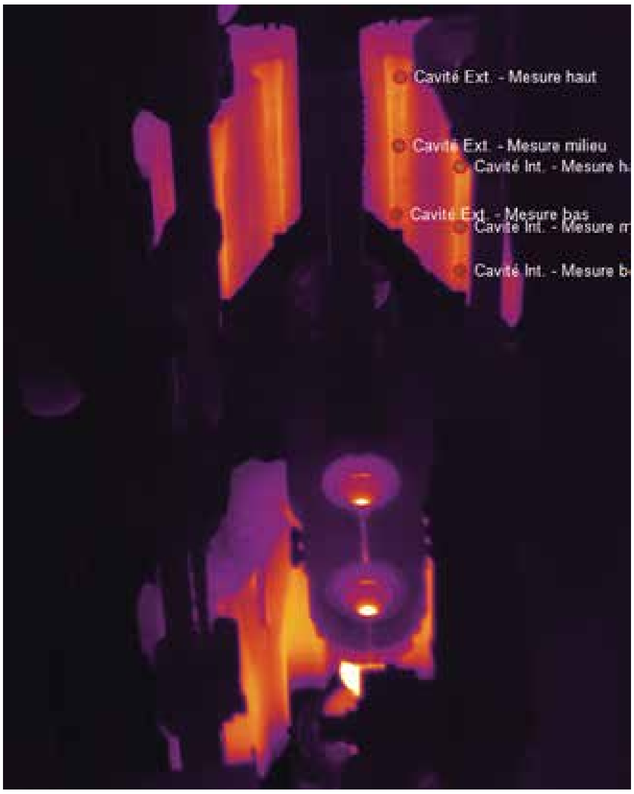
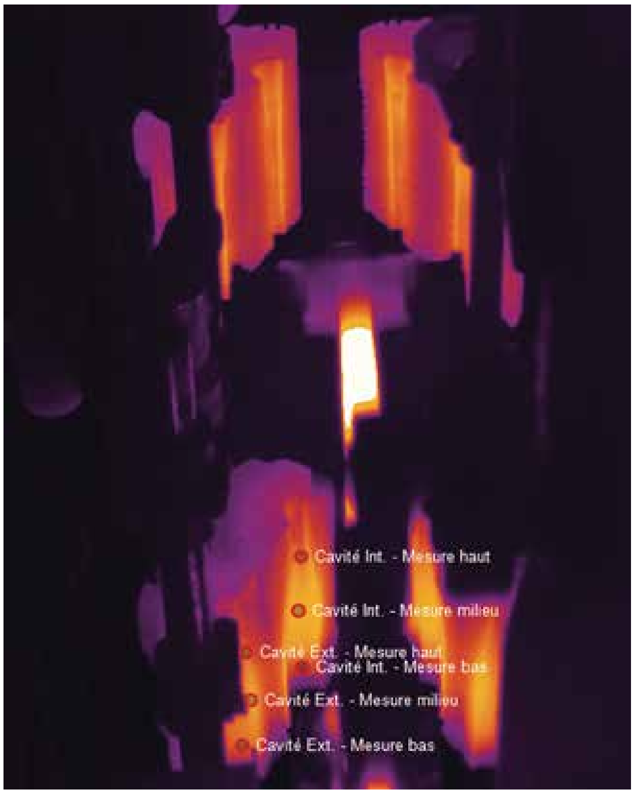
All-new KONATIC Spyro system already making waves

Putting blank and blow mould temperature control under the spotlight, glass container manufacturing expert Peter J Firth looks into the performance repeatability that's built into the design of KONATIC's super low maintenance system, Spyro





Konatic Smartgob solution with real 3D stereovision developed 7 years ago

Talk to any respected glass bottle-making expert and they will tell you that stability is of paramount importance. 'Stability', in this case, means the stability of conditions under which the glass containers are made. Indeed stability is an absolute necessity for high-quality and high-efficiency production output - something all glass plants want to achieve.

Stability does not happen by accident. It has to be created and maintained. Thankfully, new technologies are bringing more stability to the conditions under which glass production is made. Hence, giving Glass Plants the opportunity for a higher output of quality glass container production.

KONATIC LEADERSHIP

At the forefront of taking advantage of such new technologies and delivering benefits to glass container plants, Konatic is a prime example of the kind of company the glass container industry needs to thrive. Several years ago, with its Smart Gob system, it initially focused on creating better gob stability with camera monitoring of gob shape, as well as automatic control of gob weight for any IS Machine forming process (BB, PB, & NNPB).

