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Welcome to our Glasstec Düsseldorf edition of the Glass Service Newsletter

By Josef Chmelar
President of Glass Service Group



Dear customers, partners and friends,

Welcome to our GLASS SERVICE (GS) newsletter. We want to inform you about GS development and new products that will be shown at Glasstec 2022 in Düsseldorf, Germany held 20 – 23 September 2022. Our joint stand for Glass Service and FlammaTec can be found in **Hall 15 F20 & F16**. Our colleagues from **F.I.C. (UK) Limited** and **F.I.C. Germany** can be found in **Hall 12 F72**.

Please note in your agenda the dates of 21–22 June 2023, for our **16th International Seminar on Furnace Design - Operation & Process Simulation**. This time it will be focussed on CO₂ reduction. The International Commission on Glass Technical Committee 21 (ICG TC21) meeting on furnace design and operation will also be held during the event. The entire conference is an initiative supported by ICG TC21.

We are pleased to be able to meet many customers and friends once again in person in Düsseldorf. The digital meeting tools are a great help to continuing business with less travel, but from time to time it is important to meet face to face. The GLASS SERVICE group continues to grow this year by adding employees in Czech Republic as well as in our offices abroad.

With the current trend of decarbonization, we focus all our tools on helping customers reduce their carbon footprint. Our glass furnace simulation program GS GFM has been the leading tool for over thirty (30) years. With all customers looking to “go more green” by installing electric boosting and using hydrogen or biofuels, modeling has experienced a resurgence. We can see that fossil fuel prices are creating an increased customer demand to improve energy efficiency and move towards cleaner electric energy. The introduction of CO₂ trading further motivates this trend. As always, GS software solutions can be relied upon to provide these benefits during glass production.

In Europe we have seen a short-term trend to have oil & diesel backup burners available. We are pleased that FlammaTec can help customers continue their melting operation should a natural gas shortage threaten production.

Thanks to continued high interest in Industry 4.0, our Expert System *ES III*TM has reached an impressive installation base of over 340 installations worldwide. GS has become the leader in the glass industry for this high-level automatic model-based process control, and we are currently expanding application of our technology more and more downstream to forehearth, connection to gob monitors, and into the automatic tin bath float operation.

We look forward to meeting you in person at Glasstec, or at any other future event, and to share very interesting personal discussions.

Josef Chmelar, President & CEO

GS lab adds new electron microscope

By Filip Janos

GS runs the world's largest independent express laboratory for glass defects for:

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



New advanced electron microscope by TESCAN

In response to increasing demand from the marketplace to deliver the highest degree of glass quality and minimize glass defect rejects, we have installed a second advanced **electron microscope** at our facility in Vsetin, Czech Republic.

The new machine allows us to study solid defects, such as stones, cords and knots with the highest degree of accuracy.

We have expanded our highly trained laboratory team to improve our response time for customers.

