ASEAN FEDERATION OF GLASS MANUFACTURERS
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Energy efficiency and furnace security

According to Ken Watanabe, the 'Eco-Lead Furnace' is a compilation of glass engineering technologies developed over 40 years by AGC. It has been realised through two major technology developments, involving high energy efficiency and reliable operational support.

In 2016, AGC celebrated its 100th anniversary. It is also more than 40 years since the glass engineering business was launched, supplying AGC engineering technology to more than 130 glass furnaces in the interim. Among the latest innovations from AGC Ceramics is the Eco-Lead Furnace, which was announced in 2016.

This development falls in line with the company's 'Earth Saving' management policy for environmental savings, first introduced in 2012. According to this policy, the company will continue to create value through ceramics technology to protect the global environment through energy saving (developing and providing products and services with excellent energy saving performance) and the conservation of resources (contribute to resource conservation through zero emissions activities within its own processes).

High energy efficiency

High energy efficiency is achieved by AGC's Hyper regenerator technology and THERMOTECT WALL technology. Figure 1 shows a comparison for single and double pass. The AGC Ceramics Hyper regenerator adopts the double pass system. By this arrangement, it is possible to obtain a long heat exchanging passage and achieve the minimisation of passage deviation between waste gas and combustion air. As a result, higher heat recovery efficiency is achieved.

During a campaign with the single pass regenerator, sodium sulphate condensation occurs at the middle portion of checkers and affects energy efficiency. In order to remove it, it is necessary to melt and flush down to below the rider arch (figure 2). Sometimes, however, dust remains on the way to the rider arch, because the condensation area is some distance from the rider arch.

In order to clean dust easily, the AGC design has the condensation area close to the rider arch in the double pass regenerator. The company's first regenerator technology approach dates back to the 1960s, before its second generation of problem solving and expansion between the 1970s and 2000s. Since that time, reliability has been improved by simulation technology as part of the company's third generation, before finally evolving the latest Hyper regenerator fourth generation system using the THERMOTECT WALL and furnace security service.

THERMOTECT material has been available since before 2000 but in 2015, it received the grand prize for excellent energy solutions in Japan as a solution proposal.

Features of the material include:

- High thermal resistance – applicable over 1600ºC.
- Variable thermal range to fit the condition.
- High thermal insulation properties – equivalent to conventional insulation brick.
- Low shrinkage – linear shrinkage after heating at 1600ºC hardly changes.
- Easy on-site installation - monolithic materials either castables or pre-cast block.
- It is categorised as a non-hazardous material to carcinogenic agents.

Typical installation areas are shown in figure 3. ▸

Ken Watanabe addresses delegates at the 41st ASEAN Glass Conference in Da Nang, Vietnam.

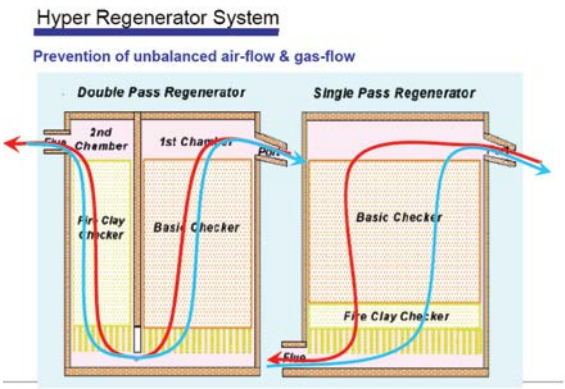

Figure 1: Difference of gas passages between single and double pass regenerators.

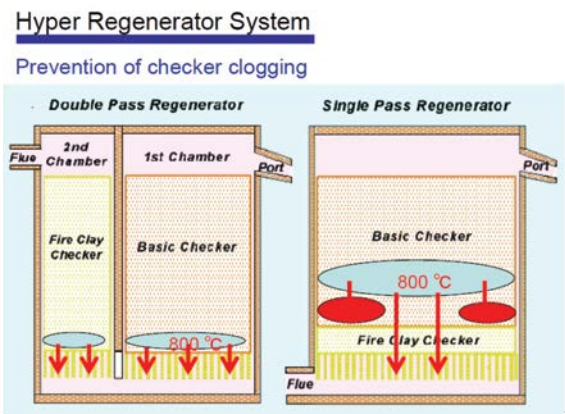

Figure 2: Difference in checker clogging between single and double pass regenerators.

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Areas with high heat loss have been identified through actual measurements in glass furnaces.

And AGC Ceramics has expanded the use of THERMOTECT as a means of more effective heat insulation for these areas. For fused cast crowns, the company has a separate solution for improving energy efficiency.

Achieving energy savings

Figure 4 shows the performance of the Eco-Lead furnace. The X axis is the pull rate in tons per day and the Y axis is fuel consumption at 50% cullet ratio, without electric boosting.

The light blue curve is the Eco-lead furnace showing less fuel consumption of 5% at 200 tons and 3% at 300 tons comparing to a conventional end-port furnace.

Furnace security

There are two important ways to achieve stable operation and long service life of a furnace.