Having created stable gob conditions, the next logical area of focus is to create stable blank temperatures. This area of control is hardly a novelty to the glass industry. However the way Konatic is currently doing it is certainly new. A defence of that conclusion follows later on in this article. For now, what needs underscoring is that, despite being new, it is already proven by multiple IS Machine installations.

To begin the story on this topic right at the beginning, having no automatic control of blank temperatures, it is necessary for manual measurement to be taken by using some form of infrared thermometer. In my experience, the results vary significantly from one person to the next when trying to take the same reading. This makes setting up blank temperatures manually very difficult.

With NNPB production in particular, the correct setting of the blank temperatures has a significant impact on production efficiencies, due to the impact on glass wall thicknesses. This includes side-to-side blank-half temperature control and the average blank temperature. The other forming processes of PB and BB are also sensitive to having correct blank temperatures held constant.

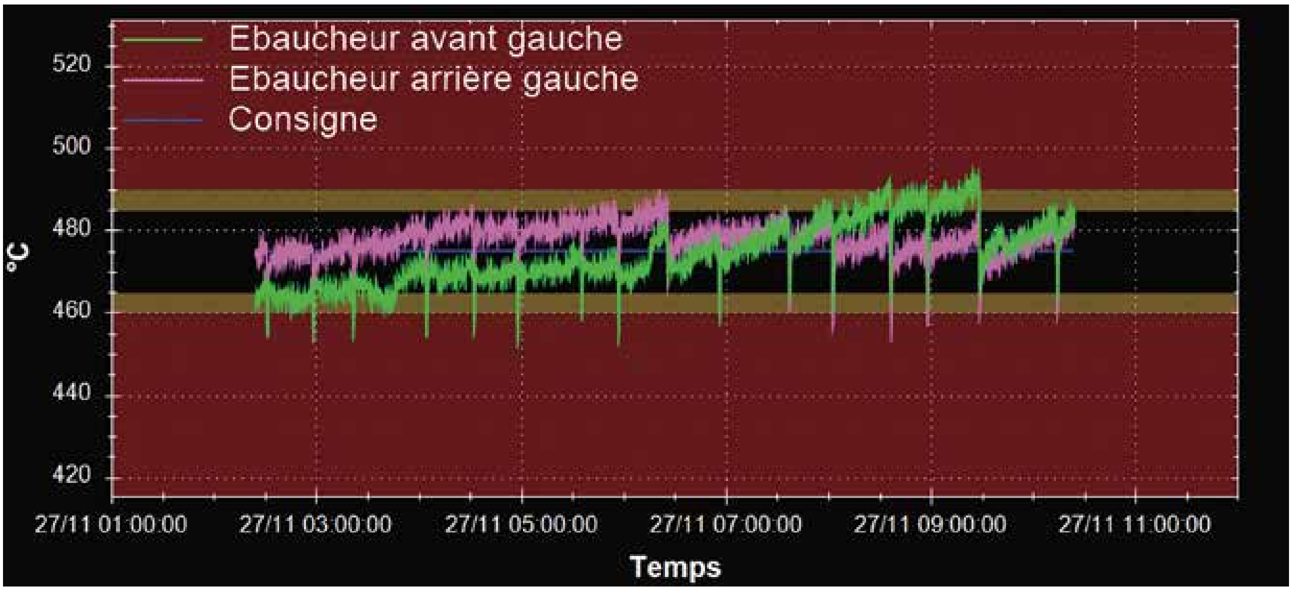
Irrespective of the forming process, a target of around 475 degrees celsius cavity surface temperature at the middle of each blank half is usually aimed for. Running much higher or lower will potentially yield hot- or cold-related blank defects.

EARLY TRACTION TOWARDS INNOVATION

Because of this, automatic control of blank temperatures was initially developed several decades ago. Originally, blank temperature automatic control was achieved using thermocouples inserted into dedicated holes drilled into the blanks that end half-an-inch (12.5 mm) from the glass contact surface of the blank mould, at the centre of the cavity.

This system unfortunately requires very high maintenance attention as the sensors require regular replacement after getting damaged. With the wires often untidily spread across the blank-side of the IS Machine, it does not help working conditions either. Such thermocouple wires get damaged quite easily because of this.

