Sorg's all-electric furnace for Heinz-Glas' Poland facility

Sorg built a new full electric furnace type VSM that is flexible for opal and flint glass production at Heinz-Glas' Działdowo, Poland facility. Volker Müller* and Frank Probst** discuss what made the project so successful.

Opal glass is a special kind of glass because of the way it is manufactured and also because of the design and the product range it is used for. Over the years, the market demand for opal glass has fluctuated with fashion – its market share is reduced but still there. The production of opal glass is not an easy job; it needs experienced specialists and the correct technology.

In the past, there have been several producers of opal glass in Europe, but today, Heinz-Glas is one of the remaining that is skilled in the specialist production process.

Since market demand for opal glass fluctuates with fashion, it is currently necessary to also produce flint glass with the same furnace to have reasonable utilisation and avoid production gaps.

Heinz-Glas produces its opal glass in Działdowo, Poland. The existing all-electric furnace had a capacity of max. 30 t/d and was equipped with two all-electric forehearths and two IS machines.

The existing furnace operated well, and the forehearths showed good performance in opal glass but were limited in flint glass manufacture due to blisters formed by electrochemical reboil.

Because of a breakdown in March 2020, the furnace needed replacing. To serve the demand of Heinz-Glas customers, the furnace had to be rebuilt quickly.

Since the installation space of the old furnace was already very tight and would not have allowed for any future expansion, Heinz-Glas decided to extend a warehouse on the other side of its property to create a second production building and build the new all-electric furnace there.

The Sorg Group was asked to develop a flexible furnace concept that was prepared for additional expansion.

Nikolaus Sorg provided a turn-key

furnace installation, including necessary materials like cooling air and cooling water with their respective piping and cabling. During the engineering phase, this was supported by 3D media design.

EME was asked to quote the complete cullet return system of the new plant as well as the extensive batch transport system required to bring the batch from the existing batch house across the site to the new building.

SKS delivered the complete furnace steel and platforms, including erection. Also, the refractory erection, including heating up and filling the furnace, was the responsibility of SKS.

Special requirements

Since the market demand for high-class cosmetic packaging changes a lot with current fashion, the focus in furnace design was on maximum flexibility.

The new furnace was designed for a pull of 35 t/d, feeding two production lines. A later expansion to 50 t/d and a third production line is foreseen. That means all furnace equipment is already prepared for 50 t/d.

To react to future market situations, the VSM must have large flexibility in pull (possible low minimum pull and large pull changes per day).

The great challenge for Sorg was the requirement to melt opal glass and soda lime flint glass, with the possibility to also run at a high PCR (post-consumer recycling) cullet content, with the highest efficiency and quality:

- Production of high-quality opal glass with high homogeneity.
- Production of high-quality flint glass with minimum seeds.

In the past, many attempts were made to melt both glass types in one furnace. However, to melt each glass type with the high output demanded, the furnace design for both is quite different. So, in a furnace designed for opal glass, the output for flint glass was inefficient and vice versa:

- To provide homogeneous opacity, the opal glass coming from the furnace must have a similar history, meaning a rather short residence time. Stagnating areas in the lower part of the furnace must be avoided.
- To provide a seed-free flint glass, the

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furnace must, on the contrary, provide a long residence time to allow for gas release and good refining.

To fulfil the request from Heinz-Glas, Sorg designed a VSM with a carefully selected melting area, specific pull, and depth of melter.

The Działdowo furnace is, therefore, in between a pure opal furnace (shallow) and a high-quality flint furnace (deep). When producing opal glass, a set of bottom electrodes is used to generate convection currents in the lower part of the furnace. During flint glass production, these are not active. The furnace steelwork and rotating crown batch charging system are oversized to fit a future expansion to 50 t/d.

Another important issue for opal furnaces is the operating life because of the highly aggressive opal glass melt, leading to intense corrosion of the refractory.

