish surface (LOF - line over finish)
- Out-of-round, body diameter
- Mould number reading (dot code and alphanumeric)
- Dark check inspection

In addition, the latest non-contact inspection features are integrated, as well as a self-learning system for camera-based check detection.

RELIABILITY AND ROBUSTNESS

It is essential for innovations to stand the test of time. In the case of many 21st Century developments, this requirement is achieved by the use of robust industrial electronics and a climate-controlled electrics and electronics compartment, together with high quality components. A touchscreen monitor, simplified access to all electronic components and an extricable mounting plate for frequency inverters and servo controllers enhance operational usability. Hazard-free working conditions for the operator is provided by a microprocessor-controlled safety module.

The machine sets the standard in terms of reliability and robustness. The user interface has been improved and makes job changes as easy as possible. Both the mechanical design and also the control unit are extremely reliable and easy to operate.

The largehood gives optimal access to the working space, reducing job change times to a minimum.

POSITIVE FEEDBACK

Feedback generated from Heye International customers has confirmed the Smart Line equipment's robustness and reliability. The mechanical design and drive system in particular are highlighted for their robust design, while the control system is praised for its reliable operation.

FURTHER INFORMATION:

Heye International GmbH, Obernkirchen, Germany

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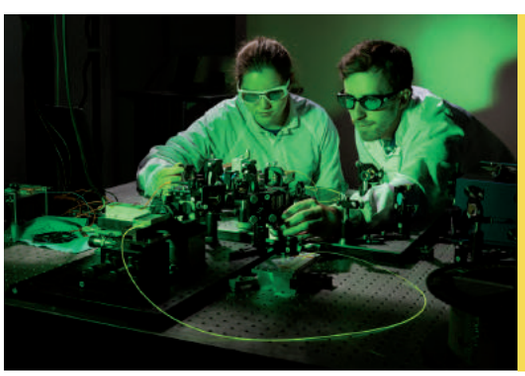

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THEME:
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AIGMF will participate as one of the Supporting Associations

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- » DEVELOPERS
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