That is in stark contrast to the simple maintenance requirements of the Spyro, which is to clean each camera lens once per month. There are no exposed wires and



no maintenance of moving parts owing simply to the complete absence of moving parts in the Spyro temperature measurement system.

SPYRO AS TRENDSETTER

The thermocouple-based systems still work very well if the thermocouples and cables are maintained. Konatic can even offer such a thermocouple-based system if you have the discipline needed to maintain it. This will not, however, monitor and control the blow moulds like the new Konatic Spyro system can. Nor will it offer the many other additional benefits that come as part of the Spyro camera-based system.

Here's why the Konatic Spyro system is simply the next logical step forward from the old thermocouple approach. The step taken is in the use of the very latest infrared camera technologies with an extremely fast 'integration time'. These modern cameras are a prerequisite for the use of camera technology able to operate in real-time to give the most responsive control possible of the mould cooling air to each IS Machine section.

It would perhaps be unfair to identify it as the 'next logical step'. That's because others have already used camera technologies to control blank temperatures. Better to say that Konatic has taken a leap forward simply because it's the way the camera's being deployed here that's entirely new.

At least as far as I'm aware the blank temperature control camera systems currently in use have been deploying their infrared camera(s) at the blank side of the IS Machine. It took Kontatic to identify the opportunity to innovatively place the camera at the mould side.

ADDING STILL MORE VALUE

But that's not all. Konatic has demonstrated that the best results are achieved by having one camera per section on the mould-side of the IS Machine. In this case, each single-camera per section 'looks

through' the section to the blank-side to see the blanks opening.

In the same camera picture, the opening of the blow moulds can also be seen and the temperatures measured. Therefore, all temperatures relating to the blanks and the blow moulds can be recorded using a single infrared camera looking at each section.

As mentioned before, providing multiple cameras for measuring across the full IS Machine means there are no moving parts to maintain. This naturally lowers the maintenance requirement while increasing the temperature reading repeatability of the system.

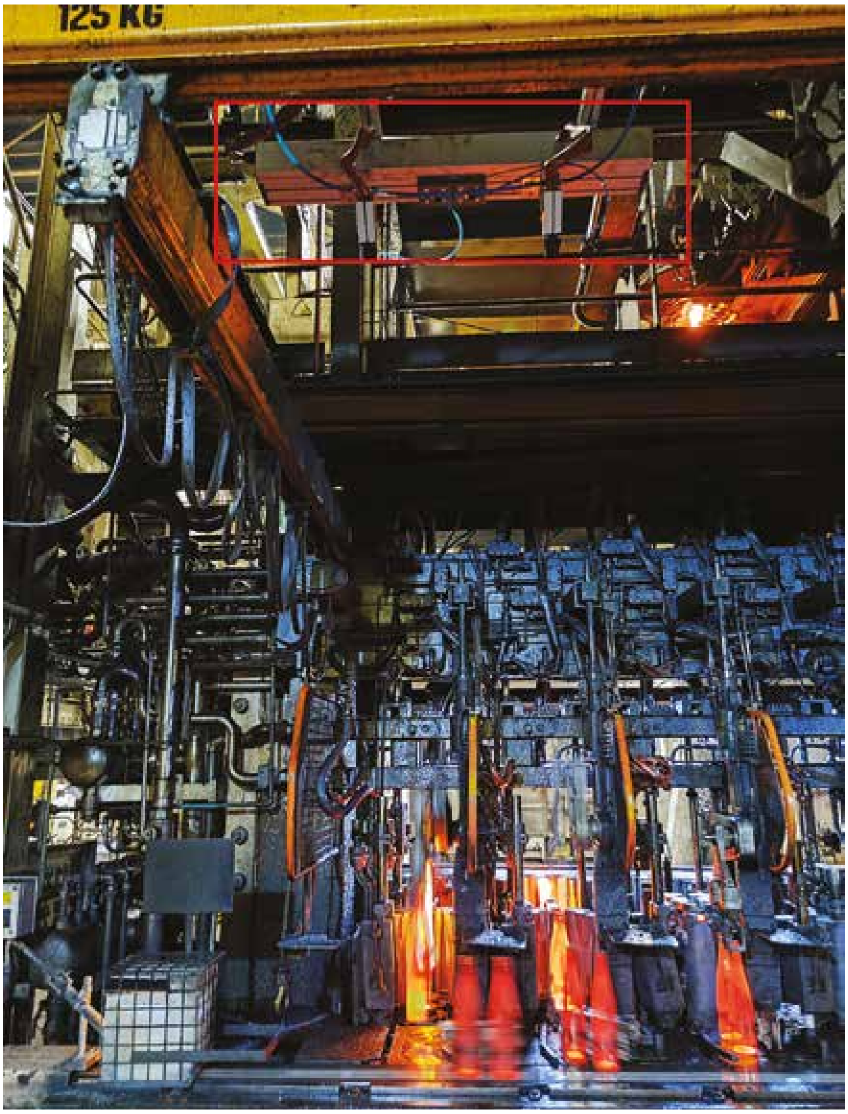
Although it might seem obvious now that it's been stated, this has every right to be called an innovation. Indeed neither Konatic nor I am aware that it has ever been done before by anyone else.

