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# Kañch

Quarterly Journal of **THE ALL INDIA GLASS MANUFACTURERS' FEDERATION**

Vol. 1, No. 4, January - March, 2014

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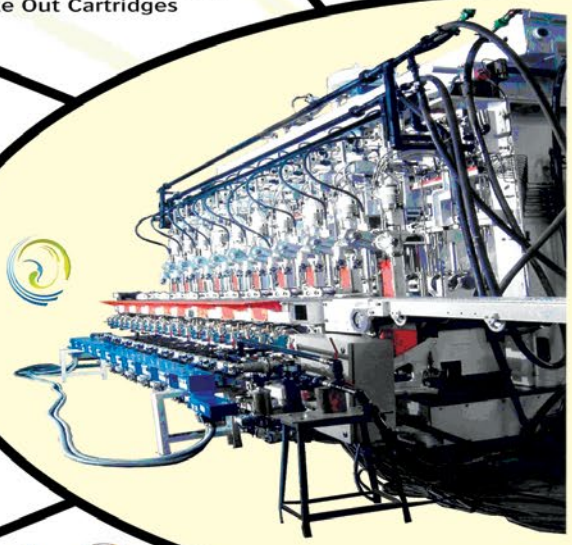

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# From President's Desk

Mr. Manohar Lal, Secretary AIGMF retired after rendering over 24 years of service to the Federation. In a function organised to bid farewell to Mr. Lal on Jan 4, 2014, senior Members of the Federation expressed their appreciation for his sincere and dedicated service to the Industry.

The Energy and Resources Institute (TERI) had undertaken a study to explore the potential of few energy intensive industrial sub sectors for their inclusion under the next phase of ongoing Perform Achieve and Trade (PAT) Scheme of Bureau of Energy Efficiency, Govt. of India.

PAT scheme intends to encourage Designated Consumers (DCs) to enhance energy efficiency through a market based mechanism with an option to trade the additional energy savings in the form of energy saving certificates.

Glass was one of the sectors that were included in the study. AIGMF participated and provided inputs in the sectorial discussion organized at TERI Eco-Friendly Complex, Bangalore on Jan 28, 2014 on energy consumption in glass manufacturing sector in India and possibilities of glass sector inclusion in the next phase of PAT cycle.

As part of the Corporate Social Responsibility, Architectural Glass Panel of the AIGMF is working to adopt new Eco-Packaging measures for packaging and transportation of float glass. Dealers of the flat glass were invited from the National Capital Region / Delhi to brief on Eco-Packaging initiative being undertaken by Glass Industry. More such meetings are planned in Mumbai, Ahmedabad, Chennai and other regions.

AIGMF Secretariat is committed to work on Green projects showcasing environmental friendly aspects of Glass and its multifarious uses.■

S C Bansal
President AIGMF

and Managing Director, Adarsh Kanch Udyog Pvt. Ltd./
Advance Lamp Component & Table Wares Pvt. Ltd, Firozabad (UP)

# 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)-New Delhi

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 & objects 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 co-operation 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.■

**AIGMF Secretariat**

# Glass News INDIA

**Farewell to Mr. Manohar Lal** (Secretary AIGMF)

**Mr. Manohar Lal with Members of the AIGMF at the Executive Committee Meeting at New Delhi on Jan 4, 2014.**

*Mr. Lal joined AIGMF on July 1, 1989. He gratefully acknowledged members sentiments and thanked everyone for understanding and consideration shown to him. He also stated that his successful working during this tenure was because of close cooperation of Office Bearers, Members and Secretariat of the AIGMF.*

## GLASS INDUSTRY APPOINTMENTS IN CII NATIONAL COUNCIL: 2014-15

Mr. Mukul Somany, Vice Chairman and Managing Director, Hindusthan National Glass & Industries Ltd., have been elected in the Confederation of Indian Industry National Council from the Eastern Region whereas Mr. B. Santhanam, Managing Director, Saint-Gobain Glass India Ltd., will represent from the Southern Region for the year 2014-15.

The National Council consists of 40 individual members and 12 Industry Associations.

## GLASS PACKAGING NEEDS RESURGENCE SAYS SANJAY SOMANY

The Indian Institute of Packaging (IIP) oragnised its 16$^{th}$ edition of its National Packaging Exhibition INDPACK 2014 at Hall No. 6, Pragati Maidan, New Delhi between Jan 16-18, 2014.

The two-day National Conference was successfully organized at Hotel Shangri-La's Eros witnessing the gathering of over 300 people. The Conference was inaugurated by Mr. K. Chandramouli, Chairperson, Food Safety and Standards Authority of India, Government of India.

Mr. Sanjay Somany, Vice President and Managing Director, Hindustan National Glass and Industries (HNGIL) expressed a need of upturn for glass packaging while speaking at IIP's National Packaging Conference in New Delhi.

"Indian container glass market is estimated to be around USD 1.1 bn and is poised to grow at 13% CAGR driven by increasing urbanization, low per capita glass consumption and attractive cost economics due to refillable nature of glass," said Mr. Somany.

"310.5 bn units of glass packaging was sold through retail in 2012. It has seen 1.6% retail volume growth over 2011-12," said Mr. Somany.

Mr. Somany spoke about the ill effects of PET and Tetra packaging in regards to human health and environment and poised glass to be a better choice for packaging.

Citing a life cycle assessment study on container glass conducted by the All India Glass Manufacturers' Federation (AIGMF), Mr. Somany said, "In India, only glass is being re-used (30%). Glass is by far the most eco-friendly material while packaging is concerned."

Mr. Somany spoke about how HNGIL has reduced 7% weight of selected bottles under light weighting initiatives in 2012-13. "This has resulted into savings of over 2000 tonnes of $CO_2$," added Mr. Somany.

"Increased recycling and reduced weight environmental effects of glass can be reduced by 50%," concluded Mr. Somany.

## KARNATAKA STATE TO CONSIDER RECOMMENDATIONS OF GLASS GUIDELINES FOR INCLUSION IN BUILDING BYE-LAWS

Skylines of Indian metros are dotted with high-rise buildings clad in glimmering glass. The trend has been to use glass, just to get 'Hi-Tech', stylish, elegant, classy and sophisticated look. Glass, which has become a favored feature in the buildings now a days, has several advantages due to its inherited properties and merits. Apart from the aesthetic enhancement, use of glass reduces the dead weight of the building. Therefore, it will continue to be one of the popular, preferred and inevitable building material in time to come. It may however have impact on human safety, energy performance and acoustic effects of buildings hence need adequate attention.

Mr. Anwarul Huda, the then Hon'ble Member of Planning Commission, in the meeting held on Dec 12, 2008 stressed the need for safe use of glass in Buildings through appropriate Bye-laws.

Confederation of Construction Products and Services (CCPS) – a not for profit organization has developed "Guidelines on Use of Glass in Buildings – Human Safety' and promoting its implementation and adoption in the country.

Government of Karnataka recognized the importance of the issue, constituted an Expert Committee comprising of resource experts vide Government Order No. UDD 75 CSS 2013, Bangalore dated 28.06.2013 to look into the aspect of safe use of glass in buildings, study the recommendations of the Guidelines and recommend to Government suitable regulations in respect of human and fire safety applicable to cities and towns to be included in Building Bye-laws of the State.

To discuss and expedite the matter, Mr. Shashi Kant, Adviser and Mr. D. S. Sachdev former DG, CPWD and Tech. Adviser, CCPS had a meeting with Secretary, UD Dept., Director and Jt. Director, Town and Country Planning, on January 25, 2014 at Vikasa Saudha, Bengaluru and decided date for holding EC meeting.

First meeting of the Expert Committee was held on Feb 24, 2014 at Vikasa Saudha, under the Chairmanship of Mr. T. K. Anil Kumar, IAS, Secretary, Urban Development Department, Govt. of Karnataka which was attended by 15 participants which include Dr. Manjula N, IAS, Commissioner, Directorate of Municipal Administration, Dr. J. Ravishankar, IAS, Housing Commissioner, Karnataka Housing

Mr. T K Anil Kumar, IAS, Secretary, U D Dept., and Mr. S. B. Hunnur, Director, Town & Country Planning Dept., discussing Guidelines on Use of Glass in Buildings – Human Safety with Mr. Shashi Kant, Adviser and Mr. D. S. Sachdev, Former DG, CPWD & Tech. Adviser, CCPS on Jan 25, 2014

Board, Mr. G Jagadeeshan, Dy. Secretary, Urban Development, Mr. S. B. Honnur Director, Mr. Aijaz Ahmed, Joint Director, Ms. Shantala M. S., Deputy Director, Mr. Shivaramu K. P. , Asst. Director, Department of Town & Country Planning, Ms. K. N. Savithri, Dy. Chief Architect, Govt. of Karnataka, Ms. Sreedevi G., Deputy Architect, PWD, Ms. D. R. Asha, Sr. Asst. Architect, PWD, Ar. Vidyadhar S. Wodeyar, Chairman, Karnataka Chapter, Indian Institute of Architects, Prof. J M Chandra Kishen, Civil Engineering Department Indian Institute of Science, Mr. T Ramappa, M/s. Bearys Properties & Development Pvt. Ltd. and Mr. G M Ramesh Suthar, Bearys Group. Representatives of Saint Gobain Glass India Ltd., were also present.

Mr. Deepak Gahlowt, Convener and Mr. Shashi Kant, Adviser, CCPS gave the presentation and Members of the Expert Committee were acquainted about the salient features of the Guidelines and highlighted the need for expeditious inclusion of its recommendations in the Building Byelaws of the Karnataka State. Proposed conditions related to human and fire safety to be considered for Byelaws were presented and discussed in detail point by point. Most of the conditions/points were agreed by the Expert Committee. Expert Committee emphasized for making available in the market of authentic, genuine and real safety glass confirming to IS 2553 with indelible and distinct BIS marking. Glass facade buildings proving to be a threat to bird population was also pointed out for consideration and solution.

With the active intervention of Mr. T. K. Anil Kumar, IAS, Secretary, UD Department the matter is anticipated to be decided and implemented soon.

## SCHOTT KAISHA COMPLETES FIVE YEARS OF SUCCESSFUL CO-OPERATION

Schott Kaisha, has completed half a decade of successful partnership. Since its formation in 2008, this 50:50 joint venture achieved consistent growth at an average of 25% every year. Currently, Schott Kaisha employs approximately 1,600 people in its plants in Daman and Jambusar and its Mumbai office and supplies primary packaging material, like vials and ampoules, to many leading pharmaceutical companies in India. "We are happy to have met highest demands of quality and supply with maximum customer satisfaction. We remain committed to help our customers achieve their own growth and quality objectives in India as well as abroad. This motivates the Schott Kaisha family to strive for the next milestones," says Kairus Dadachanji, Managing Director of Schott Kaisha.

Building on its success, the company inaugurated India's first fully automated pharmaceutical packaging plant in Feb 2013 in Jambusar, Gujarat. This Greenfield facility, set up with an initial investment of 20 million € (136 crores INR), helped Schott Kaisha to increase its production capacity by almost 50 percent to around 2.4 billion pieces per year. With the first module nearing its full capacity by Jan 2014, the company is looking to further expand the production facility and hire over a 100 people, bringing the total figure to more than 1700. The facility is housed in an area of 20 acres with ample room to construct additional production modules in parallel with the increasing demand of customers. ■

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

**Stakeholder consultation organized by TERI to share the finding of the study on exploring potential of Industrial Sub-sectors including Glass for inclusion in next phase of PAT cycle**

AIGMF at Sectorial discussion during stakeholder consultation at Bangalore on Jan 28, 2014

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# HIGHLIGHTS of the Interim Union Budget of India: 2014-15

- The fiscal deficit stood at 4.6% of Gross Domestic Product
- Food inflation remains a worry though it has declined
- $15 billion has been added in foreign exchange reserves in Financial Year 2014
- The Current Account Deficit is pegged at $45 billion for fiscal 2014
- The lack of any uptick in the manufacturing sector is worrisome, which is now proceeding without too many interruptions
- Spending on health seen at Rs. 36000 crore
- Rs. 3.36 lakh crore set aside for assistance to states in the upcoming financial year
- 296 projects worth Rs.6.6 lakh crore was cleared by the Cabinet Committee on Investment by the end of January 2014
- Rs. 29000 crore set aside for the Rail Ministry
- Allocation to defence sector increased by 10% to Rs. 224000 crore
- One rank one pension for the defence forces announced
- Rs. 11200 crore capital infusion into Public Sector Banks
- Moratorium period for all education loans taken prior to 2009 - up to 2014
- Food, Fuel, Fertilizer subsidy pegged at Rs. 2.46 lakh crore. Fuel subsidy accounts for Rs. 65000 crore of this figure; fertiliser subsidy is at Rs. 76000 crore
- Agricultural exports are seen at $45 billion
- Public sector banks' capital infusion higher than Rs. 11200 crore budgeted
- Over-reliance on cutting planned expenditure to achieve 3% of GDP by 2016-17 not positive for boosting growth potential
- Cars to be cheaper
- Excise duty on capital goods cut from 12% to 10%
- Excise duty cut from 12% to 10% for consumer durables too
- Direct Taxes Code (DTC) to be put on the website of the Ministry for public discussion
- Exports show recovery, to grow by 6.3% in 2013-14
- A 10% surcharge on incomes above Rs. 1 crore a year, which has been extended from Financial Year 2014 to Financial Year 2015
- Forward Contracts (Regulation) Act to be Amended
- 168043 Youth had Enrolled and 77710 completed their Training under National Skill Certification and Monetary Reward Scheme
- Excise duty on mobile handset to be 6% on CENVAT credit to encourage domestic production
- No changes in tax laws in interim budget
- GDP growth rate in Q3 and Q4 of 2013-14 will be at least 5.2 %
- Govt pegs investment rate at 34.8%; saving rate @ 30.1% ■

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

# Creating a float glass success story in India

Subhash Tyagi is Chairman and Managing Director of float glass producer, Gold Plus Glass Industry Ltd of Delhi and Chairman of the Architectural Glass Panel at the All India Glass Manufacturers' Federation. Mr Tyagi spoke about his company's rise to prominence and recent trends in the Indian flat glass industry. John Wallis reports.

Born and raised in the village of Muzzafarnagar, Uttar Pradesh, Subhash Tyagi is among the latest group of Indian entrepreneurs to create successful family enterprises in the world of glass manufacture. Together with his brother Suresh, he runs Gold Plus Glass Industry Ltd, a company that traces its roots back to 1985, when the original business (Jimmy Sales and Research) started to trade in various types of glass.

Today, Gold Plus Glass is described as the first 100% Indian-owned company to manufacture float glass, with a dedicated 470 tonnes/day production facility at Roorkee, Uttarankhand. In addition, specialist flat glass processing facilities are operated at Sonipat (Haryana) and Kala Amb (Himachal Pradesh).

Subhash Tyagi is the company's Chairman and Managing Director, while Suresh is Executive Director, with responsibility for production. They have worked together from the outset and have developed an effective management style. According to Mr Tyagi, as well as his brother, David Rose and Alok Modi of Gujarat Guardian Ltd have particularly influenced his glass industry career. "Their management system has been very effective and has always inspired me." In addition, at home, his wife Shashi provides valuable support. "Family is a permanent support that you can always rely upon and with a growing company, you need that" he confirms. His son, Jimmy Tyagi, is Executive Director of the company and has also recently been appointed Vice President of the Northern India Glass Manufacturers' Association, one of the regional associations of the AIGMF.

Subhash Tyagi is Chairman and Managing Director of float glass producer, Gold Plus Glass Industry Ltd.

Jimmy, Subhash and Suresh Tyagi are all involved in the day-to-day running of Gold Plus Glass.

