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GS operations hold firm during the pandemic

Dear customers, partners and friends,

First and foremost, we at Glass Service wish everyone to be safe and in good health.

Furthermore, we sincerely hope the current measures that have been put in place by authorities will be effective against COVID-19 in the foreseeable future. GS has fully complied with governmental directives and has adapted work schedules in order to protect our employees and visitors from risk of exposure. To protect from internal exposure, we have organized our teams using a combination of work from home offices using video conferencing, and shift work at the company office departments.

GS teams remain fully operational with support for furnace modelling, GFM software, laboratory services, Expert System **ES III™**, cameras, raw materials, and administration. Our customers achieve optimum levels of production with less onsite personnel, and many satisfied customers let us know we are headed in the right direction.

Our engineers are available to assist and answer customer questions at all times. Work continues on existing projects with a goal to meet delivery terms and timelines. When onsite technical work is not possible, we propose to hold meetings using web conferencing, and/or remotely access installed systems where the capabilities exist.

We are in close contact with customers in order to re-schedule our visits until travel is safe and again made possible by the authorities.

In this changing global working environment, Glass Service would like to assure its customers that support remains available to them. We have always valued our business relationships, and many of our customers have become friends.

We wish you all a sound future.

Josef Chmelar, President & CEO



GS Department Managers Virtual Meeting

GS lab supports its customers during the pandemic

By Filip Janos

GS laboratory services are active. Our laboratory team maintains all services related to identification of glass defects:

- Bubbles in glass
- Stones
- Cords
- High temperature observation of the melting and refining processes
- Glass properties



Courier delivery services are working well at these times, and we are able to respond to express service requests as we perform glass defect analyses. We wish to thank our team for a great work!

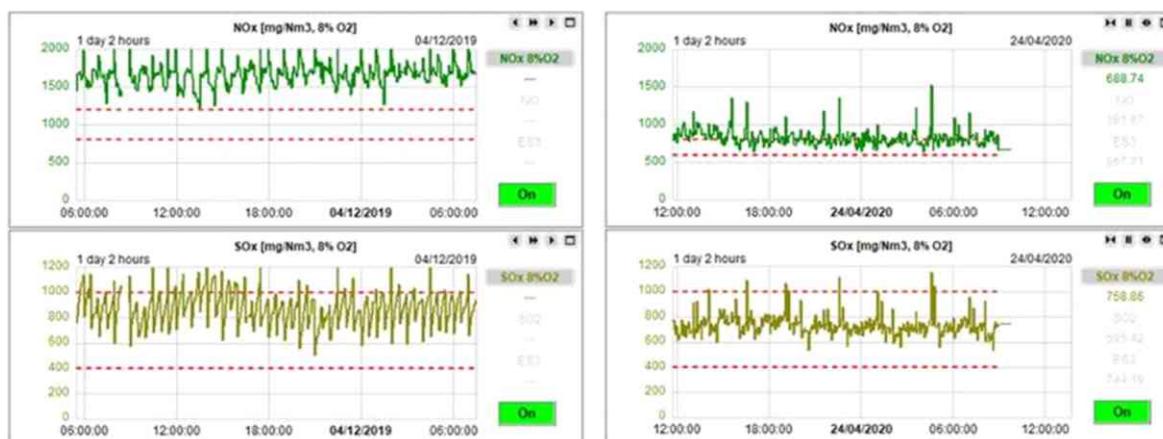
Expert System *ES III*TM automates and stabilizes glass furnace control and earns positive customer feedback during the pandemic

By Erik Muijsenberg

The GS Expert System *ES III*TM is an advanced control system utilizing Model Predictive Control (MPC).

*ES III*TM provides for furnace operating stability and automation, as well as the potential for energy savings. However, another fundamental aspect of *ES III*TM is the capability to remotely monitor furnace operations and to also remotely assist operators to optimize and troubleshoot.

The GS Expert System *ES III*TM works predominantly with Model Predictive Control (MPC), combined with Fuzzy Logic, and Rules Based Controls. This predictive control system utilizes Multiple Input – Multiple Output (MIMO) furnace operating data to predict furnace operation and adjust the control parameters accordingly. The *ES III*TM is installed as a supervisory control and takes over the furnace and forehearth control more than 95% of the time and is therefore a big help to engineers and operators who may monitor from a second location. It not only reduces energy consumption but also reduces CO₂, NO_x and SO_x emissions with our Combustion Optimizer Tool.



The left image shows NO_x and SO_x concentrations before the *ES III*TM combustion optimizer was initiated. The right image shows concentrations after it was initiated (NO_x was reduced from approx. 1500 to below 800 mg/Nm³, SO_x down from 900 to 700 mg/Nm³ in this example).