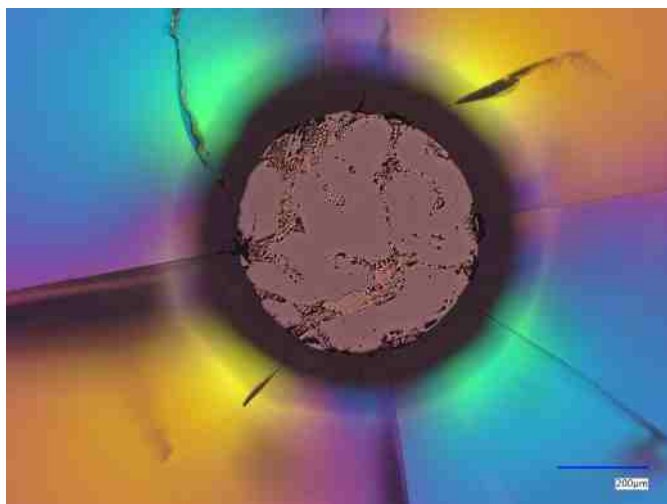


Image 1

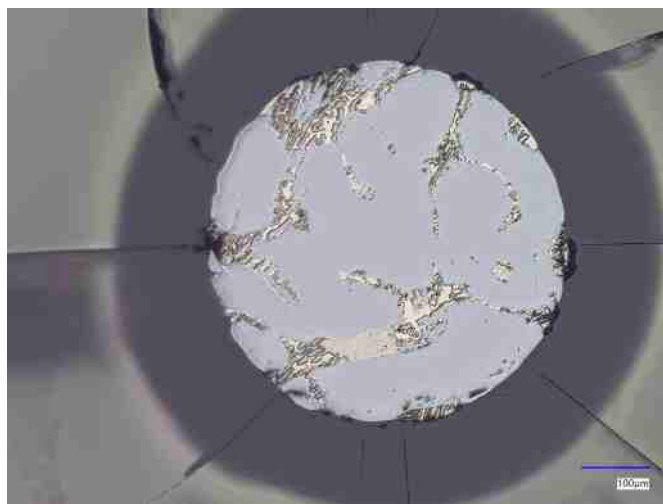


Image 2

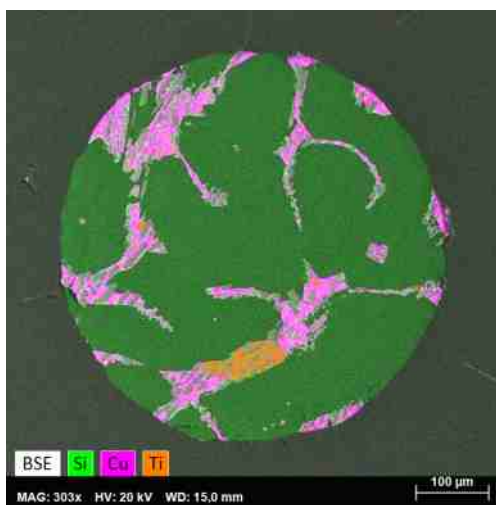


Image 3

Image 1: The silicon ball defect in the polished section in sideways light with simultaneous transmitted polarized light between crossed polars with interference wafer of the first order

Image 2: The silicon ball defect in the polished section in sideways light

Image 3: The polished section of the silicon ball defect under the electron microscope (BSE detector); X-ray mapping of the selected elements

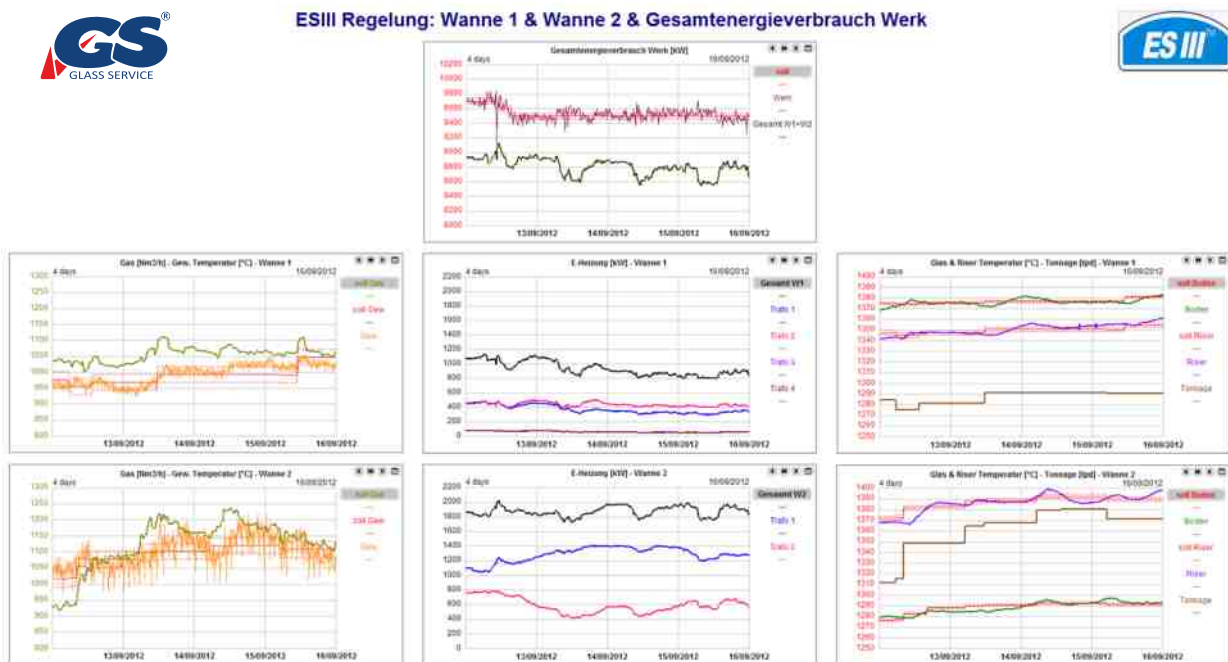
Expert system *ES III*TM helps reduce carbon