## PRODUCTION CAPABILITIES

Having traded glass since 1985, Gold Plus Glass Industry Ltd started to process automotive and architectural glass in 1996, before becoming a float producer in 2009. Today, the company manufactures between 15% and 17% of all clear float glass currently made in India. Clear, mirrored, frosted and on-line reflective substrates are offered.

For architectural customers, Gold Plus manufactures toughened, bent-toughened, heat strengthened, bent, ceramic fritted and heat-soaked glasses, as well as laminated, acoustic, burglar-resistant, bullet-resistant and insulating products. And for the automotive sector, the company produces windscreens, side- and backlites, predominantly for the local replacement market. Most output is sold to domestic customers, with small quantities exported to neighbouring Nepal and Bangladesh.

A multi-national cross-section of leading suppliers were involved in the design and construction of the float line, including Fives Stein, Grenzebach Mashinenbau, ISRA Surface Vision, Lahti Precision and Youhua. In terms of processing equipment, CNC cutting lines were sourced from LiSEC and Technometal, while grinding and polishing machines came from Glaston (Bavelloni) and Schiatti Angelo, with washing machines from Bassara Machine Tools and insulated glazing lines from LiSEC and Ekang of South Korea. Glaston (Tamglass), South Glass Technology and Landglass Technology (both Chinese) have delivered horizontal toughening and bending furnaces and a Bimatech work station is responsible for the creation of holes and cut-outs.

Chinese equipment is much in evidence throughout. In addition to the items listed above, this includes double edgers (Shunde Golive Glass Machinery), water jet cutting equipment (Dardi International), a lamination line (Ivaco), autoclave (Golden Ring) and automatic sandblasting machinery. A heat soak oven was developed in-house.

Because India is a fast growing market, Subhash Tyagi believes it presents important opportunities for international suppliers. "Along with glass manufacturers, suppliers should focus on R&D and ensure best value engeneering, not only for their machines but also for the finished product. They also need to focus more on local service and spare parts availability."

## INDUSTRIAL DEVELOPMENT

Despite the current economic slowdown, the local glass industry has changed dramatically within the past two decades. "When we entered the business in 1985, glass was used in a very minimalistic way" Mr Tyagi recalls. "We were among the country's first glass processors when we built our first unit in 1996. Before this time, nobody in India used insulated glazing but today, there are just under 100 processors throughout the country."

A dedicated 470 tonnes/day float glass production facility is operated at Roorkee, Uttarankhand.

According to the Gold Plus Glass founder, the Indian flat glass industry is still very much in its infancy, with considerable potential still to be explored. "The major growth in terms of volume and value addition will come from the construction sector, mainly in the form of energy-efficient and safety glasses. In terms of geographical coverage, we are hopeful that demand will multiply once it takes off in smaller cities and towns throughout India."

## ONE AMONG EQUALS

Subhash Tyagi took over as Chairman of the Architectural Glass Panel at the All India Glass Manufacturers' Federation in March 2013 and completes his 12 months' tenure of office this March. "The Chairman is one among equals" he explains, "where all decisions are taken with the full participation of members."

Among the panel's main objectives are the encouragement of the correct type of glass in buildings and promoting the use of float glass in unconventional applications especially. Current members of the panel are Asahi India Glass Ltd, Gold Plus Glass Industry Ltd, Gujarat Guardian Ltd and HNG Float Glass Ltd.

The bi-annual GLASSPEX India exhibition, organised by Messe Dusseldorf India Pvt and supported by the AIGMF, is considered one of the industry's most influential events. "Global companies participate and showcase their latest technologies relating to glass manufacture" Mr Tyagi contends. "Apart from Indian entrepreneurs, visitors from neighbouring countries also attend, making the show an important forum for interaction between buyers and sellers."

## CHALLENGES TO BE ADDRESSED

According to Subhash Tyagi, the greatest challenges currently facing India's flat glass manufacturers and equipment suppliers alike relate to the high cost of local production, the low cost of imports and the need to replace traditional wooden packaging with 'naked' glass transport methods.

"The industry's main challenge, however, lies in reducing the cost of production. Otherwise, it will be difficult to compete against products dumped in the Indian market at cheap prices, despite there being anti-dumping duties in place."

Conversely, India's greatest strength relates to its size and population. "In India, there are no mandatory standards for safety and energy efficiency but once these standards are put in place, there will be an important opportunity for value-added glasses in India" predicts the Gold Plus Industries founder. ■

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# Membership of

AIGMF

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.

The membership forms can be downloaded from http://www.aigmf.com/membership.php

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

- Eastern India Glass Manufacturers' Association (EIGMA)
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Opened in January of 2014 at 3,048 metres above sea level on top of Gaislachkogel peak in Sölden, Austria, the design restaurant "Ice Q" serves as a prime example for contemporary glass architecture right in the High Alps. The 900 $m^2$ glass façade with its high-performance triple-pane insulation glass was designed and built by the Austrian façade specialist GIG Fassaden GmbH. **Photo: GIG Fassaden**

# Glass architecture on the cutting edge

Finding ways to improve energy efficiency is one of the greatest challenges facing contemporary architecture. Deploying highly functional glass products and integrating energy-relevant products are effective ways to achieve optimum efficiency even in large-format glass façades.

Façades have long moved beyond being just static shells providing weather protection at the interface of building interior and exterior. With good reason, they're often compared to human skin, which indeed does have a protective role to play, but also adjusts dynamically to external conditions and thus maintains the body's "ideal temperature." Modern glass façades are tasked with exactly this function – except in relation to indoor climatic conditions. In light of significantly tightened energy efficiency standards for buildings, the building envelope must play yet another crucial role in achieving a reduced primary energy demand: Heating, air-conditioning and lighting are among the most power-hungry systems in office buildings. And the façade can directly influence these consumption factors. The goal must be to optimise thermal insulation, protect interior spaces from overheating, ventilate rooms in a controlled manner, use daylight to the fullest extent possible and minimise the use of supplementary air-conditioning.

Keeping pace with ever higher expectations, façade technology has been systematically improved in years past. One target pursued in this development process is the multifunctional adaptive façade, a shell that's able to respond dynamically to changing environmental conditions. Glass façades hold great potential in this area. Decentralised controls for ventilation, heating and cooling via the building envelope enable significant building technology reductions. At the same time, integration with building automation systems ensures that individual components can work together in perfect unison to achieve maximum energy efficiency.

## EFFICIENT COMBINATION OF COMPONENTS

Even today, the components needed for the multifunctional façade of the future are already widely available. The challenge, then, for architects, façade designers and façade manufacturers generally lies in the optimisation of existing systems and in

The Schüco E² Façade is an energy-efficient complete system that unites façade and system technology. Customised solution packages can be created thanks to its four function modules (decentralised ventilation, façade-integrated photovoltaics, façade-integrated solar shading and integrated opening units). **Photo: Schüco**

the individualised, demand-oriented integration and combination of available technologies and products. Ambitious targets have been set. In Europe, for example, the "Energy Performance of Buildings Directive" (EPBD 2010) stipulates that all new buildings in EU member states must be constructed as "nearly zero-energy buildings" from 2020 onwards. This high bar can only be cleared by using highly efficient façades that provide excellent insulation and smart indoor climate control – all while harnessing the power of the sun.

## OPTIMISED SYSTEM TECHNOLOGY

The deployment of highly efficient, variable-use façade systems is a prerequisite for the creation of energy-efficient glass façades. Therefore, system providers aim at further improving the insulating performance and application flexibility of their profile systems. Improved profile geometries and the creation of the preconditions for the use of high-performance triple insulating units are important aspects in this regard. Despite significant progress, large-format glass façades continue to be left behind, when it comes to heat transfer properties, by classic perforated façades with insulation. At the same time, however, they also offer numerous advantages over solid construction. Thanks to copious amounts of glass used, they allow for visual contact with the outside world. What's more, they create enhanced lighting possibilities and ideal conditions for solar gain.

The E² Façade by Schüco illustrates just how far system technology has progressed in the direction of multifunctional glass façades. It's an energy-efficient complete system with a revolutionary combination of façade and system technology that both saves and generates energy. Customised solution packages can be created thanks to its four function modules (decentralised ventilation, façade-integrated photovoltaics, façade-integrated solar shading and integrated opening units)

## HIGH-PERFORMANCE FUNCTIONAL GLASS

The use of safety glass brings to the fore the extensive structural possibilities and design advantages offered by glass (curved glass, screen printing, digital printing, enamelling etc.) and thus provides considerable flexibility in the design of customised high-performance glass façades. However, large glass surfaces also allow for outside conditions to strongly impact the indoor climate.

Today's argon-filled and Low-E-coated triple-pane insulation glass can reach Ug values of up to 0.6 W/m²K. In order to achieve optimum thermal insulation, it is necessary to deploy modern warm-edge seal systems such as the spacers made by Swisspacer. Combining a highly insulating profile consisting of plastic composite materials, a gas-tight foil and desiccants as filling materials, the spacer system minimises heat loss and ensures long-lasting serviceability of the insulation glass. **Photo: Swisspacer**

As a result, the functionality of glass products used is of considerable importance.

Excellent results are possible nowadays with high-performance thermal- and solar-control glass. For example, double-pane insulating glass filled with the noble gas argon and used with warm-edge spacer systems currently achieves a thermal transmittance value of around 1.0 W/m²K. This value drops to 0.6 W/m²K for triple-pane insulating glass used in standard configurations. Even 0.5 W/m²K is possible if the space between panes is increased. Even lower thermal transmittance values are possible in today's standard glass configurations by using the ultra-expensive noble gas krypton.

Another option exists for pushing down even further the thermal transmittance coefficient while using argon – quad-pane insulating glass. Even though these products achieve a U-value of 0.3 W/m²K, they're not any heavier than conventional triple-pane glass because they're made using hardened thin glass. Another option, vacuum insulated glass (VIG), would make stacking window panes an easier-to-manage task for window and façade manufacturers. Glass of this kind is already available in Asian markets, but despite focussed research efforts, Europe is still waiting to see equivalent products for façade applications become ready for mass production.

## SOLAR CONTROL AND LIGHT DIRECTING

Besides heat insulation, large-format façades must also master the challenge of providing reliable solar and glare protection. Solar control glass alone – while efficient and easy to integrate – is often not sufficient to reliably prevent undesirable heat gain in interior spaces during the summer.

The triple-pane solar control glass ipasol neutral by AGC Interpane delivers excellent thermal insulation and ideal protection from the sun in this office building, which is superimposed upon an air-raid shelter in Bochum, Germany. Partially coating the glazing with ipachrome design helps to provide additional glare and solar control, especially on the building's south-facing side. **Photo: Fotodesign Andreas Braun, AGC Interpane**

Alternatives to shading systems installed on the inside or outside of the façade are available, including special solar control glass featuring electric voltage-based automatic tinting to minimise the impact of sunlight.

In autumn of 2013, the University of Giessen presented an intriguing development in this area. Led by Prof. Bruno Meyer, the Physical Institute there developed and filed a patent application for an energy-efficient glass coating that allows for temperature-dependent thermal transmittance. Using this passive (i.e. non-voltage), transparent glass coating allows for the straightforward control of sun-induced heat gain in interior spaces. At 20 degrees Celsius, the material autonomously switches from semiconductor (permeable to light) to metal (reflective).[1]

Insulation glass with integrated solar and/or light directing control is another frequently used alternative. These systems are integrated into the glass and can be controlled manually or electronically to align with individual insolation and light conditions. Thanks to integrated slats with variable adjustment angles, daylight can be directed into the interior of the room. The Austrian company Eckelt Glass offers DLS Ecklite Evolution, for example, an insulation glass product with two separate, electrically driven louvre blinds integrated into the glass, featuring a concave section for active light directing in the upper part of the glass and a convex section for efficient solar and glare control in the vision area. Depending on exterior lighting conditions, users can choose to open either the vision area only or both the vision area and the upper area for an unobstructed view. Other effective solutions for targeted daylighting and balanced illumination of rooms besides these louvre systems include glazing with engraved louvre structures,

The synergy of active light directing and variable solar control in insulating glass: DLS Ecklite Evolution by the Austrian company Eckelt Glas integrates two separate, electrically driven louvre blinds in the cavity and features a concave section for active light directing in the upper part of the glass and a convex section for efficient solar and glare control in the vision area. If desired, the blinds can be opened completely, either only in the vision area or both in the vision and upper area for an unobstructed view. In the triple-pane configuration, a thermal insulation value of up to 0.6 W/m²K is possible. **Photos: Eckelt Glas**

rigidly mounted reflective blinds and integrated prism structures.

## ENERGY FROM THE FAÇADE

Seeing that the amount of available solar energy is 3,000 times greater than total global energy consumption, it would seem smart to harness the sun to generate eco-friendly energy right in the façade. Photovoltaic modules can be incorporated in nearly any kind of glass installation. Solutions with integrated PV can easily be implemented even with multi-pane insulating glass with thermal and acoustic protection properties and with overhead and walkable glass. Set up correctly, the solar control functionality of a PV façade can even make additional shading systems obsolete. Moreover, solar energy from collector systems integrated into the façade can be used for heat production.

glasstec 2014 in Düsseldorf will show just how innovative the glass industry really is, including in this market segment, what product solutions the sector has in store to help make glass façades more energy efficient and how architects and façade builders envision the future. From Oct 21-24, 2014 the leading international trade fair of the glass industry will present the latest developments revolving around the energy-efficient building envelope at the trade fair stands, the special show "glass technology live" and the Façade Center. This range of offerings is further enhanced by the scientific conference "engineered transparency," which focusses on "Glass Construction," from Oct 21–22, 2014 and by the International Architecture Congress, entitled "Glass 5.0 – Design, Function, Emotion," on Oct 22, 2014.

## THE BUILDING ENVELOPE AS MULTIPLAYER

Thanks to continuous construction, technology and product advancements, plenty of development potential remains for large-format glass façades. Regardless of any temporary façade design trends, topics such as energy efficiency and improvement of indoor climatic conditions will dominate architecture and façade construction in future, with additional attention paid to the sustainability of materials and products used.

Stronger multi - disciplinary cooperation will be critical on the path to energy-optimised glass façades and buildings. "Architects, engineers, builders and façade specialists must and will aim to meet political imperatives regarding the optimisation of energy consumption, without neglecting architectural and quality-related aspects or ecological and economic considerations. The building envelope turns into a 'multi-player' with the ability to coordinate and control light, air and energy flows simultaneously," says Rudolf Locher, the Managing Director of the Swiss Centre for Windows and Façades (SZFF) in summarising the future challenges awaiting façade professionals.[2]

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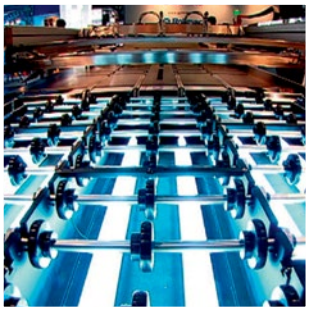

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# Experience brings stability

## HNG Global Managing Director and CEO, Jochen Böllert spoke to John Wallis about the positive changes realised by one of Europe's most technically advanced glass container factories, now under the ownership of India's leading producer.

Productivity levels and staff morale were disappointingly low when Germany's Agenda Glass AG went into administration in 2011. Since the factory's acquisition later that year by India's leading glass container producer however, an experienced local management team has been drafted in and some critical refinements have been made. Subsequently, confidence has grown and the renamed HNG Global GmbH is starting to enjoy the profitable benefits of its labours.