Whereas the operating life of other all-electric furnaces is only approx. 2-3 years in opal glass, Sorg all-electric furnaces contain a package of several measures.

With these measures in place, similar VSM furnaces for opal glass reached a record of almost four to five between cold repairs.

For the Działdowo VSM, the main measures to prolong the operating life of the furnace are as follows: several design elements to allow easy installation of future over-coatings, the shape of the tank with large straight surfaces, binding steel that can be easily adjusted, top electrode holders and furnace cooling nozzles that do not block large parts of the tank walls, and, importantly, newly designed and highly effective cooling of the side walls and at precise spots of the furnace.

The Sorg rotating crown batch charging system is installed, providing dust-free charging of the furnace and allowing for the extraction of harmful gases from the furnace superstructure.

Dust is removed by means of a baghouse filter; hydrogen fluoride is removed by gas sorption; the remaining flue gas is vented outside.

The extraction of harmful gases is important and, in this application, more important than normal. The "dual use" of the VSM makes two types of gases relevant, which means a careful design of the system is necessary:

- When producing high-quality flint glass, nitrates are often used for redox control. But as a side effect, the use of nitrates generates harmful nitrous oxide gas, which exists above the batch blanket in high concentrations.
- When producing opal glass, fluor evaporates from the melt and forms toxic and corrosive hydrogen fluoride.

Besides the furnace, special requirements are needed for the working end and the forehearths. As for the melting process, the flexibility of the furnace also has special demands for the glass conditioning system.

In opal glass, evaporation of fluoride must be avoided to prevent glass quality problems. An all-electric forehearth is best suited.

In flint glass, all-electric forehearths can lead to electrochemical reboil and blisters. For this purpose, the working end and forehearths were equipped with a hybrid heating system consisting of direct electric heating and indirect gas heating.

The key technology here is direct electrical heating by means of electrodes, which is designed to minimise electrode abrasion and reboil bubbles.

In addition, a new forehearth concept for high-quality flint glass and opal glass was designed. For flint glass production, an additional heating level with direct gas heating was installed.

All cooling systems in the working end and forehearths are connected to a central cooling air supply. Both forehearths are equipped with the Sorg Conti-Drain as well as an equalising zone stirrer unit.

EME supplied the batch transport system and the cullet preparation, which included the complete hot and cold factory cullet system as well as the feeding and storage of external post-consumer recycled glass.

Scope of supply

Nikolaus Sorg provided the furnace and equipment, as well as complete design and engineering, including all piping and cabling. All installation and services are provided on a turn-key basis.

For the working end and forehearth, as for the furnace, Sorg provided a turn-key installation including all air cooling equipment, air and gas piping, as well as control and power cabling.

EME's supplies and services are executed on a turn-key basis.

SKS has delivered all steelwork and erected the steel and the refractory material. Also, heating up and filling the furnace was an SKS responsibility.

Equipment manufacture and furnace construction and commissioning were on a tight schedule for both parties, with a building permit needed before construction of a large new furnace building and all hot and cold end equipment.

Experience

Installation and commissioning of the furnace went smoothly and with excellent cooperation between Heinz-Glas and Sorg. Achieving this while remaining within the agreed time frame is remarkable because of the tight available space and the scope of work that included the close interaction of existing and new equipment.

Since the start-up in October 2021, the furnace has already successfully gone through several high-quality flint glass campaigns, several PCR flint glass productions, and also extensive opal campaigns.

Fine-tuning of the melting process, raw material usage, and glass chemistry was completed cooperatively with regular meetings between experts from both companies in Działdowo and Kleintettau as well as Sorg's glass technology, electric melting, and glass conditioning departments.

The furnace reached all quality requirements defined in the contract without issue; energy consumption figures were also met.

Glass quality and overall furnace operation are both to the full satisfaction of Heinz-Glas.

According to previous operating experience, both forehearths produce good to very good glass quality for flint and opal. ■

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