It was first deployed by Konatic around two years ago, so the principle has had plenty of time to prove itself. The simplicity of the current system relies upon arcuate opening of the blanks and mould arms (still the most predominant approach used).

It is not a problem to integrate this into any type of IS machine because the cameras can easily be mounted in a convenient position at the blow mould side. The only interfacing work that is required is for regulating the off-timing of the section mould cooling air (separate for the left and right sides).

This will not necessitate any technical interfacing to the machine timing system since it can be simply connected in series with the cooling air event electrical signal. Up to two separate left and right mould cooling lines being connected as the application of dual cooling modes is now quite common for providing maximum blank and mould cooling.

Synchronisation with the machine is the only direct connection required, which is normal for any system serving an



IS Machine. In this case, opto-isolation with the feeder pulse is usually the approach taken for any such system.

Notwithstanding that, the system can also visually synchronise with the machine. This means the temperature readings are taken at the most stable point in the section cycle (after the blank and mould arms open). That will help improve the repeatability of temperature readings meaning increased reliability and better temperature control.

Whilst the infrared image captures the full-cavity temperature profile, the temperature control arises from selecting up to three spot points to take the measurements from, for each side of each cavity. With smaller blank and blow mould cavities, this can be reduced to just two measurement spot points where appropriate.

The controlled temperature is then taken to be the average of the two or three spot temperatures measured at a specific point in the section cycle. That average becomes the input to a PID controller which is tuned to keep each half of each mould as close to the desired setpoint temperature as possible.

On multiple cavity sections, the temperatures of the inner and outer cavities are averaged to give a control system for the PID controller as the variable to be controlled. It does not matter how many cavities there are, the inner and outer cavities form the reference temperature. That means double, triple or quad gob is easily accommodated into the system.

Measured temperature deviations will come from such events as swab cycles and section or machine stoppages, but the Spyro system is there to ensure the temperature recovery to the setpoint temperature is achieved as quickly as possible.

ADVANCING STABILITY

This is how the Spyro system creates enhanced stability of conditions that were mentioned in the opening paragraph. Stable conditions are a prerequisite for the highest possible production efficiency, according to any seasoned bottle-making expert.

As an example of how things can be without good control of blanks and blow moulds, I recall last year sitting in a production meeting and being passed a bottle which had two defects in it. This is not something I have often seen but one defect (a body tear) was created by heating at the blank side. Another defect in the same bottle was a crizzle created by cold conditions on the mould side. When using systems like the Konatic Spyro correctly, such defects would simply not normally arise. Certainly you would not be looking at getting a hot and a cold defect in the very same container.

However, that was quite an eye-opener for me to witness just how easy it is for blank and blow mould temperatures to get out of control without the aid of temperature control systems. This was at a well-respected container manufacturing facility, although I think (I hope) it was an exceptional situation.

FACTORING IN TEMPERATURE

Further, on the topic of glass container defects and the implementation of the Spyro system, certain production types have been reported to reduce glass wall thickness rejects by 1.5 percent. This was on very high value production and so the financial benefits were very significant.

Now it is well known that the day and night temperature change can impact production performance. For this reason, some cooling air fans are regulated to reduce fan air pressure when ambient temperatures cool and increase cooling air pressure when ambient temperatures rise.

Separate control systems are available for such regulation of the overall fan cooling. However, this should not even be necessary when there is direct control over the temperature of the actual blank and blow mould cavities.

More generally, the benefit of having side-to-side temperature control of each blank and (optionally) each blow mould half will be clear to experienced glass-forming people reading this article.

Additionally, having an automatic system take care of restoring blank and blow mould temperatures after a section or machine outage at or even at a machine start-up will be clear to all. A quicker way to get to the target (setpoint) temperatures saves time which in turn saves on production loss.