When commissioned in 2010, this €50 million greenfield project had been feted as one of Europe's most advanced glass container production facilities, utilising some of the industry's most sophisticated manufacturing technologies. Sadly, with limited industry experience, it is apparent that some key errors of judgement were made, both prior to the factory's start-up in February 2010 and during its first year of operation. The plant is situated at Gardelegen, approximately 200km west of Berlin and 145km east of Hannover. Part of the former German Democratic Republic (DDR), the town sits at the heart of Saxony-Anhalt, where a state-of-the-art infrastructure, excellent investment incentives and an innovative R&D environment have made it eastern Germany's leading destination for foreign investors. Since 1991, Saxony-Anhalt has generated about 330 important investments from domestic and foreign companies, who have poured almost €10 billion into the state, creating more than 20,000 jobs.

### MARKET DEMAND-DRIVEN

It was in 2006/2007 that the German glass packaging industry began a process of consolidation, partly it is suggested, in an effort to raise prices. This included the closure of several melting furnaces, especially those devoted to clear glass production, leading major domestic customers and distributors to stimulate the creation of an alternative local supplier, who could build and operate a dedicated clear glass production facility.

The factory location in Gardelegen was chosen for various reasons, including the fact that raw materials are readily available locally, in addition to which the region's road infrastructure has been the subject of considerable investment in recent decades, thereby simplifying distribution. Furthermore, unemployment rates are considerably higher in this part of the country, providing a rich source of labour. Importantly, valuable subsidies were also available to help new investors build industrial enterprises in the area.

This single furnace facility became operational in February 2010, serving three production lines. With the exception of a brief period when emerald green was melted, the furnace has produced white flint throughout.

Jochen Böllert has been Managing Director and CEO since Hindusthan National Glass & Industries Ltd acquired the business in 2011. Previously, he was Managing Director of Heye International, as well as having run the Ricardo Gallo and Sotancro glass container factories in Portugal at different times. This experience, together with that of Technical Managing Director Wolfram Seidensticker and other senior management colleagues, was to prove essential in realising a turnaround in the factory's fortunes. "The beauty of this business is that you generate immediate feedback to changes made and can measure improvements to productivity and profitability" he confirms. >

HNG's Gardelegen site concentrates on the production of white flint glass containers.

The 12-section double gob, 6 1/4in centre distance NIS machines are also capable of running in triple gob.

€50 million was spent on the greenfield glass container production complex at Gardelegen.

External view of the ZIPPE fully automated batch plant.

The Bucher Emhart Glass NIS forming machines primarily operate the NNPB process.

Sadly, the original business had failed within a year of start-up. According to Jochen Böllert, it is well known within the industry that a greenfield operation of this type needs time to improve gradually in terms of efficiency and quality, as well as building an effective operational team. "Sometimes it can take up to three years for a new factory to achieve efficiencies of 88%-89%, a level that is needed to be successful in the market." Apparently, this scenario was underestimated by the original owners, so inadequate funding was put in place to give the fledgling concern adequate time to make the necessary improvements. The company was losing money and producing bottles at efficiencies of less than 70%.

Ultimately, the business went into receivership but continued to operate, protected under German law for a period of several months. During this time, a couple of possible buyers emerged, expressing interest in acquiring the assets of Agenda Glass. India's leading glass container producer, HNG had been looking for an opportunity to expand its operation and put together a successful proposal to acquire the business, persuading both the administrator and authorities in Saxony-Anhalt that they could offer the best package for the glass factory's ultimate success. HNG took over the business legally in August 2011 and Jochen Böllert joined later that year to spearhead its rejuvenation.

## ADVANCED CAPABILITIES

Despite its original operational problems, the Gardelegen glass factory remains one of the most advanced of its kind, worldwide. As a greenfield facility, the latest dedusting and deNOx pollution control investments have been made, making the facility one of the industry's cleanest. A ZIPPE fully automated batch plant and cullet return equipment are installed and the plant was automated using the Simatic PCS 7 process control system from the Siemens Industry Automation Division.

The SORG natural gas-fired, end port design furnace has a nominal melting capacity of 360 tonnes/day and serves three of the same company's latest design gas-fired forehearths. A furnace and forehearth control package from STG Combustion Control GmbH & Co KG is operated. The first furnace repair is scheduled for 2022.

All three production lines operate Bucher Emhart Glass NIS forming machines, primarily operating the NNPB process. These 12-section double gob, 6 1/4in centre distance machines are also capable of running in triple gob, a transition that is likely to start on at least one line during 2014, depending on the success of the company's revised product portfolio.

The three Ernst Pennekamp annealing lehrs are gas-fired and were built to the company's advanced energy efficient design.

At the cold end, the latest Bucher Emhart Glass FLEXinspect inspection technology has been installed. This feeds fully automatic palletisation and shrinkwrapping equipment, delivered by MSK Verpackungs-Systeme GmbH, after which output is stored in a 35,000m$^2$ covered warehouse.

## PRODUCTIVITY PLAN

The new owners admit that it was a tough transition, including some unexpected challenges to overcome but two years later, the business is heading in a positive direction. "It was a difficult time for the workforce, coming to terms with new owners from a different part of the world and bringing some different ideas with them" Mr Böllert explains. Throughout, HNG has been working closely with suppliers to optimise system operation.

The first priority was to develop a productivity plan, analysing production over the initial period, changing management behaviour and with the help of HNG technical and personnel management, turning the factory from a loss maker to a profit generator within the space of 12 months. Some modifications were made to the cold end layout that assisted these efforts, as did the decision to change an existing triple gob IS machine to double gob operation. "There is a need for greater operator experience when running triple gob equipment and swabbing needs to be conducted differently" says Jochen Böllert.

Perhaps the major change achieved, however, was a change in the mind-set of the plant personnel via an intensively managed team-building process. "You can have the best equipment in the world but unless you also build a skilled team to operate it, that equipment will not work." In the opinion of Jochen Böllert, the human factor represents at least 40% of a factory's success in the glass container business.

Sanjay Somany and his colleagues at HNG have been very supportive of the local management team's revisions, which are geared to optimise the performance of a German company, serving the German market. HNG has not simply 'exported' its successful formula to the German subsidiary, supporting the local managers to find workable solutions. Increasingly, the two organisations are coming closer together and are now helping one another to overcome forming and mould issues etc, where HNG (India) is profiting from HNG Global's greater experience in NNPB operations and the German business is benefitting from the Indians' considerable experience in high speed BB operation. The Gardelegen factory is also benefiting from the market leading position maintained by its parent business, maximising the access afforded to market leading international customer brands.

By October 2013, the factory had realised pack-to-melt efficiencies of 88%. Although this is not the level where the plant wants to peak, the management is pleased with the improvements made in the space of just three years. The target is to exceed 90% but this is likely to take another 12 to 24 months to achieve. Furthermore, it is acknowledged that with constant job changes on the factory's three machines, it is becoming increasingly difficult to make quantum levels of improvement. It is now more a case of finetuning on a day-by-day basis.

All of this has been achieved >

The latest Bucher Emhart Glass FLEXinspect inspection technology is installed.

with a workforce with little or no long-term experience of glassmaking. Training has been the responsibility of skilled glassmakers who were brought in from other German glassworks, although coming from different companies with different philosophies, they also needed to agree a common approach. In addition, the specialist training services of Siegler Consulting continue to be a valuable asset, especially in the areas of IS production, maintenance, forehearth tuning etc.

## CHANGING CUSTOMER FOCUS

Employing 143 people and five apprentices, HNG Global is now in transition to a different group of target customers. Formerly, up to 85% of output was supplied to two large German glass distributors, with the remainder supplied to the local mineral water industry. Now, the company is in the process of reducing its dependence on distributors and is establishing more direct links with customer industries. A standard range of products is offered to the beer, milk and water industries, in addition to which it continues to work closely with distributors, primarily for the liquor trade.

Direct sales are handled from an office at the Gardelegen site and Jochen Böllert expects the company to continue to focus on the local German market. In part, this is driven by the size and weight of containers produced (between 0.2 and one litre capacity), which are arguably too bulky for remote shipment. HNG Global's export rate is between 20% and 25%, in line with the German industry average.

## FUTURE PRIORITIES

Major targets for the business are to stabilise production efficiencies at a higher level, while also maintaining the company's profitability. Although there is space for a second tank at Gardelegen, current market conditions are not conducive to such an investment.

Jochen Böllert believes the German glass container market is currently finely balanced between production and demand, with approximately 25% of output exported. "Product quality is high and unit costs are competitive due to controlled manufacturing, energy and labour costs" he contends. "This all helps Germany to be a successful exporter."

The founder of the original HNG business in India and winner of the 2013 Phoenix Award, Mr CK Somany is keen to use the Gardelegen project as a starting point for HNG to develop 50% of its business outside India. Jochen Böllert believes acquisition is a more realistic way to achieve these goals than building new factories. "We need to build a critical mass on a global scale" he concludes "and hope to get there within a few years." ■

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HNG Global operates three high speed production lines.

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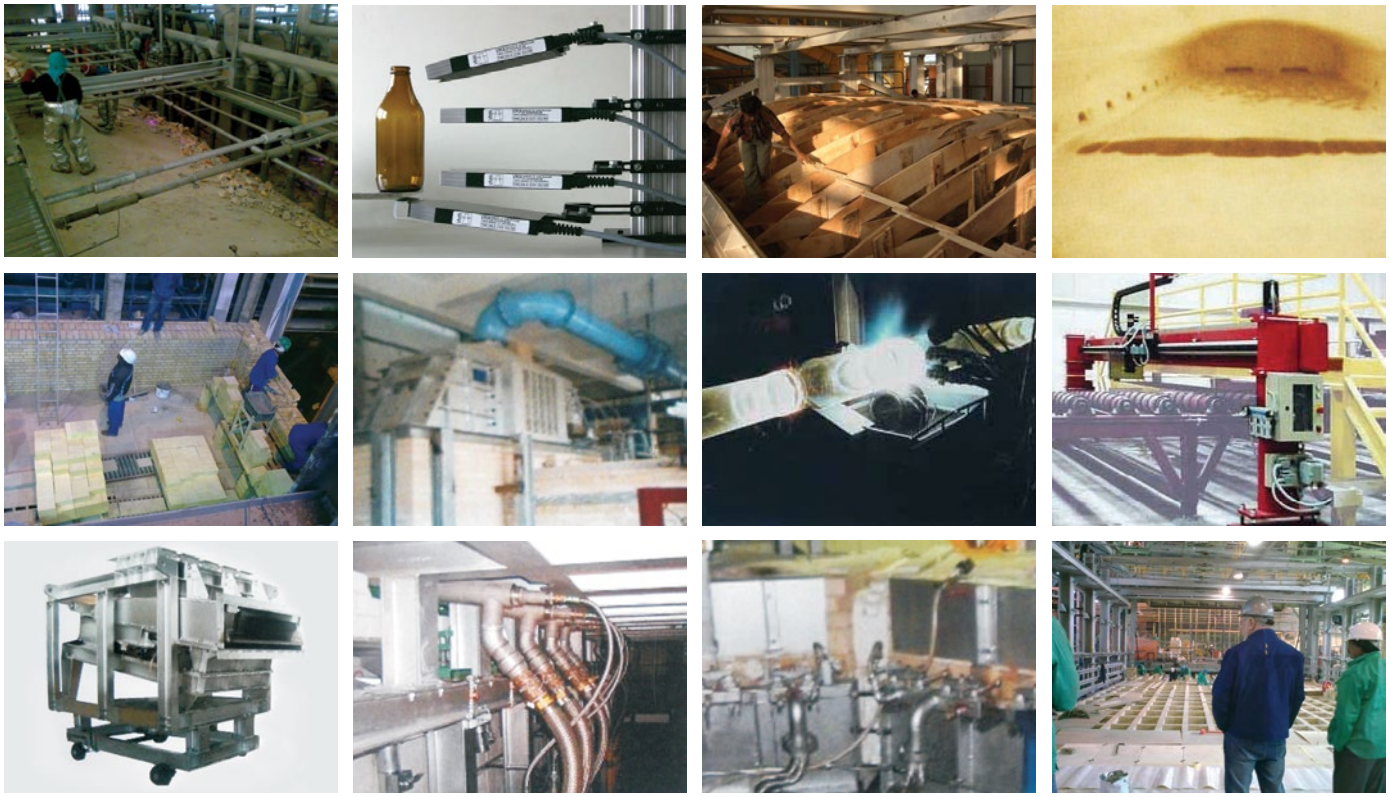

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# Glass Products becoming Increasingly Functional

Individualised media façades can be realised by incorporating LEDs in glass laminates. This photo shows an application where the "powerglass" product by German producer Glas Platz GmbH & Co.KG was used. **Photo: PopSign**

*Thanks to on-going research and development efforts glass products can take on ever new functions. Even today, glass panes can be transformed at the press of a button, upscaled to radiant media glazing or – in wafer-thin versions – be used as high-performance displays.*

Glass products are used for more applications than ever before and their performance range is growing constantly. Ever new applications require the optimisation of existing, and development of ever new, special glass types with specific functionalities. The unique transparency of this material continues to be a paramount criterion but the versatile applications are today determined by the add-on functions achieved by specific manufacturing and finishing technologies.

A wide variety of functional glass has stood the test of time in windows and façades for decades already and over the past ten years, in particular, glass products have virtually boomed in interior design thanks to the very successful development efforts undertaken by glass companies and glass machine manufacturers. Highly developed manufacturing and finishing techniques make for high-performance functional glass with properties that are precisely tailored to customer needs for both exterior and interior use.

For building skin applications performance characteristics like thermal insulation, solar protection, sound proofness and security are in the foreground. Thanks to the use of innovative coating and lamination technologies the products in this market segment push the limits of technical feasibility. For interiors, on the contrary, design considerations play an especially pivotal role. Here, too, the positive developments can be attributed especially to new processing and treatment technologies alongside glass companies' innovative power and intensified marketing efforts.

## SWITCHABLE GLAZING

Attractive potential use for both outdoor and indoor applications is now also provided by switchable glazing. Various versions are currently available on the market: for instance, LC or PDLC glass (liquid crystal/polymer dispersed liquid crystal) turns opaque at the push of a button. This glass function is based on a polymer-liquid-crystal film laminated

Switchable glazing allows quick changes between transparency and opacity. This photo features an animation of AGC Interpane's ipaview CF product, which can be used in partition walls or insulating-glass units and can be combined with a wide variety of glass types. **Photo: Interpane AGC**

between two glass sheets and connected to a power source. While no voltage is applied the glass remains non-transparent but as soon as electricity flows the liquid crystals of the polymer align in such a way that the glass sheet turns transparent. This allows the glass condition to be changed between transparent and opaque in fractions of a second. Such a variable functional glass is ideal for using in partition walls or for ensuring flexible privacy for conference rooms. Integration in insulation glass for windows and façades is also possible. This glass, however, is not suitable for solar protection due to its complete opacity.

Efficient solar protection is provided by electrochromic glass. Depending on the direct current applied, this functional glass takes on various shades of blue thereby allowing variable sun shading. Here the wafer-thin electrochromic coating does not change colour spontaneously but the process takes several seconds up to minutes. Once the polarity of the voltage changes, the glass turns transparent again. While there is no current flowing it retains its given colour. Electrochromic solar protection glass is designed for use in windows and glass façades and has already been used successfully for several years like LC glass.

The third group of switchable glass types is thermochromic glass. This changes its light transmission characteristics without any human intervention. Its function is based on thermochromic materials that react to temperature changes. As soon as the glass panes heat up when exposed to solar radiation, the film containing the thermochromic substances laminated between the two glass sheets changes colour automatically. If the solar energy decreases the glass laminate cools off and turns transparent again. This functional glass is also suitable for integration in insulation glass and therefore qualifies for window and façade applications.