By Erik Muijsenberg

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

*ES III*TM provides furnace operating stability and automation, as well as the potential for energy savings. Also important, a fundamental aspect of *ES III*TM is the capability to remotely monitor furnace operations, while remotely assisting operators to optimize and troubleshoot.

Today saving energy has lost some of its importance, as many furnace operators feel the need to increase electric boosting to bring about a smaller carbon footprint. If this electricity comes from renewal resources it reduces carbon emissions, however electricity costs often vary differently than the costs for fossil fuels. Based on dynamic prices, *ES III*TM can automatically choose the most optimal way to melt the glass with lowest costs and carbon emissions by varying the amount of boosting versus the use of natural gas.



The image shows how *ES III*TM decides to lower electric boost on two (2) furnaces during the daytime and increase it overnight while keeping all temperatures at the throat of the container glass melting furnace on the desired setpoints. Left images are natural gas input, middle images are amount of boosting on transformers, right images are glass bottom setpoints – all changes are followed accurately by *ES III*TM.

The *ES III*TM works predominantly with MPC, combined with fuzzy logic, and rule-based controls. This predictive control system utilizes Multiple Input – Multiple Output furnace operating data to predict furnace operation and adjusts control parameters accordingly. The *ES III*TM is installed as a supervisory control and takes over furnace and forehearth control more than 95% of the time. It not only reduces energy consumption but also reduces CO₂, NO_x and SO_x emissions with our combustion optimizer tool.

AI 5 MP Near Infrared (NIR) furnace camera

By Frantisek Masarik

The GS high resolution camera vision systems & software have developed significantly in the last years. The imaging software uses Artificial Intelligence (AI) neural network segmentation

techniques to learn detection of certain features in the furnace image such as batch, refractory, flame and glass level, as well as other objects, i.e. dirt on the camera. Very reliable automatic batch monitoring can be performed using exact temperature measurements. The AI module automatically recognizes if the camera has changed position or a dirt spot is blocking a reliable temperature measurement. It then informs the user and **ES III™** concerning this situation or possible error.



AUGMENTED
SENSORS & SYSTEMS

Our hardware is continually upgraded with improved resolution and picture quality.



Left screen: Furnace image in visual spectrum and batch monitoring in a bird view
Right screen: Infrared coloured information to display the furnace temperatures and temperature trending

GS releases a revolutionary new Batch Island Model

By Miroslav Trochta

The last release of GFM (version 4.24) included the final version of a new batch island melting model called Discrete Element Batch (DEB) which provides a more realistic batch melting 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



Left: image from the real furnace monitored by GS NIR camera

Right: digital calculated batch island result (snap image of dynamic calculation)

