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glass WORLDWIDE

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Batch technology for thin glass

Egbert Wenninger discusses the latest thin aluminosilicate glasses for portable electronic devices and the importance of high specification batching equipment for raw materials processing and handling.

EME Maschinenfabrik Clasen GmbH was founded in 1920 and joined the SORG Group in 1987. The company is now one of the leading suppliers of batch preparation and cullet treatment equipment to the glass industry worldwide. Together with sister company Shanghai Precision Dosing & Weighing System Co Ltd, EME has supplied more than 250 batch plants to the glass industry.

The SORG Group of companies, comprising EME and its affiliated companies Shanghai Precision, Nikolaus Sorg and Sorg Keramik Services (SKS), supplies all necessary equipment and technologies required for the complete batch and melting process, starting with the delivery of raw materials through to the transfer of conditioned glass to the forming process.

SERVICE VERSATILITY

Batch plants are required for all types of glass and compositions, from very small installation, with a melting capacity of just 10 tonnes/day, up to giant batch plants of up to 2400 tonnes/day. In terms of operational melting furnaces and tonnage, the glass container sector is by far the biggest. Glass containers are the superior packaging material for beer, soft drinks and many other products in the food and beverage industry – durable, safe and fully recyclable.

Compared to glass containers, float glass is a fairly young industry, in particular flat glass produced via the revolutionary float process, which began its commercial success in the early 1970s. The main use of flat glass is in architectural and automotive applications, as well as indoors. With the booming market for flat TV screens and portable electronic devices, demand for thin and ultra-thin glass (0.3mm – 1.1mm) with very specific properties has skyrocketed within a very short period of time and new production processes and glass compositions have been developed. Also the solar industry created a short-term boom for ultra-clear glasses with low iron

content and this was one of the reasons for the ongoing overcapacity in flat glass.

Glassfibre represents a growing part of the glass manufacturing industry, with a wide range of applications. The main product types are glassfibres for insulation purposes and composite materials but there are many more such as woven roving fibres, mats and chopped fibres that can be found in filters, car batteries or wallpapers. The range of glass products is completed with tableware, cosmetics, pharmaceutical, special, optical, lighting and water glasses. EME and its sister company Shanghai Precision serve all of these markets and can offer tailor-made solutions that accommodate the special needs of each glass type.

THIN GLASS FOR PORTABLE ELECTRONIC DEVICES

The first successful PDAs (Personal Digital Assistants) with touch screens were introduced in the mid-1990s but the real breakthrough came with the introduction of the first iPhone in 2007 and the iPad in 2010. It is difficult to imagine a world without smart phones and tablet computers. The number of smart phones sold in the third quarter of 2015 is reported to be as high as 350 million units (source www.statista.com). This created an enormous momentum within the glass industry and today, there are several specialist glass manufacturers that produce these glasses via the float or draw process.

The screen does not just display the information, at the same time it is the 'keyboard' and



Deflection test of a smart phone cover glass.

incorporates almost all of the operating functions of such devices. This requires many innovative glasses that until now, were considered to be fragile materials. The cover glass must be thin and lightweight, with a perfect optical transmittance for brilliant high resolution pictures. Furthermore, an outstanding level of mechanical impact and bending strength is required, as well as high resistance to scratches and sharp contact damage. The answer to this set of demands is an aluminosilicate glass, which is chemically strengthened via an ion exchange treatment. The most famous brand in this field is Gorilla Glass from Corning. In the meantime, the fourth generation of this glass is on the market next to Asahi's Dragontrail, Schott's Xensation and others. The image shown at bottom left was taken from YouTube's TechBreak Channel and demonstrates the outstanding physical strength after penetrating the cover with a key and a knife. It is difficult to believe that this is glass!