## LUMINESCENT GLASS THANKS TO LEDs

New possibilities for realizing lighting concepts or creating individual room atmospheres also come care of LED glass. The combination of glass and light-emitting diodes not only produces impressive light effects but LEDs also require very little energy. There are various LED glass systems on offer these days. One version allows the LEDs to be positioned freely on the glass surface, thereby realizing individual motifs and lighting concepts. To protect the light-emitting diodes from outside impact they are embedded in a cast resin between two glass sheets and supplied with power through an

Electrochromic solar protection glass permits individual light control and hence a control of the heat input by colouring the glass. In the photo: an exhibit of the dimmable insulation glass ECONTROL by Econtrol-Glas GmbH & Co. KG. **Photo: Econtrol-Glas**

In future, it is thought organic light-emitting diodes will be the first choice for transparent light designs. They also offer great potential for glass applications. With its design luminaire "Rollercoaster" lamp manufacturer Osram has shown that transparent OLEDs are now ready for industrial mass production. **Photo: Osram**

invisible, conductive glass coating. Available in white or RGB colours, these LEDs can create single or multi-coloured motifs. Even moving motifs can be realised by connection to a computer control unit.

Another product solution is LED illumination of surfaces. Here the light-emitting diodes are not laminated between glass sheets but emit light from the sheet edge. Unlike with the glass shelves known from furniture, this product is illuminated across its entire surface rather than only around its edges. This effect is produced with the help of a laser-cut diffusing glass. LED screens like this make for individual illumination of glass panels. Motifs printed onto the front panels virtually radiate through this direct backlighting. Since the glass panels lit with this technology are very thin, they are also very well suited for retrofit-designs of ceilings and walls. This product only became possible through new laser technology for large-area glass engraving.

Of great interest for the design of façade displays is another product version – here LED strips are embedded in a glazing unit with a PVB film. Since each individual LED can be controlled separately, coloured moving images (videos) can be projected onto this media glass as well as individual images or motifs such as labels or writing. A major benefit of this technology is the fact that individual LED strips can be replaced subsequently – meaning you don't have to replace the entire glazing unit in the event of strip failure.

## NEW LED GENERATION

Experts forecast great future potential and versatile applications in electronics but also in the field of glass interior design for organic LEDs. Organic Light Emitting Diodes – for short OLEDs – are luminescent thin-layer components from organic, semi-conducting materials that light up when electrically stimulated. OLEDs can produce any number of colours, are highly efficient in energetic terms and – compared to inorganic LEDs – can be applied using thin-layer technology. This makes it possible to produce extremely thin products with very brilliant colours. The new technology for which experts see a market worth billions is especially well suited for self-luminescent displays in Smartphones or tablet PCs. Even

The technology group Schott produces an ultra-thin, flexible glass with a thickness of as little as 25 micrometres. This material is manufactured in a continuous drawing process and then coiled. **Photo: Schott**

large-screen TV sets are already offered with OLED technology. Unlike liquid-crystal displays (LCDs) OLED displays no longer require any backlighting. This saves a considerable amount of energy and makes the products even thinner. The organic material is applied using tried and tested printing techniques (ink-jet or offset printing) and can be applied to plastics, glass and other materials. If you select sufficiently thin materials, OLED colour displays can be easily bent or even rolled up.

At present, electronics manufacturers are already highly satisfied being able to offer extremely flat OLED TV sets with a diagonal just shy of 55 inches. If bigger sizes could be realised in future completely new potential applications would open up through this technology. One could think of media glass applications in buildings and in façades or large-surface interior lighting. Visionaries are already talking about OLED wallpaper or curtains whose colours and patterns would change at the touch of a button. The extent to which this technology has found its way into the glass industry will be revealed by glasstec 2014 in Düsseldorf. From Oct 21-24, 2014 the world's most important glass trade fair will showcase not only the current product innovations in the international glass sector but also the entire field of manufacturing technology and the latest applications.

## ULTRA-THIN GLASS FOR INDUSTRIAL APPLICATIONS

While the façade and window industries consider two to three millimetre thick glass thin, electrical and laboratory engineering focus on completely other magnitudes. Here glass thicknesses of far below one millimetre are required for specific applications. For instance, for display glass the filigree glass substrates not only have to be very thin but must also boast high strength and scratch-resistance. And that's not the end of it – a US-based special glass producer also intends to offer its Gorilla glass in a bent format for Smartphones and Smartwatches. A firm known for its sheer special glass is Schott AG. With its in-house developed Down-Draw process this German technology company succeeds in manufacturing ultra-thin glass in an almost inconceivable thickness of as little as 25 $\mu$m (0.025 mm). This glass is currently supplied in a width of up to 500 mm and in a flexible length. As one possible application the company also mentions OLED lighting. ■

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# Glass Manufacturing – Part I: Heat Transfer Process in Glass Tank Furnace

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In the glass manufacturing process there are various features that are also dependent on the type of glass and the manufacturing method. This is already known to all concerned in the glass industry. Many people make glasses without going deeper into the subject. However, some important aspects in the manufacture of glasses are very important and they mainly pertain to theoretical understanding of different processes involved in making the glass. These aspects are heat-transfer and fluid flow, particularly the interaction between them is very important to study. In this article, only the heat transfer process in the glass tank furnace is taken up in terms of different issues involved and the second part will deal with heat transfer in the glass fabrication, while fluid flow is also very interesting subject that will be dealt with in the future publications.

## INTRODUCTION

First of all, it should be emphasized that there is a significant difference between ceramics and glass products manufacturing. The oxide and non-oxide ceramics in powder form (mixed with little or no water to make dry/moist solid or liquid) are fabricated by various manufacturing techniques for a variety of shapes and sizes, and then dried to remove the water (if any) and fired to impart strength so that they can be handled for other supplementary manufacturing process/es. Eventually, apart from customer appeal, they must be mechanically stronger for handling during their usage. However, for glass manufacturing, mainly oxides, carbonates, nitrates, etc., are homogeneously mixed and then directly fired or rather melted in a typical tank furnace at very high temperature depending on the glass composition, viscosity, etc. In any manufacturing process, two types of system are possible. Either it is a batch type, e.g. optical glasses melted in a pot (about 1 to 1.5 ton capacity) to maintain high level of homogeneity, and also special types of glasses **[1,2]** – or, it is a continuous process of manufacture **[3,4]**, e.g. float glass, container glass, glass fibre etc. For continuous operation, right from the mixing stage of different raw materials, feeding, melting, refining and then fabrication of various types of glasses – different processes are operative, e.g. heat transfer inside the glass tank furnace, heat-transfer in the glass fabrication and fluid flow, etc.

Recently, there has been a massive development in the field of "materials science" or "materials technology" for developing newer class of materials and newer types of techniques that involves the study of this technology more extensively. This has a possibility of overlooking the existence of such large materials manufacturing industries, i.e. glasses, that have been developed over so many years and they involve (a) large capital investment, (b) employment of a large number of people, (c) millions of tons of materials, etc. A proper understanding of the 'physical principles' of different processes used in the glass manufacturing industry is clearly needed. Needless to say, the mechanization of the glass manufacturing processes in the late nineteenth and early twentieth century was solely achieved by trial and error method. If there were any standard booklet available for fixing the conditions in a tank furnace or in the forming machines, and about their proper synchronization,

then starting a given 'glass plant' would have been much easier and less time-consuming thus reducing the total cost of the project.

As an example, about 3-5 years ago, in a given glass plant of a large industrial group, 50-55 senior engineers and technical managers were brought into India from their US and Brazilian plants to stabilize the tank furnace conditions, and even so they took about 2.5 to 3 months to do the needful. Then, more time was spent on stabilizing the fabrication conditions. The total cost must have been more than a few million US$ just for this purpose, as this plant with a larger capacity than the existing one needed about 7-8 months to be ready for production after all the installations were completed. Although such type of scenarios involve a massive management and logistics approach, but the depth of the technology knowledge and its application on the shop-floor for this type of purpose cannot be ruled out. Overall, there is a strong need of correcting many aberrations in our approach toward technology and we still need to do a lot more in careful planning and implementation. If this approach is coupled with many technological insights that are the result of intensive R & D work in different facets of glass technology. In this article, only heat-transfer problem in a glass tank furnace will be discussed in the context of glass manufacturing process.

## RADIATIVE TRANSFER OF HEAT

During the last 50-60 years, there has been a series of newer interesting developments in field of glass technology, counting the small but incremental developments. One of them is a more or less adequate knowledge or clarifications on the 'role of radiation' as a mechanism of heat-transfer process in glass. This can occur at high temperatures (1250 – 1600C) as well at relatively lower temperatures (620 – 1100C) encountered in the different fabrication processes. Heat is transferred from one body or system to another by three different means – viz. conduction, convection and radiation. The latter is very important in relation to the other two mechanisms that depend on certain factors.

### *IR Absorption Study*

First of all, we have to indicate the ability of glass to absorb and emit the radiation, which ultimately depends on the absorption spectrum of the concerned glass related to its chemical compositions, more particularly from infra-red (IR) absorption curves. In the IR spectra of glasses, the absorption coefficient, $\alpha(\lambda)$, considerably varies with the wavelength ($\lambda$) in $\mu$m and also with temperature of the glass inside the tank furnace. For the latter, as we cannot do the IR absorption measurement inside a glass tank furnace, different set-ups were devised to do such experiments with the glass melt in a small refractory or platinum crucibles at different temperatures. Some features need to be mentioned here. The following are the main features of the IR spectra:

a) At about 1.11 $\mu$m, there is an absorption peak that increases with decreasing temperature; this peak at 1.11 $\mu$m is ascribed to the absorption of $Fe^{2+}$ (ferrous) ion. This means that if the furnace atmosphere is highly reducing, more of $Fe^{2+}$ ions will be frozen in the glass that will show up in the observation of this peak. This is prevalent in window glass, which is also the case for other 'commercial' but colorless glasses. This peak depends on the percentage of iron oxide present as impurity in different raw materials and also upon whether the furnace atmosphere is oxidizing or reducing. For example, for very low iron content, if the furnace is operating under oxidizing condition, then almost all the iron ions will be in the $Fe^{3+}$ (ferric) state, and it will impart a tinge of color to the melt or glass. So, for a given iron content, ultimately the concentration of $Fe^{2+}$ ions matters to make an effective colorless glass.

b) From about 2.92 $\mu$m to 3.54 $\mu$m, there is quite a steep rise in absorption coefficient that is ascribed to the presence of OH ions. This means that however efficient one's dryer system is in operation for drying of different raw materials, there has to be a very minute proportion of water molecules that are manifested as OH ions in the glass melt, which can be tested by IR absorption method and characterized by peaks in this range of wavelength. So, this characterization is very important in glass technology.

c) At about 4 $\mu$m, there is again a rapid rise that is due to stretching vibration of –Si-O-Si- bonds present in the glass network formation. This strong absorption indicates the strength of network formation and hence good structure with mechanical strength.

It should be pointed out that some glasses are coloured with a small addition of transition metal oxides. This is intentionally done for having colored window glasses, and these colouring additions have a significant effect on the radiative heat transfer in the hot glass. This also depends on how the IR absorption spectra are affected by such additions. However, the effect of temperature on IR spectra is not known with great details.

### *Mathematical Relations*

For a given glass, the spectral volume 'emissive power', $J(\lambda)$ is known to be directly proportional to the absorption coefficient ($\alpha(\lambda)$). The relation between these two parameters is expressed as:

$$J(\lambda) = \alpha(\lambda)n(\lambda)^2B(\lambda)_T \quad ...(1)$$

Where, $n(\lambda)$ is the refractive index of glass, $B(\lambda)_T$ is the intensity of black radiation of wavelength $\lambda$ at temperature T **[5]**. After specifying the concerned properties of the material, the complicated task of solving various technological problems of interest remains at hand, i.e. for different elements with a given material, the mathematical equation that describes the 'energy balance'. This requires some equations involving some terms describing the emission and absorption of radiation for a typical material element, and others describing the changes in heat content due to conduction and possibly also to another method of heat-transfer, i.e. convection. Inside the glass tank furnace, the "glass-air interface" is also very important in that the effects of reflection and refraction of radiation incident in each direction on the interface are taken into consideration.

In many fields of physics, a tremendous amount of work has been done towards solving problems of heat-transfer by radiation in an absorbing medium. However, in the field of glass technology, the problem of radiative heat-transfer is much more complicated. This assumes more significance, as other heat-transfer mechanisms are included in the process as well as the reflection and refraction effects of boundaries that influences the technological interest. In many situations, analytical solutions are not possible due to several factors at play at the same time (i.e. during the melting process) and it is safer to take recourse to well-known numerical simulation techniques that are aided by a variety of new software. Moreover, many glass companies are now having a band of software engineers who could also do the job. There are various good reviews that could be of some help **[6,7]**.

We have to decide now about the problem to be solved? It is the steady-state heat-transfer by radiation in large thicknesses of glass, such as that found in the actual glass tank furnaces for melting. This thickness is about 1 to 1.2 meters depending on the furnace capacity. About 50-55 years ago, the comprehension on this issue of radiation heat through the thickness of the melt was not adequate. For transferring any significant amount of thermal flux down from the 'burner flame' and the 'furnace crown' through the glass, the understanding was that the radiation alone could not be held responsible. This is due to that fact that simpler calculations indicated that the penetration of most of the radiation from the crown was not significant, and that the absorption could only occur within a few centimeters of the glass surface. If we take an example on the temperature of a typical crown as 1620C, then we find that the concerned wavelength distribution of black body radiation has a maximum intensity at 1 $\mu$m. For window glass, at this wavelength, the absorption coefficient is about 0.02 $mm^{-1}$ at typically 1320C. Therefore, the intensity of the radiation entering the volume of glass from the crown is reduced in 100 mm to a fraction of 13% of its initial intensity. It has to be noted that the fraction reaching the bottom of the glass in the furnace is very much negligible.

At this point, by efficient use of the thermocouples in different locations along the thickness of the glass melt and the bottom refractory body, a close inspection has to be done on the vertical temperature gradients. There is another mechanism in addition to the thermal conduction of heat through the glass. If we consider a steady-state condition, the downward heat flux is the same in the refractory base as it is in the glass melt. Incidentally, the thermal conductivity of glass is very similar to that of refractory. But it is not manifested in the curve wherein we plot the 'thermal gradient' (temperature) vs. 'vertical distance from glass surface'. Actually, the temperature gradient is quite sharp in case of bottom refractory blocks compared to that in the glass melt, say, after 1 meter thickness. Therefore, it is quite evident that a relatively smaller fraction of thermal flux inside the glass can be accounted for by thermal conduction.

It is apparent that a contradictory situation has arisen. A clear qualitative explanation is thus needed. It is known that the surface layers absorb the radiation entering the glass melt from the furnace crown. These surface layers are always at a higher temperature and hence they emit radiation. There are successive steps of radiation and absorption for passing thermal energy deeper into the glass melt. This requires a good qualitative understanding of mathematical development **[8]**.