Near Infrared (NIR) Furnace Camera

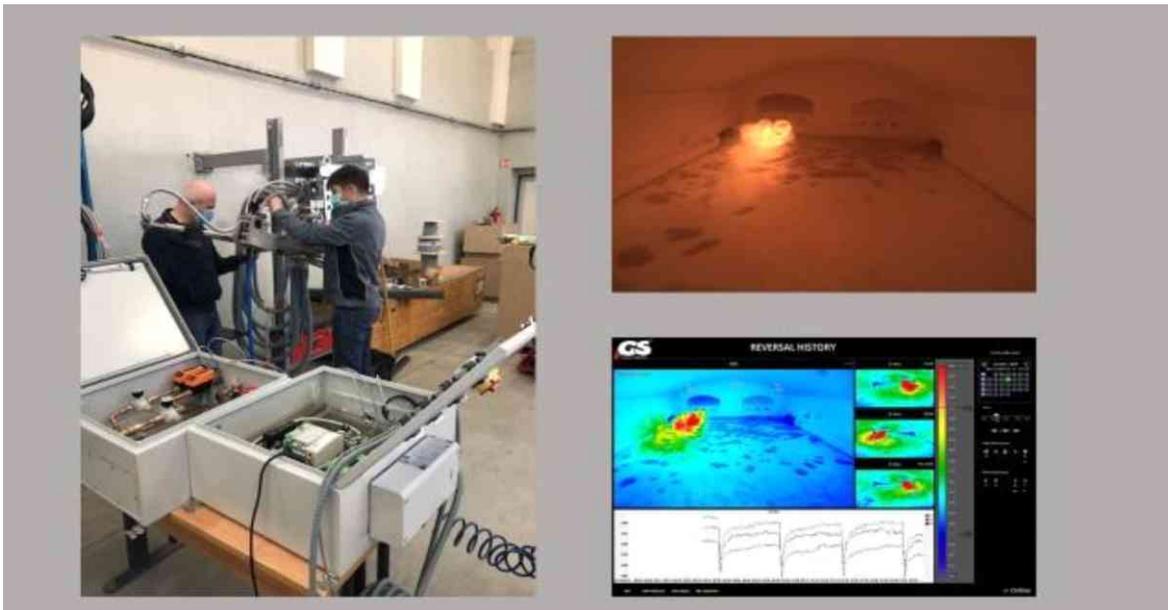
By Frantisek Masarik

The GS Advanced Camera Vision System is a new generation of camera operating in Near Infrared wavelength (NIR) and Visual (RGB). Hence, the furnace can be seen for temperature measurement by NIR, and also visually by RGB for identifying furnace operation.



The camera system is pre-assembled and tested at our GS Camera Assembly Facility. Our development team works actively on the camera system hardware and its furnace imaging software. This new level of vision technology is being integrated into the furnace information system and its control strategy, with the use of advanced process control – the Expert System *ES III™*.

The GS Furnace Image Browser allows monitoring of furnace temperatures from a second location such as a home office.



Left image: assembly line of NIR camera

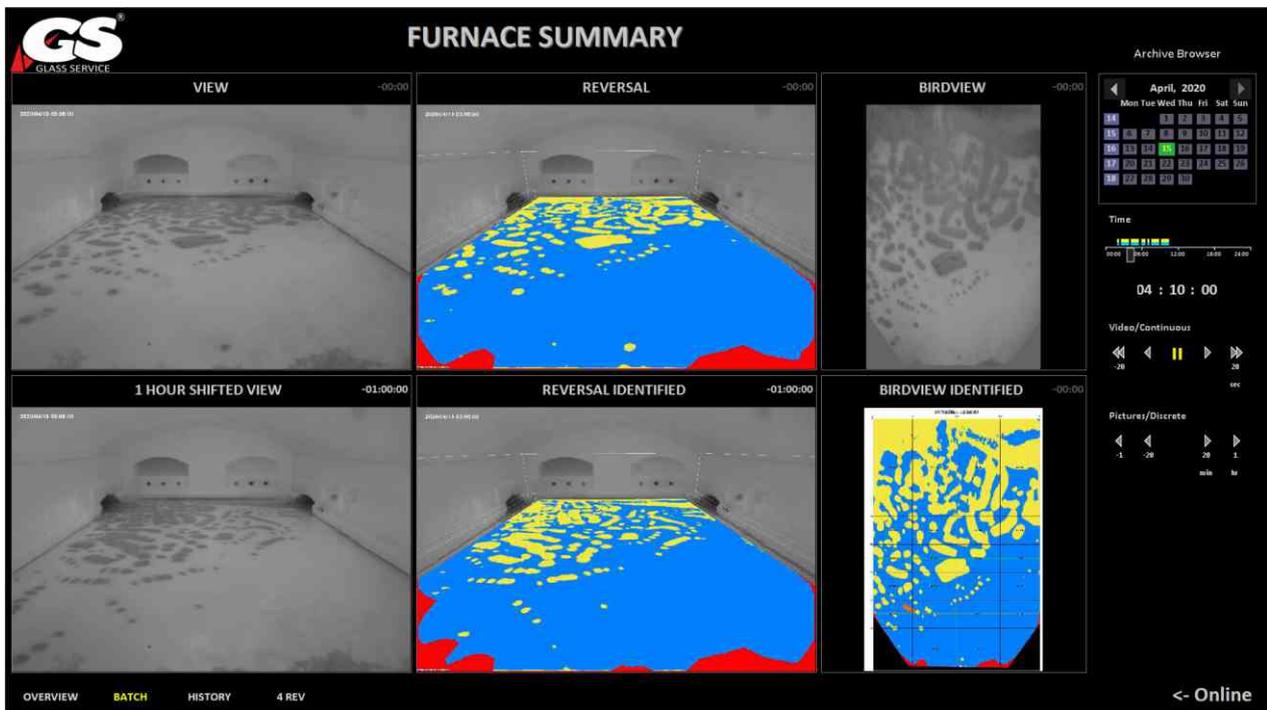
Right image above: furnace image in visual spectrum