F.I.C. gives update on super boosting and hybrid furnaces

By Christoph Jatzwauk

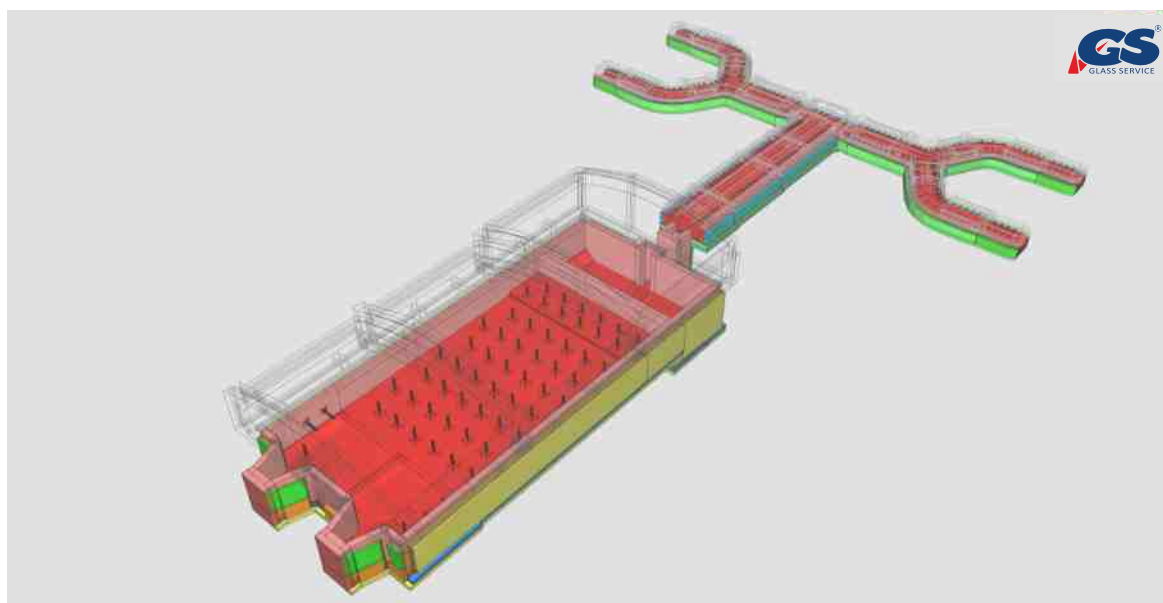


F.I.C. (UK) Limited, together with GS, has led the field for the last five years in its concept of super boosting and hybrid furnace design, using extensive computational fluid dynamics (CFD) modeling of large container furnaces over 350 TPD and float furnaces over 600 TPD.

The combined GS knowledge of modeling, and the F.I.C. experience with large float electric boosting gives customers a high degree of confidence in these new developments.

Super boosting is the interim stage whereby progressively 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 uses carbon-free generated electricity over 4 MW for currently 50% of its melting energy.

Further conversion of the forehearth from gas firing to electric melting can result in 70–80% energy savings, and corresponding cost reduction. A premixed burner using non-preheated air is known to be very inefficient.



CFD study of the CO₂ reduction using intensive electric heating
– SUPERBOOST on a Hybrid melter and electric FH

FlammaTec oil and diesel burners boom

By Josef Chmelar

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



FT helps customers secure reliable backup burners, as many have concerns about gas prices and its availability. Burners in high demand are those that provide dual fuel capabilities allowing for the fluctuation of the amount of gas versus oil or diesel, depending on price and availability. FT has been a specialist in this field for many years, with these burners predominantly sold to Asian customers in the past.



Dual fuel burner

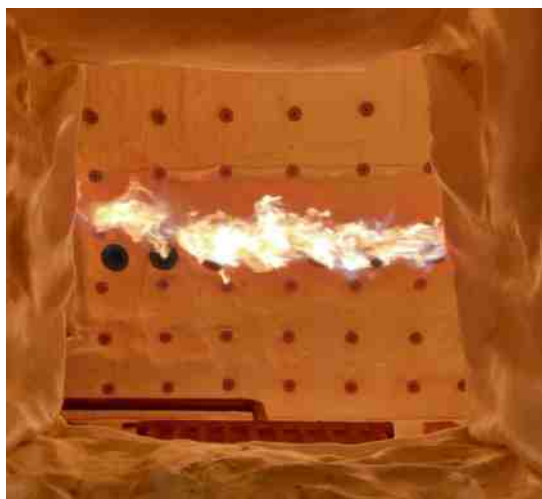
FlammaTec developed Hydrogen CF™ carbon free burner

By Petr Vojtech



A team of German and Czech FlammaTec (FT) engineers and the GS simulation department jointly developed a new generation FT hydrogen/oxygen carbon free burner in response to environmental challenges to reduce the CO₂ footprint dedicated to glass industry applications.

The *Hydrogen CF*™ burner design project required extensive computer simulation and engineering work, followed by testing at a high temperature combustion facility. The results included proven burner parameters, flame flexibility, and a stable highly efficient combustion process. The *Hydrogen CF*™ burner also has been tested with dual fuel options while varying several levels of natural gas mixed with different levels of hydrogen. This allows to convert furnaces slowly depending on the availability of hydrogen.



Burner operation left side is 100% natural gas/oxygen, right side is 100% hydrogen/oxygen

21-22 June 2023

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Velke Karlovice, CZ



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