There is a simplified approach in the analysis of radiation heat-transfer that is regarded the radiation as being propagated only in the direction of the normal to the glass surface, which is the direction of the heat flow. The second simplification consists of considering the glass as a grey absorber, i.e. with an absorption coefficient ($\alpha$) which is independent of wavelength. The above two simplifications permit an expression to be derived for the 'emissive power' per unit area of a slice of thickness ($\delta x$) at a temperature (T degree Kelvin). This equation is shown as:

$$J(T) = 2n^2\alpha\sigma T^4\,\delta x \quad ...(2)$$

At this point, for the balance of radiation energy for such a slice of thickness of glass, another equation has to be derived. This equation is shown below relating the "net radiation heat flux density" ($Q_R$) that is flowing down through the glass thickness in the direction of increasing "*x*", i.e. towards the refining and working ends of the glass tank furnace, and "vertical temperature gradient (dT/dx):

$$Q_R = -(\alpha^{-1})d/dx(2n^2\sigma T^4)$$
$$= -(\alpha^{-1})[8n^2\sigma T^3]dT/dx \quad ...(3)$$

On the right hand side, the factor in the third bracket is very important, which is equation as the radiation conductivity ($K_R$). This is shown as:

$$K_R = 8n^2\sigma T^3 \quad ...(4)$$

The equation (2) also suggests that the total heat flux density may be calculated by multiplying the temperature gradient (dT/dx) by a total conductivity, which is the sum of the radiation conductivity and the true thermal conductivity of the glass. More work has been done on this subject and considering the diffuse nature of radiation, the modified equation for the radiation conductivity is written as:

$$K_R = (16n^2\sigma T^3)/3\alpha \quad ...(5)$$

The above equations were based on the absorption coefficient ($\alpha$) being independent of the wavelength ($\lambda$). However, there is a method of calculating the 'Radiation heat flux', when the absorption coefficient varies with wavelength by deriving its normalized value. This consists of an integral of $dB(\lambda)_T/dT$ with respect to $d\lambda$ between zero and infinity containing $\alpha(\lambda)^{-1}$ and divided by the same integral without any $\alpha(\lambda)$ term. This is the usual way to take the mean value of a given parameter **[6]**.

For a commercial glass that is colourless, the radiation conductivity obtained by this formula is typically within the range: 70 – 80 $Wm^{-1}C^{-1}$ at 1320C. This value appears to be at least 30-40 times greater than the true thermal conductivity. Therefore, it is possible to get a satisfactory quantitative account on the heat flux density and temperature distribution in the glass melt in a tank furnace.

For a large thickness of glass melt (say, 1 to 1.20 meters), if we consider the heat flow, the concept of radiation heat conductivity appears to have some meaning, but a more careful look will tell us that its general usefulness is rather limited. The proximity of the boundaries and the nature of boundary conditions in the mathematical formulation seem to quite remarkably affect the relative amounts of the total heat flux carried by radiation, the relationship between heat fluxes and temperature gradients, and conduction **[9]**.

Let us take a sheet of glass sandwiched between two blackbody slabs 1060 and 960C respectively, as a matter of a simple example, the temperature distribution is not linear. It could be linear if the glass had a constant 'total thermal conductivity' throughout its thickness. For a given sheet of glass, the calculations indicate that the heat flux carried by radiation varies through the sheet and it is found that this is minimum at the two surfaces than inside the bulk. The heat flux through the sheet of glass calculated from the radiation conductivity of the glass is about 82 $KW/m^2$, whereas it is found to be considerably lower in experiment at about 45 $KW/m^2$. This information gathered on the radiative heat transfer inside a glass tank furnace is quite useful while dealing with heat transfer in general for the fabrication of glasswares, e.g. container glasses. It will also noted that the boundary conditions are much more important while dealing with very thin glassware of about a few millimeters thickness, although in many instances, the contribution of radiation heat flux could be considered as negligible.

## CONCLUSIONS

For glass technology both heat transfer and fluid flow are important considerations for developing our required theoretical understanding on the manufacturing processes. In this first part of the article, only heat transfer process is discussed with a particular reference to the radiation heat transfer process in a glass tank furnace and the mathematical relations that are important to calculate the relevant parameters to get an overall view of the process are elaborated to some extent. In the second part, the heat transfer process will be discussed in relation to the glass fabrication technique. The question of fluid flow will be taken up in a future publication in Kanch.

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Please note that non-fulfillment of discharge obligation of a carnet can cause forfeiture of the security deposit, besides other procedures as per law.

Provided that there is no evidence of the carnet entering into dispute, the deposit/bank guarantee will be released as soon as possible.

ATA Carnet holds significant importance to the exporters as they can participate in international trade fairs/ exhibitions, go out on business promoting tours using ATA Carnet without paying import duty. FICCI is the sole National Issuing and Guaranteeing Association for ATA Carnets in India.

The key benefit of using an ATA Carnet is that it is valid for six months to a year and for multiple trips and a single document is enough for clearing goods in different countries. Not only does it allow exhibitors/business travelers to enter foreign countries temporarily without paying duties or taxes, it allows them to do so in 73 carnet countries and territories throughout the period of its validity.


**For any further information, members may please contact:**

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## WORKSHOP ON 'WHY SHOULD INDIA EXPAND THE ATA CARNET SYSTEM'

A Workshop on 'Why Should India Expand the ATA Carnet System' was organized by FICCI in collaboration with the World ATA Carnet Council (WATAC), International Chamber of Commerce (ICC), Asia and Confederation of Asia-Pacific Chambers of Commerce & Industry (CACCI) was held in New Delhi on March 26, 2014.

This initiative is one of multiple steps and initiatives taken by FICCI and the Indian government recently to encourage greater usage of the ATA Carnet.

The Indian Government is actively considering to expand the scope of ATA Carnet convention. At present, India is a signatory to convention on exhibitors and fairs only. It is proposed to expand the same to cover commercial samples, professional equipment, private exhibitions, film shootings, musical troupes, sports, media coverage etc.

L to R: Ms. Ambika Sharma, Dy. Secretary General & Head International, FICCI, Mr.Ashok Ummat, Dy. Secretary General FICCI & Executive Director, ICC India, Ms. Shobha L Chary, Member, Central Board of Excise & Customs (CBEC), Department of Revenue, Ministry of Finance, Government of India, Ms. Lee Ju Song, ICC Asia Director & Member of the ICC WCF World ATA Carnet Council, Mr. Nirankar Saxena, Senior Director, FICCI

***The prime objectives of the workshop were:***

- To expand India's participation in the ATA system to cover professional equipment and commercial samples for the benefit of all national guaranteeing organizations affiliated to the international ATA Carnet guarantee chain
- To enhance customs-business partnership
- To create awareness amongst Indian exporting fraternity about the benefits of ATA Carnet
- To discuss and review the practical operation of ATA Carnet System in India

At present 73 countries recognize ATA Carnet, including Australia, Canada, France, Germany, Japan, Korea, Malaysia, Spain, UAE, UK and USA. To facilitate Carnet like mechanism for temporary movement of goods/ exhibits between India and Taiwan, a protocol was signed between FICCI in India and TAITRA in Taiwan.■

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# Environment

## US$ 25 BILLION: RETROFIT POTENTIAL OF EXISTING BUILDINGS IN INDIA BY 2025

The Indian Green Building Council (IGBC) of CII, organised the first edition of Conference on Green Existing Buildings at New Delhi on March 19, 2014.

Mr. D Diptivilasa, Additional Secretary, Ministry of Urban Development (MoUD), Government of India in his Chief Guest address, emphasized the need to address environmental issues in a holistic manner. He said that we need a strategy to make the Existing Buildings more sustainable and efficient. He lauded IGBC for launching the exclusive IGBC Green Existing Buildings Rating System. The concept of green buildings should reach every nook and corner of the country and the MoUD will extend all its support and will be happy to jointly work with IGBC, added Mr. Diptivilasa

Mr. D Diptivilasa, Additional Secretary, Ministry of Urban Development (MoUD), Government of India presenting the plaque of 'Bombay House'- India's first building to be certified under IGBC Green Existing Building Rating to Mr. H N Aibara, Tata Group at CII-IGBC's Conference on Green Existing Buildings on March 19, 2014 at New Delhi

Dr. Prem C Jain, Chairman, IGBC & Chairman, AECOM India, spoke about India's challenges to conserve energy & water. Today, we have about 25 Billion sq. ft of existing building stock, of which over 2,400 projects amounting to over 1.86 billion sq. ft are going green with IGBC," said Dr. Jain. He emphasized that there is tremendous opportunity to convert existing buildings into green by effective operations and maintenance.

Mr. Ramesh Sanka, Chairman, Conference on Green Existing Buildings & Managing Director, Rental Business, DLF said, converting existing buildings into green is not only environmental friendly but also helps in enhancing the bottom line. By 2025, the retrofit potential of existing buildings in India is worth USD 25 billion, he added.

Mr. Gurmit Singh Arora, Chairman, IGBC Green Existing Building Rating System & Managing Director, Rajco Metals, said, it is now time that we divert our attention to Existing Buildings to solve energy and water crisis. India is the fourth largest carbon emitter and in the next 20-30 years, the demand will increase to 132%, making it the highest emitter in the world, he added. The only solution to these existing problems is making our existing building green. By doing that, we can save 20-30% in energy, 30-40% in water and at the same time, enhance great occupant, health and comfort, said Mr. Arora.

Mr. S Raghupathy, Executive Director CII – Godrej GBC concluded the inaugural session by highlighting that IGBC aspires to have five billion sq. ft. of Green Building footprint in the country by 2016. He suggested the Government to consider providing incentive on Property Tax for high performance buildings.

Mr. Diptivilasa launched an exclusive link in IGBC website that provides information on the possible retrofit technologies in existing buildings. The Chief Guest awarded IGBC Gold Rating to Tata Group's corporate headquarters 'Bombay

House' in Mumbai, which is India's first building to be certified under IGBC Green Existing Building Rating.

Other green projects felicitated with IGBC Awards included: DLF Mall of India – Noida, Eicher Good Earth Pvt. Ltd - Gurgaon, MoUD's GPRA New Residential Township, New Delhi, and Thyagraj Sports Complex, New Delhi.

## REVIEW OF SUBSIDY PLAN FOR OFF-GRID SOLAR APPLICATIONS

The Government is reviewing the subsidy scheme under its flagship programme aimed at promoting off-grid solar applications such as irrigation pumps, home lights and solar lanterns after its dues to solar equipment makers swelled to 1,000 crore because of unanticipated rise in demand.

The vendors, which charged consumers only 70% of the product price in the hope that the government would contribute the balance, are now waiting for the Ministry of New and Renewable Energy to settle their long-pending claims.

"The Ministry has requested the Government to release money from the National Clean Energy Fund while the Ministry is also contributing its share. The Ministry is allocating subsidies as the project proposals come," said Mr. Tarun Kapoor, Secretary in the Ministry of New and Renewable Energy.

Under the Jawaharlal Nehru National Solar Mission (JNNSM), the Government has set an ambitious target of commissioning 20,000 mw of grid connected solar power projects and 2,000 mw of off-grid capacity by 2022.

The total installation of solar off-grid applications across the country increased to 35.09 mwp (megawatt equivalent power) in 2013-14 from 17.59 mwp a year ago. The total number of installations rose to 20 lakh by the end of 2013.

The Ministry is redesigning the format of subsidy disbursement in the wake of growing demand and delays. It is also benchmarking the performance of off grid-products and introducing efficient monitoring system to make the programme more effective. "The impact of subsidy to incentivise off-grid has shown its results. It has drawn in many players, most of them working at the grassroots. The Government needs to link benefits to the performance of the companies now," said ShyamPatra, founder and chief executive of Naturetech Infra, an Uttar Pradesh-based company engaged in installing micro grids in rural areas.

The Ministry has allocated 350 crore for off-grid solar projects out of the total budget outlay of 1,500 crore per financial year, which is proving insufficient in view of the success of the programme, an official said.

An executive with a Delhi-based equipment maker said his company had received just half of the subsidy it claimed, that too after a year-long wait.

The Ministry official, who is a part of the drafting process for the revised subsidy scheme, said, "The government wishes to move away from pure implementation-based model to more 'result-linked benefit' model. As the outreach of off-grid is increasing and multilateral financing is being pumped in renewable energy, subsidy disbursement needs to be closely monitored."

## GLASS FOR EUROPE URGES THE COMMISSION TO STAY CONSISTENT WITH ITS OWN WORDS BY SETTING A 2030 TARGET ON ENERGY EFFICIENCY

Glass for Europe deplores the likely absence of a binding target on energy efficiency in the European Commission's communication on the 2030 climate and energy framework. To Glass for Europe, the absence of a binding target on energy efficiency would be a sign of the European Commission's inability to draw lesson from the 2020 policy framework, which failed to deliver the much-needed energy efficiency gains.

"Over the past months, we heard many times Commission officials praising energy efficiency improvements as a means to reduce $CO_2$ emissions, to generate robust economic activity and jobs and to reduce energy dependence. Yet, we hear rumours that the Commission may not propose any objective for energy efficiency either binding or even indicative", says Bertrand Cazes, Secretary General of Glass for Europe. "It would be incomprehensible to count on major energy efficiency improvements to achieve a competitive low carbon economy and yet to dismiss a target on energy efficiency as part of a fifteen-year strategy" he added.

Glass for Europe deplores the Commission's intention to postpone the decision on a target to the future assessment of the Energy Efficiency Directive expected in June 2014. Progress on the energy efficiency directive must not dictate ambition levels for 2030. On the contrary, instruments must serve to achieve pre-defined policy ambitions. Setting an energy efficiency target for 2030 must come first as part of the communication on a 2030 energy and climate package.

The joint Parliamentary report adopted by the ITRE and ENVI on Jan 8, recognises the tremendous energy and $CO_2$ saving potential of non-ETS sectors. The EU ETS alone cannot deliver the huge savings potential

of the building (61%) and transport (41%) sectors as it will be the case with a GHG target alone. The clear call from the ITRE and ENVI committees of the European Parliament for energy efficiency targets, including a specific one for buildings, must be heard by the European Commission.

Glass for Europe therefore calls on the European Commission to consider a binding objective for energy efficiency within the 2030 framework and to investigate possible new robust measures to tackle the vast potential of non-ETS sectors.

## BOSCH Ltd., BETS BIG ON ENERGY SERVICE BUSINESS THROUGH INVESTMENTS IN GREEN BUILDINGS

Bosch Limited, the Indian subsidiary of the world's biggest supplier of car parts, plans to earn more revenue from its energy solutions business as the company prepares to make it among the three leading players in the country by 2020 and help the company expand its business in the non-auto business.

The new business vertical of the company, formed last month in India, and in 2011 in Germany, aims to offer energy efficiency solutions to commercial buildings in the northern capital region and Bangalore in the south. "We have set a vision, by 2020, we want to be among the top three players in the country in the energy service space," said Mr. Venugopalan CM, head of energy division at Bosch India.

"Our focus area for the first three quarters of this fiscal year will be India. We have a team of 50 in the energy division and we remain optimistic that by the year 2020, the market for this would almost double," Mr. Venugopalan said in an interview.

Commercial buildings in the country consume 20-25% of energy while industries consume another 15%, making global firms, including Siemens and homegrown Voltas, offer solutions to make buildings consume less energy.

"Entry of Bosch is interesting (but) it remains to be seen if they would do much. There are many companies offering such solutions in market that has its own problems," said a Bangalore-based executive at Schneider Electric India. The executive declined to be named as he is not authorised to talk to the media.

One of the problems referred to by the executive is the costs. New commercial units planning to turn green drives up overall costs by 15%, thereby making many developers jumpy to the idea of constructing energy-saving buildings.

Bosch sees an opportunity in this problem and since it is willing to share the extra costs for a new building to have efficiency features, it believes swanky glass units that house Infosys and TCS offices would seek its help in making buildings consume less energy.

"At this moment, we are a full-liner energy solutions company. We'll do energy assessment and implement without any client investment under the shared savings model," explained Mr. Venugopalan. The energy efficiency market in 2012 was estimated to be $16 billion, and the Bureau of Energy Efficiency forecasts it to grow to $148 billion by 2022. But Mr. Venugopalan says 90% of this market is "unrealistic" and so in the coming months, it will reach out to its existing clients.