BATCH PLANTS FOR ALUMINOSILICATE GLASS

It is obvious that these outstanding glass properties start with raw material processing and handling in the batch plant. The grain size of the raw materials is smaller than with ordinary soda lime glass and all of them are dry. This requires special dust prevention concepts in order to minimise sources of dust by using the appropriate transport system, having covers and correctly dimensioned filters at all critical points.

Metallic and organic contamination also has a serious impact on glass quality. In particular, the minimisation of ferrous metals, nickel and chrome is one of the key design elements of such batch plants. Charging hoppers have a plastic or special wear-resistant metal lining in order to reduce metal particles. Before the raw materials are stored in dedicated silos, they need to pass by a magnetic grid to remove magnetic particles. The silos typically feature an appropriate coating inside or are constructed from stainless steel.

The dosing devices also have a wear-resistant lining >

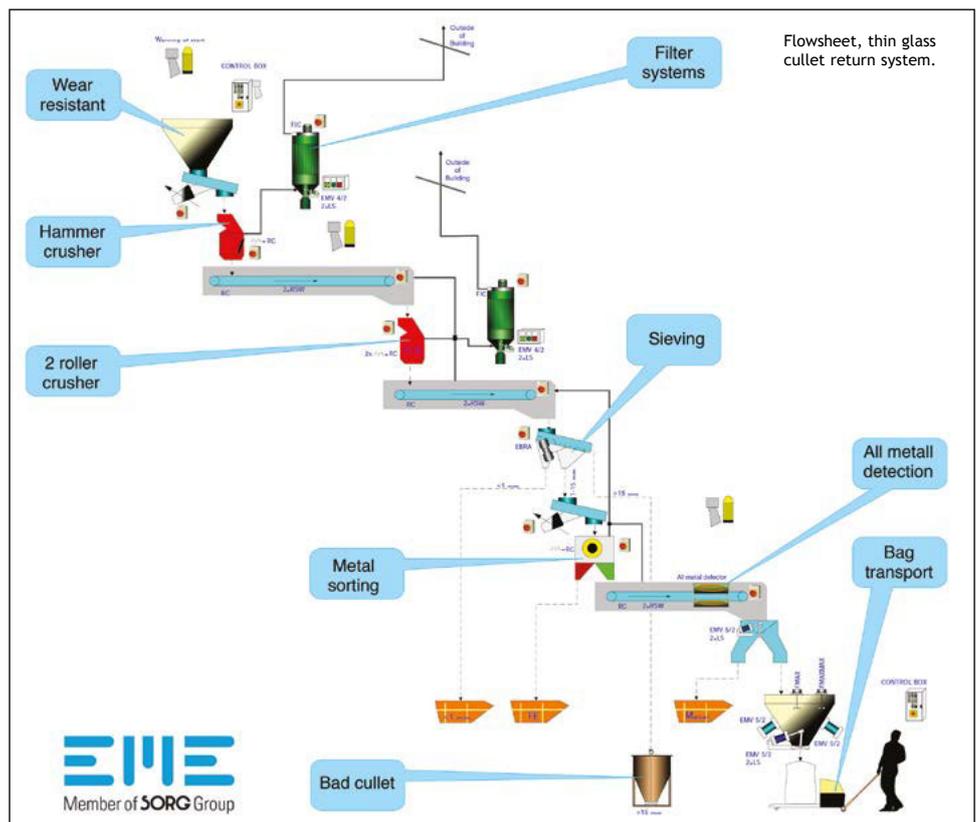
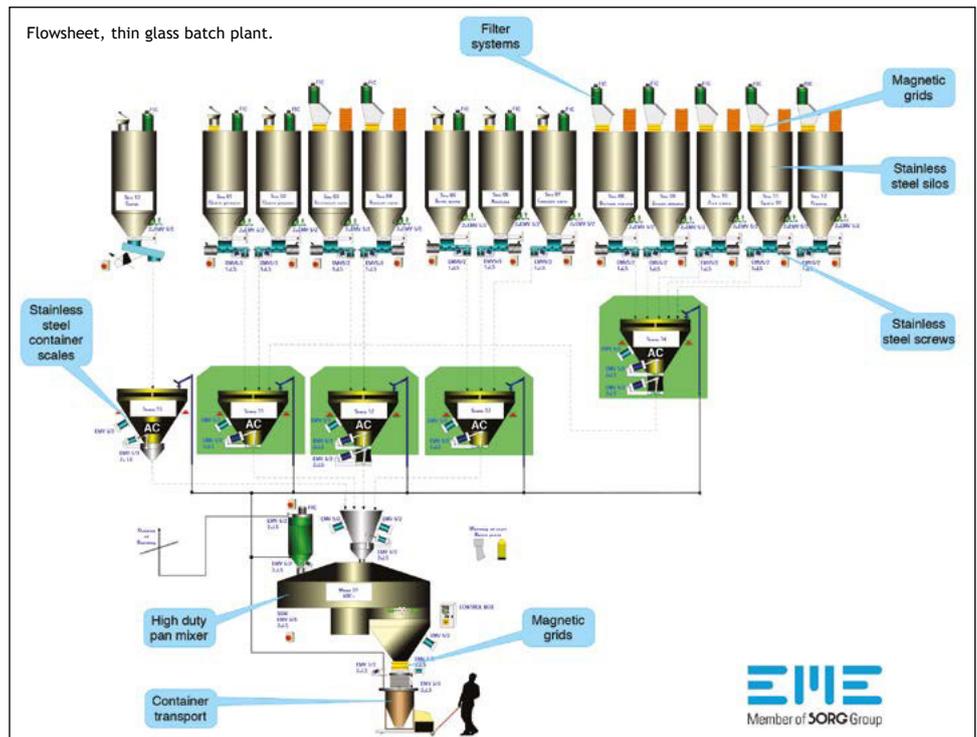