Even the recovery of temperatures more quickly after a swabbing cycle has been carried out (where manual swabbing is taking place) can show benefits in putting more ware into the lehr and rejecting less at the cold end.

Savings from temperature recovery after swabbing may be hard to quantify. This is simply because the level of disturbance created by each machine operator swabbing can vary significantly. But the principle is clear.

Having these systems work for the glass bottle maker is one thing, but, of course, there is set-up work required as well to get the best out of the system. Just like with the maintenance requirements of the system, careful attention has been given to reduce the time and effort taken to set up for each production.

SETTINGS AND MEASUREMENT

The measurement points are simply achieved by the movement of a 'spot' that is placed where the measurement is required. Temperature measurement of up to three spots can be used for each blank half, and the same for each blow mould half, as mentioned before.

A graph of the real-time cyclical temperature profile for the average of each of measurement points is displayed, for each mould half (left and right for each cavity). This is then used to select the best time during the section cycle to highlight the most stable reading.

A setpoint temperature for the blank moulds is then assigned and the system will then adjust the cooling-off times to achieve the setpoint temperature - likewise for the blow moulds if this additional control option is also being used.

The set-up procedure is carried out on just one section. then those settings are used to 'fill' the other cameras' processing software with the same settings. This approach drastically minimises the set-up work required.

In electronic and computerised machine timing systems this is by and large how optimal event-timing settings on the IS Machine are copied to each section. Likewise, each section can then be 'fine-tuned' if this is required at all. In the case of the Spyro, it would be a slight adjustment to the measured position 'dots' on the moulds, and a slight adjustment of the temperature reading timing.

After all these settings have been established, there is the feature to save them all to a 'job file'. This means on future job runs it is just a matter of loading the file to get an exact repeat set-up.

Saving the Spyro settings can also be done on a 'Best Day History' basis which many glass container plants now use. This is where all the data on a best-performing day for a particular job on a particular production line is saved and used as a baseline for future job set-ups.

Of course, the usefulness of the 'best day history' approach is only as good as the amount of set-up data that can be recorded and repeated in future. That's where the Spyro scores heavily in terms of being able to record both blank and mould temperature settings.

A WORK IN PROGRESS

Despite the Spyro system being very mature in terms of completeness of the features all glassmakers prefer (low maintenance and ease of set-up), Konatic still sees additional benefits it can quite easily deliver on.

Konatic still likes to see the Spyro as a 'work in progress'. This means even the existing purchasers of the system will benefit from future work as most of this will be software development work which means existing systems are easily upgraded. A few of the potential near-future features and benefits were discussed with them.

Connectivity to Big Data systems for the correlation of data with production output is already a reality, it just needs a connection to the Open Platform Communications (OPC) data output. This will give time-stamped temperature data that can be aggregated in any way the user chooses, or simply left as raw data representing each section cycle and the associated temperatures recorded.

Just a little further development work will see the detection of IS Machine sections that jam up with glass stopped automatically and then an alarm raised for the operator to attend. In this case, the 'normal stop' can be used to bring the section to a controlled stop and prevent an unnoticed jam-up presenting the threat of an IS Machine fire.

TROUBLESHOOTING ANOMALIES

The detection of the jam up and any other anomaly where there is a high-temperature reading that should not be present is a natural part of having the camera look through each IS Machine section from the mould-side to the blank-side. The cameras see everything in infrared so such anomalies in temperature are very easy to detect.

Measurement of the neck-ring temperatures can already be carried out with the blow mould side camera. However, this is not under automatic control just yet. For that, it is thought maybe a dedicated camera on the blank side may be required.

Neck-ring temperature control does not however fall into the same league as the requirement for blank temperature control. Monitoring the neck-ring temperatures and alarming upon detected deviations could simply be all that is required in practice.

VIDEO CALLS WITH KONATIC

Having covered many matters concerning the Konatic Spyro system, I'm nonetheless mindful that the low number of words allowable in a technical article can never answer every question. This is why Konatic offers one-to-one video calls with anyone or any company wishing to know more, which has the technical team on hand to answer questions.

Notwithstanding that, I hope the above has conveyed some appreciation of how this new technology benefits the glass container industry. In relentlessly seeking better quality and higher output from glass container plants, using modern tools to make that possible renders the challenge much easier. For more information and to arrange a one-to-one call with Konatic, go to the link https://bit.ly/spyro-info. ■