However, industry players doubt if Bosch's entry in the energy efficiency market would make companies seek help of energy solutions firms to cut energy costs.■

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

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# Glass News Worldwide

## EU GLASS RECYCLING RATE PASSES 70% MARK

Latest industry data – published ahead of the European Commission 2012 figures expected at the end of 2014 – confirm average glass recycling rates in the European Union have passed the 70% mark. This means that over 25bn bottles and jars were collected throughout the European Union in 2012 to make new bottles. The savings in virgin resources could build two Egyptian pyramids.

"Recycling makes good sense for us," said Stefan Jaenecke, President of FEVE. "That's why already 40 years ago we helped to put in place glass collection schemes, to inform the public and to treat recycled glass bottles and jars as a precious resource for our industry. We did not call it at that time the circular economy but this is it."

"This is a concrete case of the decoupling effect that we want to build in a resource efficient Europe. It has been put in place many years ago and works very well," said Filip Kaczmarek, member of the European Parliament. "As policy makers we need to preserve and to support such business models that enhance economic growth, produce high value goods, generate value from waste, while reducing their environmental burden. We need therefore to work on a legislation that acknowledges and incentivises such business models".

## 44TH RECIPIENT OF THE PHOENIX AWARD®

Mr. G. Clinton (Clint) Shay has been selected to be the 44th recipient of The Phoenix Award®

Mr. Shay, now retired from Corning Inc., has been awarded this prestigious prize for his significant contribution to the glass industry in the field of glass forming.

Phoenix Award Committee Chairman, Mr. Wally Evens (left) and Phoenix Award Winner 2014, Mr. G. Clinton Shay (right)

Clint, as he is known to the glass making fraternity, is responsible for inventing the revolutionary, 'down draw' or 'fusion' process. This process produced a pristine flat glass as an alternative to the well-established Pilkington's float process. He was also leader of the team that invented the chemical strengthened fusion glass which resulted in the widely recognised name of Pyrex glass, as well as its use in ophthalmic glass and LCD products. However it was in the 1990's when the technology really came in to its own, with the convergence of the LCD, TV market. The fusion process's thin low warp hard-glass, fulfilled the needs of this technological breakthrough in visual communications. Since those days the process has now moved on to be incorporated in to the hand held devices market, such as touch screen computers, tablets, mobile phones and many other electronic devices, utilizing the protective touch screen glass carrying the brand name of Gorilla® Glass.

The Phoenix Award Committee are proud to be able to make this award to such a deserving person as Clint, and look forward to presenting him with The Phoenix Award at the presentation ceremony later in the year, at a venue yet to be announced.

## FORWARD FOCUS FROM GLASS TECHNOLOGY SPECIALISTS

Independent research, test and design specialists Glass Technology Services Ltd (GTS) will be debating current developments and looking forward to future innovations at Glass Focus 2014 - the glass industry supply-chain conference to be held on May 16, 2014.

Both speaking at and sponsoring the event, the glass specialists will discuss some of their latest research, development and support available to the supply-chain. Rob Ireson, Innovation Team Leader at GTS will be outlining how GTS is leading developments within the photonics and medical devices sectors through innovative new materials and process

capabilities. He will also be presenting GTS's future visions for this exciting and unique material, looking at how glass will continue to revolutionise the way we live in the future.

Glass Focus 2014, an annual glass supply chain conference organised by British Glass, is themed "Innovation within glass and the supply chain" and aims to deliver an informative day which will cover innovations, developments and insights across glass manufacturing sectors and their extensive supply chain - including architects, designers, brand owners, retailers and food and drinks sectors.

GTS Business Development Manager, Philip Marsh, comments: "We are proud to be sponsoring this year's Glass Focus conference and look forward to discussing with delegates the dynamic changes taking place throughout the industry and across the supply chain. This is also a great opportunity for us to catch up with many of our clients and we encourage all those using glass – whether it be for packaging, new technologies, reinforcement, construction, architecture or home goods – to attend and be part of the discussion and help shape the future."

For full details of the conference, please see www.britglass.org.uk/GF2014

## ARDAGH REDUCES COKE BOTTLE WEIGHT BELOW THE 200G MARK

Ardagh has reduced the weight of a 330ml Coca Cola bottle to below the 200g level for the first time.

The new 190g bottle is the result of a series of improvements, which have seen the 330ml version of the contour bottle reduced in weight from 240g in 2005 to its current weight.

The 200ml container has had its weight reduced in three stages during the same timeframe, from 170g in 2002 to its current weight of 140g.

CarstenBerkau, Design Manager for Glass Europe at Ardagh Group, stated: "Lightweighting is an ongoing process through well-established design and manufacturing techniques.

"Our task is keep the brand shape, while determining the stress points and the optimum weight of a glass bottle. State of the art technology ensures that when we are challenged, we can respond with even greater precision."

Ardagh is also working with Coca Cola on other sustainability projects with a view of reducing energy and $CO_2$ emissions.

## CURZON STREET STATION'S 1,300FT GLASS FACADE UNVEILED

Curzon Street Station will become the biggest building in central Birmingham, with a shimmering glass facade stretching a quarter of a mile.

The proposals, set out in the Curzon Street Masterplan, show it will stretch from Millennium Point to the existing Moor Street station opposite the Bullring Shopping Centre.

The lower eastern entrance will be at ground level from New Canal Street and Curzon Street while the upper concourse western entrance will join Moor Street Queensway, with a connection to Moor Street station.

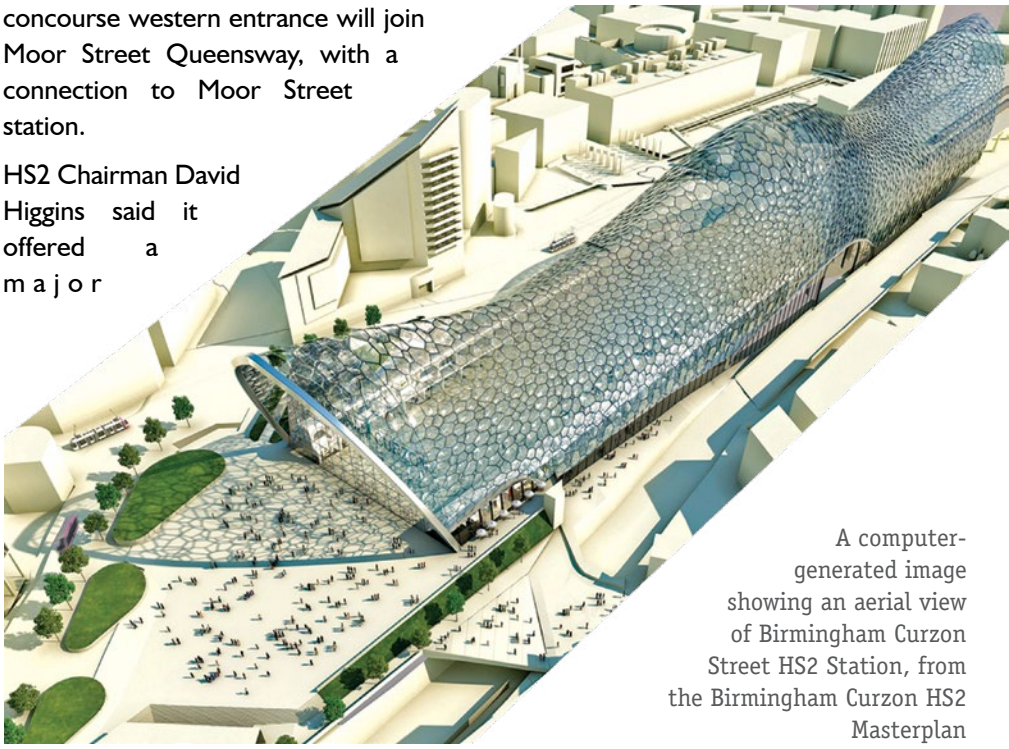
HS2 Chairman David Higgins said it offered a major opportunity to stimulate investment and was excited about the city council's plans.

He said: "We welcome the launch of the Curzon Street Masterplan which shows an exciting vision of how the area around the station can be developed and transformed. This is exactly the kind of ambitious plan that will stimulate the public, private sector partnerships needed to unlock investment.

"HS2 offers a great opportunity for investment and jobs around the station, and for the wider region. We are committed to working closely with Greater Birmingham partners and the local Eastside and Digbeth communities to bring this scheme to life and to help ensure that the most is made of the opportunities that HS2 brings."

The structure of the Curzon Street station will take about five years to complete, starting in 2018. It will take another year to fit it out from 2023 and undergo testing and commissioning until 2026.■

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



A computer-generated image showing an aerial view of Birmingham Curzon Street HS2 Station, from the Birmingham Curzon HS2 Masterplan

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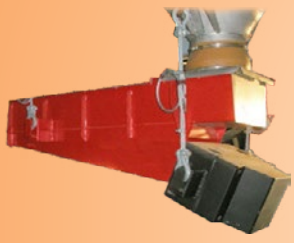

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# Glass Manufacturing – Part II: Heat Transfer Process in Glass Fabrication

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## ABSTRACT

There are various features in the process of manufacturing of glasses.This normally depends on the type of glass and the manufacturing method. Some important aspects in the manufacture of glasses are very important and these aspects mainly hint at theoretical understanding of different processes involved in making the glass. These aspects are heat-transfer and fluid flow, particularly a study of the interaction between them is very interesting indeed. The heat transfer process in the glass tank furnace has already been discussed in the first part. In this article, the second part will deal with heat transfer in the glass fabrication, while the fluid flow is also a very interesting subject that will be dealt with in the future publications.

## INTRODUCTION

During the past several decades, there have been a lot of newer interesting developments in field of glass technology, counting all the small but incremental developments. One of them is a more or less adequate knowledge or clarifications on the 'role of radiation' as a mechanism of heat-transfer process in glass. This can occur at high temperatures (1250 – 1600C) inside the 'glass tank furnace' for melting as well as at relatively lower temperatures (620 – 1100C) encountered in the different fabrication processes. Heat is transferred from one body or system to another by three different means – viz. conduction, convection and radiation. The latter is very important in relation to the other two mechanisms that depend on certain factors. The process of radiative transfer of heat flux at higher temperature that occurs in the glass tank furnace has already been discussed. However, the process of heat transfer at lower temperature that occurs during the fabrication of different glass products assumes special importance.

Compared to ceramics manufacture, where shapes are made first and then the firing is done, for glass manufacturing, the raw materials are first homogeneously mixed and then melted and refined at high temperature. The refined melt is then used to shape different products, including special type of glasses **[1,2]**. This is true for batch type of operation, i.e. for optical glasses, as well as for continuous operation of float glass, container glass, etc. **[3,4]**. Depending on whether the glass melting is batch type or continuous type, the fabrication technique could be continuous, and hence heat-transfer in the glass fabrication process also assumes importance.

## HEAT TRANSFER IN GLASS FABRICTION

The field of engineering related to glass fabrication encompasses a whole gamut of applications, such as mechanical, electrical, electronics, robotics, etc. After melting and refining at high temperature, where radiative heat transfer is significant in the glass tank furnace, the glass products are fabricated at lower temperature (620-1100C) to attain the required higher viscosity so that the fabrication of the right size or shape can be performed. At this lower temperature range, the heat transfer process is also important.

### *Container and Other Glasses*

A large variety of fabrication processes are used in different glass plants for different range of products. For container glass manufacture, the products are made by pressing in contact with metal moulds. As the glass first comes in contact with the mould, its temperature is around 1000-1100C, while the surface of the mould is at much lower temperature, i.e. at 400-500C. For the metal moulds, the surface temperature is of utmost importance, as it determines not only the smooth heat-transfer process, but also fixes the quality of the glass products.

For example, if the temperature is too high, the viscosity of the glass will be such that it will stick to the mould increasing the rejection losses. However, if it is too low, the glasses will have poor surface finish that will be less appealing to the customers of the particular product items. This is a serious "quality control" problem, but it should be also viewed by the knowledge of the "glass technologists" regarding viscosity - temperature relation that is fundamental to glass making. The curve of viscosity falls exponentially with temperature, i.e. viscosity increases sharply with decreasing temperature. A higher temperature at the mould surface will prevent the heat-transfer between the glass and the mould, thereby increasing the glass temperature, or rather the temperature does not fall enough to give rise to the required viscosity. This in turn will decrease the viscosity so that the fluidity of the hot glass is enough to give rise to "sticking" problem during the fabrication of container glasses. On the other hand, a lower surface temperature will enable a faster heat transfer, but in that case the "glass surface" will be affected.

Ultimately, the temperature difference in the "glass-mould" interface is of interest to glass fabrication. If the initial temperature difference at the interface is large, then there will be correspondingly larger heat flux across this interface, which is of primary importance. The magnitude of such heat flux depends upon the thermal resistance of the interface, which finally depends on the "intimacy" of contact between the mould and the glass. So, for container glasses, the nature of heat-transfer is conductive. In other processes, such as the manufacture of glass tube (i.e. for lighting) and glass fibres (i.e. for insulation purpose), the moulds are not used. In such cases, the glass looses heat by radiation and convection to the surrounding atmosphere. However, in such processes, the "heat flux density" of the surface is much less than that of 'container glasses' involving the physical contact with metal moulds.

As the temperature is reduced, its viscosity increases, i.e. the fluidity decreases that tend to be more like a solid. Hence, the distribution of temperature in a glass at any moment of time obviously determines the viscosity distribution, i.e. it decides on the way the glass will flow in relation to the force applied to the glass. Therefore, one has to understand the factors controlling heat transfer during the fabrication process, which is a very important component for a thorough knowledge of the process.

### *Non-Steady State Heat Transfer*

For the radiative heat-transfer, the steady-state problem was discussed in the first part of the paper. In the glass fabrication process, the non-steady state heat transfer problem is encountered, wherein the heat transfer is by both radiation and conduction. In the shaping process, the behavior of couloured glass is expected to be different from that of colourless glass, if it is proven that the part of the total heat flux through radiation is large enough and it has an important effect in determining the temperature distribution inside the glass. This is quite obvious for glassblowers who find difficulty in blowing coloured glass, as the cooling rate is different in differently coloured glasses in free cooling crucibles. Therefore, it is again proven that the radiation is relatively more important. Thus, the "glass colour effect" significantly varies from one set of conditions to another. The physics of the whole situation had to be properly understood so as to appreciate why coloured glasses behave differently in relation to the colourless glasses.

In order to start the discussion, it is convenient to mention about the "emission" of radiation from a sheet of glass, which is initially in isothermal condition at a temperature T $^0$K. This isothermal sheet of glass is assumed to be suddenly exposed to cold surroundings. Therefore, it is possible to neglect the 'radiation' that has to be received by the glass sheet from the surroundings. Let us calculate the total radiation emitted by the sheet and then in the initial rate of cooling at different positions of the sheet. The theory for this purpose was developed by Gardon **[5,6]**. Let us take a sheet of thickness *X* made from a grey absorber of absorption coefficient ($\alpha$), and the expression for initial radiant emission is:

$$M_{\varepsilon} = \varepsilon\sigma T^4 W/m^2 \qquad (1)$$

Where the emissivity ($\varepsilon$) being the function of the dimensionless "optical thickness" ($\alpha X$) of the sheet. However, when $\alpha$ is a function of wavelength ($\lambda$), the emissivity can be deduced by calculating the 'optical thickness' using a mean value of the absorption coefficient. This 'mean value' is normally deduced by an integral (within the limits of 0 and $\infty$) of the 'intensity of black radiation' multiplied by the absorption coefficient.