Right image below: furnace image with infrared information and temperature trending

Batch Monitoring Software (BMS)

By Robert Bodi

The GS Batch Monitoring Software (BMS) utilizes the view from a camera or multiple cameras and analyzes the information to show the batch line and the batch distribution within the furnace. From a given camera position within the furnace, a bird's eye view of the batch is made. The image is digitized when converted within the BMS and can be verified over time to give an understanding of the batch movement for furnace control purposes. These images are transformed into critical data that can be used in making *ES III™* control decisions.



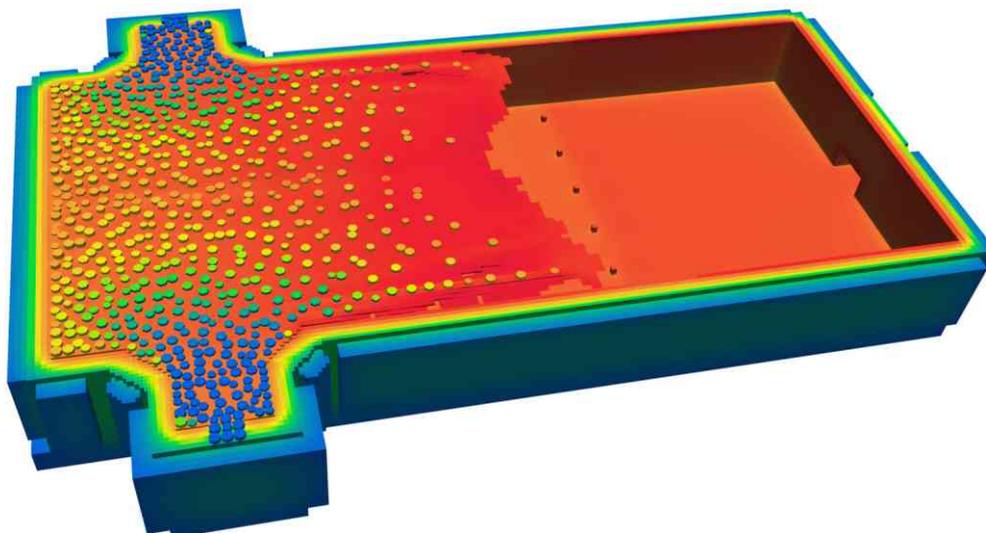
Batch monitoring in perspective and bird's eye view before and after image identification

GS is finishing work on a new CFD Batch Island Model

By Miroslav Trochta

The upcoming release of GFM (version 4.22) will include the beta version of a new batch island melting model called Discrete Element Batch (DEB) which provides a more realistic batch behavior. Instead of showing the batch as only a sheet where fluid equations are solved, DEB uses a novel approach to simulate batch motion and melting including the behavior of batch agglomerates. That is, just like in a real glass furnace, the “particles” that represent batch material interact with each other in terms of motion and cohesion. This motion is also influenced by glass flow and combustion gas flow. DEB shows heat transfer and material conversion as it is simulated in and amongst the particles, and is characterized by:

- the ability to form batch islands and logs that disintegrate as melting proceeds
- more realistic distribution of mass flux of molten material from batch to glass domain
- the mechanical effect of batch pushers
- inclusion of primary foam production in the simulation
- correct handling of drag forces and their impact on mass and heat transfer
- a model of conversion from raw materials to products
- heat transfer inside batch agglomerates, including radiation
- a fully transient model that is able to capture effects of alternating gas flow due to reversal on batch motion