One is continuous monitoring of operational furnace trends and the second is to conduct periodical checks on the furnace condition.

AGCC recommends its 'Furnace Security Service', which consists of remote monitoring and periodic checks on site.

Components of the remote monitoring system are shown in figure 5. From the DCS on-site, operational data will be downloaded to the AGCC server that is secured with firewall application. This data can be monitored by the company's engineers on various media via the internet for checks and analysis.

AGC Ceramics offers its Pleasure system for data logging and monitoring. Developed in the 1990s, this system features high reliability. The system not only processes big data at high speed but is also suitable for the operation management of glass furnaces.

Periodic on-site checks are very important for stable furnace operations. AGCC regularly dispatches experienced engineers to the site to provide advice and solutions through various inspections. In this case, an engineer within the R&D centre in Japan can monitor furnace operation data in four overseas plants in real-time (figure 6). While sharing these objective data screens, engineers regularly discuss furnace operation. Within the AGC Group, for example, engineers can advise another engineer in an overseas plant on operation matters with reference to similar cases in other furnaces.

Success with remote monitoring

With the help of both data analysis and on-site checks, AGCC has managed to detect the root cause of critical problems such as knot defect generation, wrong control logic for batch feeding and faulty equipment (ie transmitter) and also provide solutions for each problem.

A sustainable approach is adopted to optimise furnace operation. Most glass manufacturers want low energy consumption, high reliability through long life and high quality products. AGCC supports this goal by various types of technologies relating to the glass furnace, such as refractory materials, analysis (including simulation and defect analysis), engineering services and accumulated experience. ●

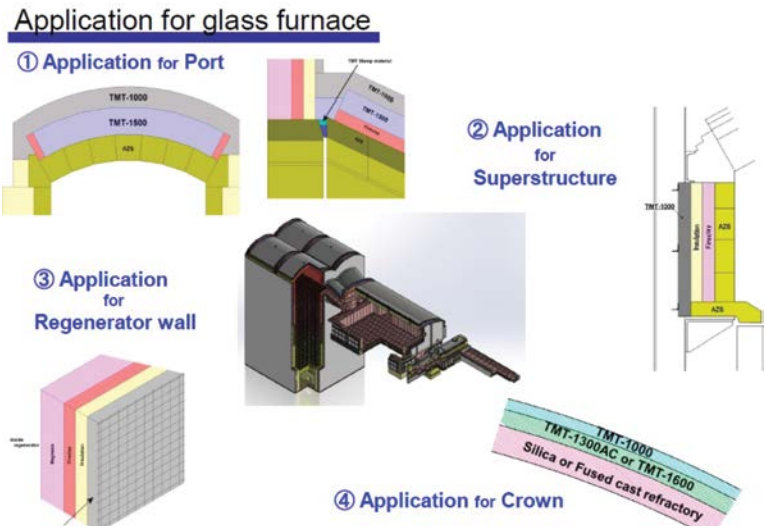

Figure 3: THERMOTECT applications in a glass melting furnace.

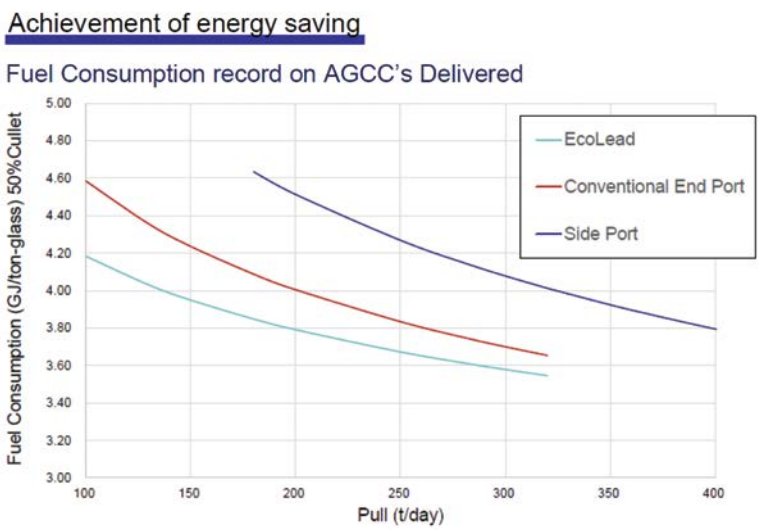

Figure 4: Energy consumption of a glass furnace delivered by AGC Ceramics.

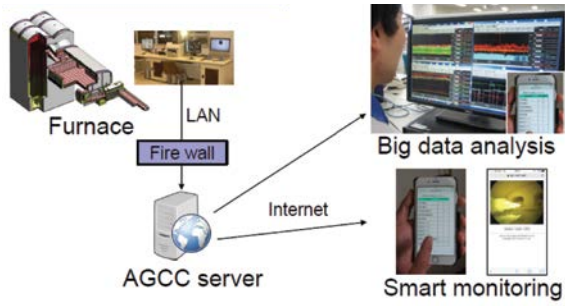

Figure 5: Remote monitoring system.

Figure 6: Sharing furnace operational data in real-time.

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