There is a shift of the radiation energy distribution in relation with increasing temperature toward the shorter wavelength. At this shifted wavelength, most commercial glasses have lower $\alpha(\lambda)$ values, and consequently the emissivity decreases with increasing temperature. This point is quite important in the glass fabrication process. Therefore, at room temperature, a 10 mm thick 'window glass' sheet has an emissivity of 0.93. This value decreases to 0.56 at a very high temperature of 1200C. Here, the treatment is done on a sheet of glass that is initially free from any temperature gradients, and the initial cooling rates at different positions in the sheet are determined only by the radiation terms in the energy balance equation.

## GARDON'S TREATMENT

Gardon treatment **[5]** is very well-known in the field of heat-transfer during fabrication process, where the rate of cooling is considered at the centre of a glass sheet. At very low value of the absorption coefficient ($\alpha(\lambda)$), the rate of emission of radiation from the glass is low, i.e. the "rate of cooling" is low. When $\alpha(\lambda)$ is high, the emitted radiation is very quickly re-adsorbed within a short distance from the centre of the sheet. Therefore, as a consequence, the "net rate of loss of energy" from the central layer is again small. Gardon's analysis of this problem shows the rate of cooling at the centre of the glass sheet is a maximum, as the optical thickness ($\alpha X$) is 1.5.

This is a piece of interesting information that is to be understood in terms of certain features of heat transfer during glass fabrication process. In order to develop a presentable model, the situation or rather simulation of the problem at hand, i.e. "pressing operation" for the container glasses, an assembly can be considered with a 10 mm thick sheet of glass with similar absorption properties as that of window glass, which is also initially considered to be at a uniform temperature of 1000C. The model is further expanded with this glass sheet suddenly sandwiched between two metal plates at a lower temperature of 400C, and the plates are in contact with the glass. However, in this model, the main concern is that the transparent glassy material is considered and the initial rate of cooling will be zero at the centre of the glass sheet, and also it would remain very small for some time after the glass comes into contact with the metal plates.

It has been found that a large amount of cooling would take place for values of dimensionless parameter less than about 2 and this value is described by: $X/4(at)^{1/2}$, where "X" is thickness of the glass sheet and "*a*" the thermal diffusivity of the glass. The corresponding time is 2 seconds for a 10 mm thick glass sheet. For pressing operation in the container glass production, this is about the time at which the plunger in an IS machine comes into contact with glass "gob". Therefore, there will be very small cooling at the centre without any radiation. It is worth noting that due to the radiation effects, the initial rate of cooling is quite large. As per the analysis of Gardon, it can be easily shown that the initial rate of cooling there is around 7 $^0$C/s. It has also to be noted that for a heavily coloured glass, it is usual to neglect the radiation effect. In such a case, the problem is simplified in that the heat transfer takes place mainly by conduction, whose solution is already known.

In a sheet of glass, the rate of cooling at its centre is much less important than at the surface. During the shaping process in the fabrication of various glass articles, both the temperature and the corresponding viscosity at the surface, as discussed in the Section-2.1, have a much greater effect on the overall behavior of the glass. As it will be evident later, normally the radiation has a minor effect in determining the distribution of temperature and heat flux close to the glass-mould interface. When the contact between the mould and the glass is considered to be perfect, the surface temperature of both glass and the mould change immediately after coming into contact at a temperature that can be taken as the "critical temperature ($T_c$), which ultimately remains constant for some time. The value of $T_c$ is given by

$$T_c = T_{Mi} + (T_{Gi}-T_{Mi})\, E_G/(E_G+E_M) \quad (2)$$

Where, $T_{Gi}$ and $T_{Mi}$ are the intial uniform temperatures of the glass and the metal mould respectively **[7]**. The parameters (*E*) are denoted as "thermal contact coefficients" **[8]** that are related to the "thermal conductivity" (*K*) and "thermal diffusivity (*a*) as:

$$E = K/\sqrt{a} \quad (3)$$

Actually, the thermal contact between glass and metal mould is hardly perfect. There are various reasons for this imperfectness that is due to thermal resistance of the interface temperature of glass and mould tends towards the $T_c$ value given by the equation (2) at a finite rate. The heat flux across the interface at any instant is proportional to the difference between the surface temperatures of the glass and metal mould, which is expressed as:

$$Q(t) = h(T_{Gs}- T_{Ms}) \quad (4)$$

Where *h* is the "interface heat transfer coefficient". The single most important factor is perhaps the value of h for determining the rate at which heat is "extracted" during glass forming processes that involve metal moulds. Generally speaking, it is practically impossible to determine the value of *h* by experiments under the "conditions" that are relevant to the fabrication of glasses. The reason for this experimental difficulty lies in the fact that the "values" are greatly affected by the "pressure" applied across the mould-glass interface. Moreover, from computer analysis, it has been found by McGraw **[9]** that the value of *h* considerably decreases during the "time period" of contact between glass and mould. Normally, for ordinary glasses, these values are in the range: 1 – 10 KW/m$^2$.

If we assume an initial difference of surface temperature between glass and mould of 500C, the initial heat flux across the interface will be in the range: 0.5 – 5 MW/m$^2$. This is definitely more remarkable than that expected from a contribution of radiation. Hence, at a much higher temperature of 1000C, the value $\sigma T^4$ is only 0.15 MW/m$^2$. A detailed computer simulation work by McGraw **[9]** and Jones and Basnett

**[10]** support the above conclusions. The idea is that while the glass is in contact with the mould, the variation of the 'absorption coefficient' of the glass has no practical significance on the distribution of temperature near the interface and the heat flux from the glass to the metal mould. Therefore, in this kind of shaping or forming process, glasses differently coloured would behave in a similar manner.

It is well known to glass technologists dealing with container glass that when the glass article is removed from the mould, the surface temperature of the glass starts to increase. This is due to the combined effect of the large reduction in the "rate of heat extraction" from the surface of the glass. This is also due to a very steep temperature gradient that occurs when the glass was still under the contact with the metal mould. This is a typical "reheat" effect, which is an important feature of glass manufacturing process.

On the question of container glasses, they are made of two moulds. The first one called a "parison" mould that is used for forming the "neck" of the particular container and a 'preform' of the body. The final product is made by blowing out 'preform' or 'parison' in the second mould. When the glass 'parison' is released from the 'parison' mould, its surface needs to allow an increase of temperature or "reheat" before the final shape can be blown. Moreover, when the finished product, e.g. a container bottle, is released from the "blow mould", some 'reheating' takes place at the surface of the glass, and on release from the 'blow mould', when the rise in surface temperature is too large, the glass piece could collapse under its own weight. Here, there is a role played by surface viscosity. As the surface temperature rises due to this 'reheating', the viscosity decreases (i.e. increased fluidity) and consequently the glass bottle could deform or collapse (where its weight also plays a role), thereby increasing the 'rejection losses'. Moreover, in this reheat part of the manufacturing process, the radiation heat transfer within the glass as well as from the glass surface might have a significant role.

The above describes the situation for container glasses (i.e. bottles, drinking glass, bowls, etc.). Another example can be described for 'glass tubes'. In this case, the glass does not come into contact with metal moulds, and so the radiation is the dominant mechanism of heat transfer in the process of tube manufacture. Here, the heat is lost from the outer surface of the glass tube by natural convection and also by radiation. For natural convection, the coefficients of heat transfer are of the order 10W/m$^2$ giving a value of 10kW/m$^2$ for the 'surface heat flux' from the glass surface at about 1000C to air at ambient temperatures.

In my Department of Glass Technology at the University of Sheffield (UK), our great Professor Turner did an extensive work on coloured glasses **[11]**. Therefore, an example should be given on coloured glasses vis-à-vis . For a 10 mm thickness of a commercial coloured glass, the 'radiation heat loss' is much larger, i.e. about 80 kW/m$^2$. Therefore, in this type of process for making coloured glasses, there is a marked effect of "colour" on the rate of cooling and hence on the working behavior of the glass during the shaping process **[12].**

## CONCLUSIONS:

In the first part, a description on the heat transfer process in the glass tank furnace was given in details. In this article, in the second part, the heat transfers that take place during fabrication or forming processes are described. In particular, the heat transfer is discussed in terms of container glass manufacture and then the non-steady state heat flow during the glass fabrication process is briefly discussed. Finally, Gardon's treatment is elaborated with some real data that could help the glass technologists to undertake some small steps of calculations of various heat flux data with a particular reference to container glass manufacture, but some data are also shown on glass tubes for lighting as well as for coloured glasses, which behave differently than that of commercial colourless glasses.

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# समाचार

## गैस कटौती पर मुख्यमंत्री से मिले उद्यमी

**फीरोजाबाद:** उद्योगों को मिलने वाली रियायती गैस में कटौती का मुद्दा अब मुख्यमंत्री और विधानसभा तक पहुँच गया है। उद्यमियों ने जहाँ मुख्यमंत्री अखिलेश यादव से मिलकर अपनी फरियाद लगाई तो भाजपा विधायक मनीष असीजा ने इसे विधानसभा में उठाया।

नियम 51 के तहत विधायक असीजा ने कहा कि उच्चतम न्यायालय के आदेशानुसार फीरोजाबाद के कांच उद्योग को 11 लाख घनमीटर एपीएम गैस का कोटा आवंटित किया गया था। वर्ष 1996 से लागू इस कोटे में अब भारी फेरबदल करते हुए दामों में भी बदलाव किया जा रहा है। जिससे 100 साल पुराने कांच उद्योग और इससे जुड़े लाखों मजदूरों के समक्ष संकट खड़ा हो जाएगा। सालाना के 1200 करोड़ रूपये के निर्यात पर भी असर पड़ेगा। विधायक ने शासन को अवगत कराया कि टीटीजेड क्षेत्र होने के कारण गैस के विकल्प के रूप में दूसरे किसी ईधन का प्रयोग नहीं किया जा सकता। ऐसे में पूर्व निर्धारित कोटे में कटौती कांच उद्योग को तबाह कर देगी।

उधर उद्यमियों का एक प्रतिनिधि मंडल राष्ट्रीय महासचिव एवं सांसद प्रो. रामगोपाल के निर्देशन में मुख्यमंत्री अखिलेश यादव से मिला। उद्यमियों ने गैस कटौती पर चिंता जताते हुए उद्योग को बचाने की गुहार लगाई। इस पर मुख्यमंत्री ने केंद्रीय पैट्रोलियम मंत्री वीरप्पा मोइली को पत्र लिखकर गैस कटौती समाप्त कराने का अनुरोध किया है। प्रतिनिधि मंडल में बिन्नी मित्तल, रीतेश मित्तल, अनुराग मित्तल और दीपक गुप्ता शामिल रहे।

## महंगी पड़ेगी गैस, आएगी आफत

फर्ज करें कि पहले से आपका उद्योग मुश्किलों से जूझ रहा हो और एक नई आफत आ जाए। या आप पहले से ही बढ़ती महंगाई से परेशान हों और महंगी बिजली का करंट लगे। महंगे पेट्रोल से बचने के लिए आपने अपनी गाड़ी में सीएनजी किट फिट कराई, पर यह वैकल्पिक ईंधन अचानक 12 रूपये प्रति किलो महंगा हो जाए।

**सूक्ष्म, लघु एवं मझोल उद्योग (एमएसएमई)** सेक्टर तकनीक और प्रतिस्पर्धा जैसे मसलों से पहले ही जूझ रहा है। ईंधन के रूप में प्राकृतिक गैस का इस्तेमाल करने वाले उपक्रमों पर संकट आने वाला है। आगरा और फिरोजाबाद जैसे कुछ एमएमसएमई क्लस्टरों की बात करें तो उन्हें पर्यावरण की दुहाई देकर अनिवार्य रूप से बतौर ईंधन कोयले की जगह गैस अपनाने पर बाध्य किया गया। उस समय कुछ सहूलियतें मिलीं, लेकिन ईंधन का यही विकल्प उनके लिए बड़ी समस्या खड़ी करने वाला है। अब तमाम उद्यमियों को कड़े फैसले लेने पर विवश होना पड़ेगा।

देश में इस क्षेत्र की सबसे बड़ी संस्था फेडरेशन ऑफ एमएसएमई (फिस्मे) के महासचिव अनिल भारद्वाज का भी कहना है कि दो तरह के एमएसएमई ईंधन के रूप में गैस का इस्तेमाल करते हैं। पहले वो जिनके उत्पादों का कोई विकल्प नहीं है। इन उद्यमियों को दिक्कत नहीं है क्योंकि वे बढ़ी लागत का बोझ उपभोक्ता पर डाल देंगे। मसलन, फिरोजावाद का चूड़ी उद्योग। देश में कहीं और चूड़ियां न तो बनती हैं और ही चीन से इनका आयात होता है।

पर समस्या कांच के झाड़–फानूस, चाय पीने वाले गिलास और शराब पीने में इस्तेमाल होने वाले ग्लास बनाने वालों के सामने खड़ी होगी। इनका चीन, मलेशिया और कोरिया जैसे मुल्कों से धड़ल्ले से आयात होता है। गैस के दाम बढ़ने पर इनके उत्पादों की कीमत भी बढ़ेगी। तब उन्हें उत्पादन छोड़ कर कारोबारी बनना होगा।

गैस से कास्टिंग यूनिट चलाने वाले आगरा के उद्यमियों पर भी आफत आनी तय है। इन यूनिट्स में ऑटो, मोटर, जनरेटर और पंप सेट कंपनियों के लिए प्रोडक्ट बनाए जाते हैं। ये प्रोडक्ट्स पश्चिम बंगाल के हावड़ा–लिलुआ क्लस्टर और दक्षिण भारत के कोयम्बटूर क्लस्टर में भी बनते हैं। इन क्लस्टरों में कोयले के इस्तेमाल की छूट है। लेकिन आगरा में कोयले का इस्तेमाल इसलिए बंद करवा दिया गया ताकि ताजमहल पर बुरा असर न पड़े। ■

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

**AIGMF organized meeting with Dealers of the Flat Glass at NCR/Delhi on Jan 31, 2014**

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FOR ENTIRE
Cosmetics
Packaging

CLOSURES
Metalising
Anodizing
Foiling

SPRAY PUMPS
Cartons
&
Lables

GLASS BOTTLES & JARS
Frosting
Printing
Coating

## Pragati Glass Pvt. Limited.

| | |
|---|---|
| Head Office : (Marketing) | 111, Damji Shamji Ind Complex<br>9, L.B.S. Marg, Kurla (W), Mumbai 400070<br>Tel : +91 22 25164922/24<br>Fax : +91 22 25153677<br>Email: info@pragatiglass.com<br>Web: www.pragatiglass.com |
| Plant : | Kosamba, Dist Bharuch, Gujarat, India |
| Furnaces : | Two |
| Capacity : | (80+90) 170/TDP |
| Glass : | Flint |
| Range : | Manufacture glass bottles ranging from 10 ml to 1000 ml for Cosmetic/Perfumery, Food processing Pharmaceuticals, Liqour etc.<br><br>Being a single source for entire cosmetic/perfumery packaging we have frosting, printing and coating facilities along with closures, matelizing, anodizing and foiling. Also spray pumps lables and mono cartons. |
| Export : | Almost 50% of production is exported to 20 countries |

## Pragati Glass LLC. Oman

| | |
|---|---|
| Plant: | 267, Nizwa Industrial Estate, Nizwa, P.O. Box 1314, P.C. 611, Sultanate of Oman<br>Tel: +968-95703147<br>Fax : +968 25449431<br>Email: info@pragatiglass.com, Web:www.pragatiglass.com |
| Furnace : | One |
| Glass : | Flint |
| Capacity : | 135/TDP |
| Range : | Manufacture glass bottles for Liqour, Food processing and Cosmetic/perfumery etc. |
| Export : | Almost entire production |

## P. G. Glass Pvt. Limited.

A 80/TDP green field plant established in Kosamba, Gujarat in 2008-09 was closed due to some technical reasons and prevailing market conditions.