Dosing and weighing of an EME thin glass batch plant.

and transport the required amount of each raw material into stainless steel or rubber container scales. The accuracy of such scales and dosing units is very important, since an extremely precise composition of the batch is mandatory. This also applies to the following high duty mixer system. The homogeneity of the mixed batch directly influences glass quality and needs particular attention, eg using extra tools in the mixers. At the discharge opening of the mixer, another magnetic grid removes any remaining magnetic contaminants. Last but not least, any de-mixing of batch during transport to the furnace must be minimised or completely avoided. The melting capacity of such dedicated thin glass lines is relatively small compared to other flat glass installations and this is the reason why very often, a container transport system is used. Thus the segregation of batch coming from different grain sizes and surfaces is minimised and in some instances, container transport is automated as well.

Cullet processing and handling in such thin glass lines should not be neglected. Paying special attention to the avoidance of metal abrasion in the crushing process and making sure to have an optimum cullet size is another parameter for glass quality. All crushers have a wear lining that minimises metallic particles in the cullet. A two-step crushing process is recommended; first a hammer crusher to break up the bigger pieces, followed by a twin roller crusher to realise a defined spectrum of cullet size. The preparation process is completed by sieving.

Larger pieces are crushed again and all fines are rejected into a container for further use in other glass lines. Cullet processing is completed with a magnetic drum to separate magnetic contamination from the cullet and afterwards, an all-metal detector identifies the remaining non-magnetic metals and a small amount of cullet around the detected metal is dumped into another reject container. The clean and processed cullet is either transported automatically into a cullet silo or is handled in movable containers. As per the recipe, the cullet is then added to the batch that goes to the furnace. Because of the extremely high quality of the glass, only internal cullet is used, since glass from outside may have a different chemical composition.



PARTNERS

With its long experience in batch plant and cullet return systems, EME and its sister company Shanghai Precision are suitable partners for thin glass production lines. Not only can superior batch and cullet plants be provided but the organisation has expert knowledge of raw materials and their behaviour in the furnace. ■

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