Batch and primary foam in an oxygen-fired unit melter

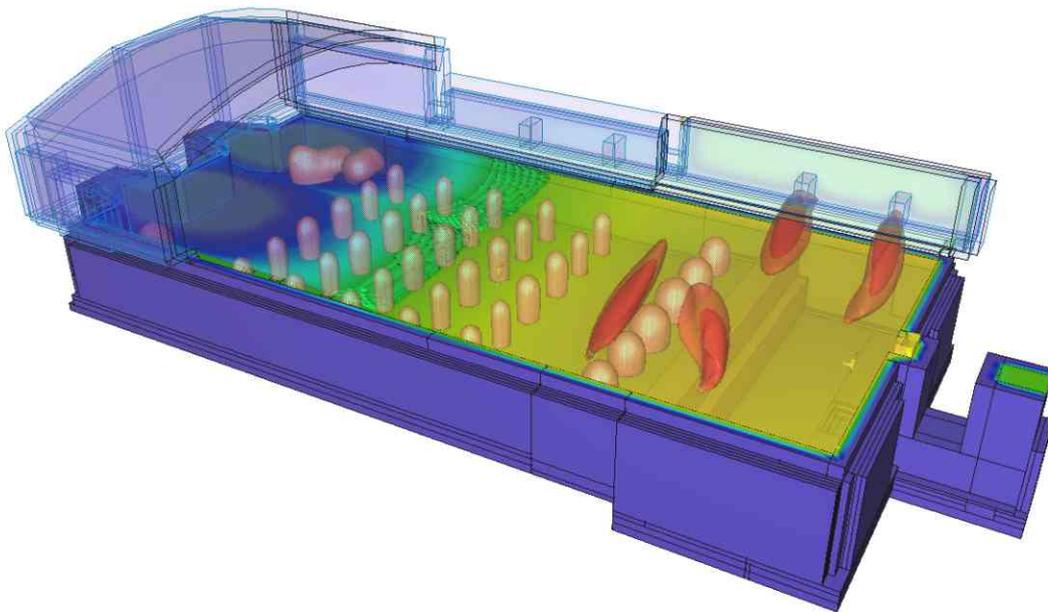
F.I.C. UK originates Super Boosting and Hybrid Furnaces

By Christoph Jatzwauk

F.I.C. (UK) Limited, together with GS, has pioneered a Super Boosting and Hybrid Furnace concept by extensive CFD modelling of large container furnaces over 350 TPD and float furnaces over 600 TPD.

GS modelling knowledge and F.I.C. experience with large float electric boosting has given a high degree of confidence in these new developments.

Super boosting is the interim stage whereby progressively more and more electric boost is applied to conventional furnaces by adding additional zones and/or increasing the power of existing zones. Hot drilling of furnaces during operation is not at all unusual and it is well proven that dedicated electrode blocks are not essential. F.I.C. maintains a large reference furnace in operation that already uses about 50% of the melting energy coming from the carbon-free generated electricity over 4 MW.



CFD study of the CO₂ reduction using intensive electric heating – SUPERBOOST

FlammaTec continues to serve its customers around the world



By Josef Chmelar

FlammaTec, spol. s.r.o. and FlammaTec Germany GmbH operations continue with full production capacities. Production and shipments of FT burner equipment is on schedule.

FT production sites in the Czech Republic and in Germany are at full operational capacity while complying with health protection regulations. The workshop is divided into work by shift and internal contact between the working teams is minimized. Personal protection equipment using respirators is strongly emphasized and systematic disinfection of shared spaces is performed.



FT burners ready for shipping

FlammaTec introduces new Hydrogen CF – Carbon Free Burner



By Petr Vojtech

A joint team of German and Czech FlammaTec engineers together with the GS simulation department have developed a revolutionary, new generation FlammaTec Hydrogen/Oxygen Carbon Free Burner in response to environmental challenges to reduce the CO₂ footprint dedicated to glass industry applications.

The burner design project required extensive computer simulation and engineering work, followed by testing at a high temperature combustion facility. The results include proven burner parameters, flame flexibility and a stable, highly efficient combustion process.



Burner operation at testing stand (flame is visible here, but a high temperature flame is nearly invisible)



Burner operation test in a high temperature furnace.

The flame is almost invisible due to the chemical reactions during the H₂ and O₂ combustion.

GS 30 years in business

March 1, 1990 – March 1, 2020

By Josef Chmelar

We celebrate 30 years of service to the glass industry.

We thank our customers, employees and business partners for their trust and support.

Glass Service, founded by four partners in 1990, grew into a multinational corporate group providing services to many industry customers worldwide.

Our team of more than 100 employees is operating from nine countries covering the Americas, Europe and Asia.



Glasstec 2020

Glasstec will be held on **October 20-23, 2020** in Düsseldorf, Germany.

We are looking forward to meeting you there!



16-17 June 2021

16th Int. Seminar on Furnace Design
Velke Karlovice, CZ



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