Propose to re-start the same with some partners.

# "Crystal Clear" Thermal Process

## High availability, transparency and efficiency in melting and cooling optical glass with the latest process control technology

A redundant version of an established process control system provides maximum availability, "clear as glass" process control and very simple operation at a new melting tank and the corresponding annealing lehr – thus guaranteeing consistently high quality of optical glass blanks. Operators, service providers and system integrators worked together to implement a solution in approximately 100 days which can also be applied to future projects.

You don't build a new glass melting tank every day. And if you do, it's rare that it only takes 100 days from when the order is received until the first time the furnace is fired up. After the management decided to expand production capacity, the increased demand needed to be met quickly, so the aim of Barberini GmbH was to achieve this task in just a third of the time usually required. The company, which is located in Grünenplan, near Hanover, is the German branch of Barberini S.p.A. (Silvi/Italy), a well-known manufacturer of high-quality optical glass in different grades, colors and forms. The Italian company acquired the optical glass section of Schott AG in Grünenplan in 2010 and expanded their market position. Since then, they have been using various services in addition to the technology of the previous owner, including batch preparation and servicing and maintenance of the production plants.

Lars Bothe-Linke is responsible for the electrical engineering at Schott in Grünenplan. Linke is also very familiar with Barberini's plants and requirements and was therefore entrusted with finding a user-friendly, reliable and cost-efficient automation solution for a new, fifth melting tank. The company wanted a modern solution based on current standards for which spare parts and support would still be available in 15 or 20 years. Schott's Head of Electrical Engineering relied on his experience with Siemens automation technology and on cooperation with On/Off Engineering GmbH from Wunstorf near Hanover. The company belongs to the first generation of Siemens Automation Solution Partners in Germany and is, among other things, a "Certified specialist" for the SIMATIC PCS 7 process control system, also in safety applications (box).

In cooperation with Rainer Adebahr, the Technical Head of Barberini GmbH, the requirement specification was created and the system integrator was given the order to implement automation and process control, redundant in parts, for the new melting tank and the existing annealing lehr. "Our customer wanted everything from a single source, from design to commissioning, including the process control technology, all software, low-voltage distribution, switchgear, AC power controllers and control panel construction", says Jürgen Flütter, sales engineer of On/Off, providing a broad outline of the project scope.

### TRIED-AND-TESTED PROCESS WITH NEW CONTROL

With the capacity expansion, the manufacturer can quickly and flexibly cover the rising demand for high-quality special glass, in particular for phototropic (adapting to light conditions) or optical (corrective) sunglasses and also glass forms for the manufacture of plastic "glasses".

The main tasks of the new, plant-wide automation technology are closed-loop and open-loop control as well as operator control and monitoring of the thermal processes, which themselves have not changed: starting with entering the batch into the melting tank, to controlled melting, purification and mixing of the glass with continuous level measurement, all the way to transfer to the forming press. Additional automation tasks include temperature control in the annealing lehr after pressing and control of the oil extraction.

### REDUNDANCY ENSURES AVAILABILITY

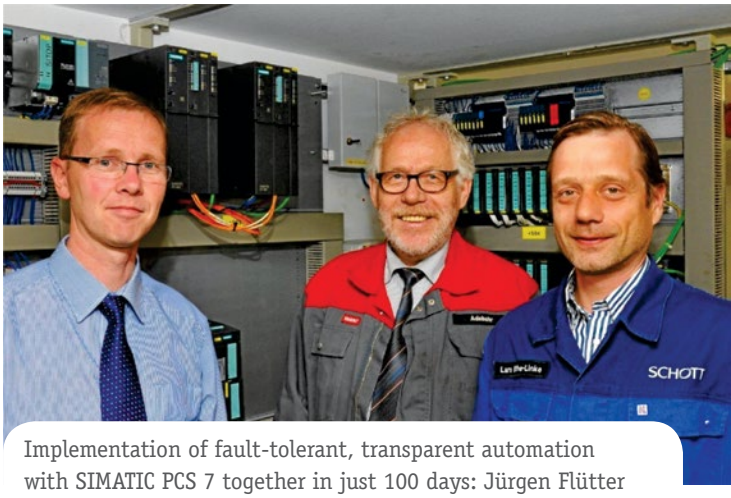
The core of the automation solution is the SIMATIC PCS 7 process control system from Siemens. Its two CPUs (S7-414H) are connected to one another via fiber optic cables and constantly synchronize with each other during runtime. If one CPU fails, the other automatically takes over operation. The faulty unit can be replaced during operation, which

means that a continuous, problem-free melting process is guaranteed. "Ultimately, this redundancy gave us the courage to completely dispense with the emergency manual operating level familiar to us in the company, which was originally planned", says Rainer Adebahr. "This means that we were able to almost halve overheads and save a great deal of time and, of course, considerable costs".

While the plant previously contained hardware controllers, often in duplicate, the new plant contains only a few measuring systems, mainly to record temperatures. The signals from these measuring systems can be processed reliably and in a redundant manner by the high-performance SIMATIC controller. For this purpose, two sensors each are connected to the controller via two different input/output cards in two different input/output modules (channel-specific redundancy). The controller processes the two physical measured values in each case as one logical value, adjusts the temperature control via heaters or fans as necessary, and ensures consistent process conditions and therefore consistent glass quality.

The integration of available heaters and transducers as well as existing plant sections into the new process control system was also possible without problems. The controller of the existing annealing lehr was also renewed and included in the new automation solution. This is completely in line with the concept of Totally Integrated Automation (TIA), Siemens' consistent automation approach. It was also possible to achieve considerably more efficient peak load management in PCS 7. With intelligent division of heating zones and a new heating up program, the maximum energy consumption in this area was reduced from 500 kW to about 120 kW.

Communication in the field is redundant and takes place via Profibus and coupled interface modules from the ET200M range. On the higher plant level and the terminal level, redundant ring topologies ensure reliable data transmission via Industrial Ethernet. The process data is saved on two redundant servers (SIMATIC 547D industrial PCs) and transferred from there via OPC (OLE for Process Control) and fiber optic cables to the existing quality assurance system on the central computer of Schott and Barberini.




Implementation of fault-tolerant, transparent automation with SIMATIC PCS 7 together in just 100 days: Jürgen Flütter (sales engineer at On/Off Engineering GmbH), Rainer Adebahr (Technical Head of Barberini GmbH) and Lars Bothe-Linke (Head of Electrical Engineering at Schott AG) (l to r)

Simple, efficient operator control and monitoring

The entire automation technology is located in an air-conditioned control room, which requires considerably less space than the systems of the other four tanks. The control room contains an operator station and an engineering station, primarily for service tasks. From these stations, authorized users can change outgoing parameters and intervene more in the melting process via the restricted operating level.

However, Rainer Adebahr's most urgent request was a simple operator control and monitoring concept reduced to what is absolute necessary which gives plant managers only the information and intervention possibilities that they actually need in their daily work. Based on this request, a visualization system was set up with four large touch displays, each of which shows only the most important process parameters of a specific plant section. Using the time sequence of the elementary parameters of the melting furnace in trend form, the user can identify at a glance whether the process is running within the specified limits. The PCS 7 specialists from On/Off further simplified and compressed the standard operating interface as well as the four plant areas on to one page each in order to avoid unnecessary scrolling and malfunctions.

The Schott service providers benefit from the fact that they are always at the process level and can quickly localize deviations in the process thanks to the central bundling of all parameters in the new control system. This means that they can provide high-quality service with comparatively low overheads and contribute towards the high availability of the new solution.

## BUILT-IN LONG-TERM SECURITY

For the operator, an important reason for the consistent use of standardized hardware and software components from Siemens is that these components are widely used in practically all industries, meaning that corresponding numbers of service providers are also available. With large suppliers like Siemens, spare parts supply or migration to future systems is guaranteed over the long service life of the new tank.

## ADDITIONAL PROJECTS IN FOCUS

The responsible parties at Barberini and Schott have been won over by the fast, problem-free implementation of the new automation solution and the fact that it has been operating without faults for over a year. The operators quickly got used to the unfamiliar operation by touch screen and now appreciate the convenience and simplicity of touch operation. As yet, the emergency manual operating level has not been missed.

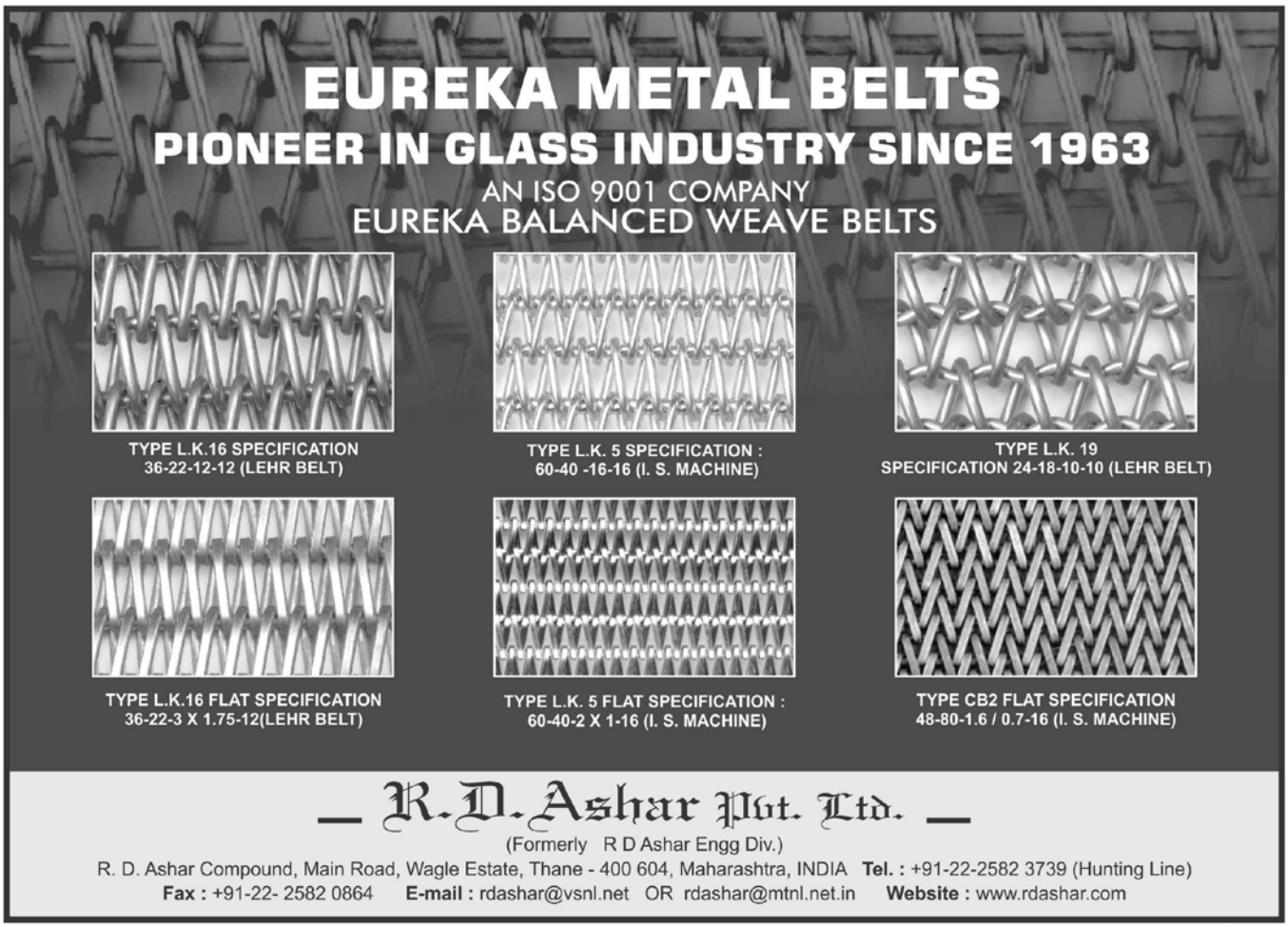
Both sides are considering whether to automate existing and new melting tanks with the very latest technology according to the tried-and-tested approach with SIMATIC controllers and the SIMATIC PCS 7 process control system. In this way, the cooperative partnership between Barberini, Schott and On/Off could be continued.

## INDIVIDUAL SOLUTIONS FROM CONCEPT TO SUPPORT

On/Off Engineering GmbH, one of four companies belonging to the On/Off Group, was founded in 1988 in Hanover as a product- and system-independent engineering office for automation technology and has developed into a leading service provider in the field of process automation. The company now employs over 140 workers and, with several branches throughout Germany, is always close to the customer. The company's range of services covers all tasks in the areas of process automation, area/process monitoring, computer validation, MES solutions, I&C management, control cabinet construction, assembly and site management. On/Off develops individual concepts according to customer-specific requirements and offers everything from a single source: from system consulting and analysis, to configuration and implementation of turnkey overall solutions, all the way to maintenance and servicing. Its customers include medium-sized and large companies from sectors including chemicals, pharmaceuticals, food and beverage, water, glass, energy, mechanical engineering, oil and gas, pulp and paper, cement, and building material.

The On/Off Group has been a certified "Siemens Automation Solution Partner" from an early stage, including the categories "Specialist" and "Industry". As such, the company has proven its solution competence based on products and systems from Siemens in a large number of projects in different sectors.■

*Contributed by Siemens.*

Europe is the world leader in the specialised knowhow to make high end perfumery containers.

# Building brands with designer glass

## FEVE Senior Communications Manager, Michael Delle Selve discusses how glass flacons made in Europe are key to brand building.

At the recent Luxury Goods Packaging Exhibition in Monaco, CEOs from Europe's leading producers of designer glass flacons for cosmetics and perfumery told delegates how 'building brands with designer glass' is one of Europe's strong points. According to the CEOs, glass packaging makes a brand stand out on the shelves and it communicates to consumers' design, elegance and prestige. Glass helps consumers 'feel' an emotional connection with the brands.

According to a recent Europe-wide consumer survey[1], 67% of European consumers think glass offers the most prestige to the product among all packaging materials and they associate glass with their favourite brands.

The turnover of glass flacon producers for cosmetics and perfumery in Europe amounts to over €1 billion annually and the sector employs almost 9500 people. Europe is world leader in having the specialised knowhow to make these high end perfumery containers.

The appeal of glass and design are packaging characteristics today that are vital in a crowded and demanding market. European consumers are increasingly looking for rare or extraordinary products that can make them feel good, as well as consumers in emerging markets who have progressively similar demands.

According to the panellists, brands want to have ease of access to high quality packaging solutions that meet increasingly demanding design and technological requirements and that can only be achieved with the most advanced knowhow of European glass manufacturers. CEOs said that Europe excels in the kind of knowhow needed to create and provide beautiful packaging. Europe's flaconnage sector has a long tradition and continues to innovate in building state-of-the-art decoration facilities, allowing them to provide finished premium packaging products directly.

Delegates also heard that what the glass flaconnage industry is doing for the perfumery sector is now being applied to other high end segments like spirits and this is finding resonance among consumers. More than 60,000 consumers are members of the Europe-wide Friends of Glass social media community because they consider glass packaging as part of their lifestyle choice.

The panel session at Luxepack 2013 was organised by FEVE – the EU container glass federation. Panellists included Hubert Varlet, former CEO of Pochet group, Ashok Sudan, CEO of SGD, Ulrich Nebe, CEO of Heinz Glas, Johannes Schick, CEO of Stölzle and Alberto Bormioli, President of Luigi Bormioli. ■

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REFERENCE
1. The Insites research was carried out from Insites Research in December 2010. Data are available on www.feve.org

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