Automated process control with FlexIS closed loops

Bucher Emhart Glass is looking into ways to automate the glass-forming process by closing the loop between temperature and plunger process readouts and the adjustments required.

For several years measurement systems such as Plunger Process Control (PPC) and Temperature Control System (TCS) have been giving glass container manufacturers valuable insights into their production processes.

However, for machine operators, systematically monitoring all the parameters involved and making manual adjustments is a demanding job. To achieve consistent production and higher efficiency, the next logical step is to automate this process with closed loops.

Blank mould temperature

Suppose a glass plant has a current-generation AIS or BIS machine from Bucher Emhart Glass, producing in 12-section triple gob. In this setup, no fewer than 72 mould-half temperatures and related cooling valves can be adjusted.

As production data confirms, it's already a major challenge for an operator to keep all these temperatures within ±15°C over a 24-hour period. Moulds have a naturally long reaction time to cooling inputs, therefore it's easy to overcompensate – so this is a job for an experienced and disciplined operator.

This is where BEG's FlexIS Blank Cooling Control is helpful. With this technology fitted, blank mould temperatures are automatically maintained within a narrow range (typically ±8°C) around their setpoint, day and night. Following a new production startup, cooling is also adjusted to match the new desired mould temperatures.

The result is that it's easier to maintain good product quality, because the variation of critical parameters is reduced. The operator has more time to focus on other tasks and can focus on improving quality or efficiency in other ways.

Plunger control

Another demanding task is controlling the pressing in press-and-blow or narrow-neck press-and-blow forming – particularly when multiple-pressure pressing is being used. That's where FlexIS Plunger Up Control comes in. ***(Fig 1)***

The closed-loop system obtains the characteristic timing values from the PPC system for every plunger stroke, then adjusts initial pressure levels to achieve the desired setpoint for the plunger rise time/dwell time.

FlexIS Plunger Up Control uses four pressure levels (including zero bar). The first and second are adjusted by the closed loop, while the third is applied during the dwell time and is defined by the operator.

With multi-pressure pressing, the operator can control the initial up motion and the distribution of the glass independently from the applied pressure during dwell time. This is an advantage in terms of controlling the characteristics of the parison and preventing defects.

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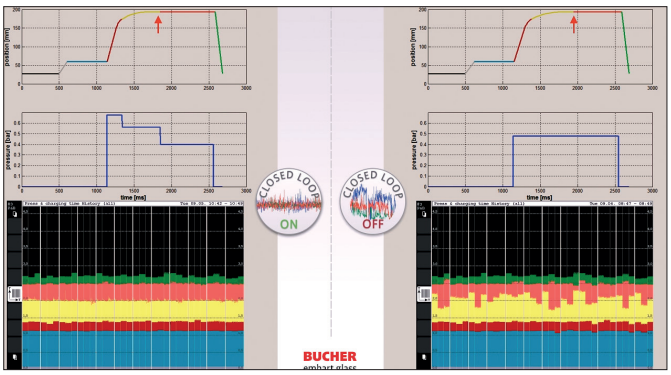

Fig 1. PPC Plunger, On/Off.

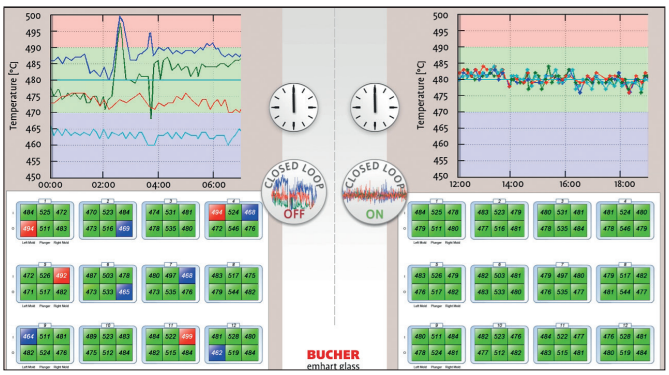

Fig 2. Blank Cooling, On/Off.

Choosing the right time to switch pressure levels is key – but FlexIS Plunger Up Control takes care of this too, determining the correct moment for each cavity based on the last few press curves.

Full integration

Both these closed loops are fully integrated into BEG's FlexIS control system, allowing the machine operator to set up and adjust all the necessary parameters on the FlexIS User Console (UC). Settings for each job can be saved and reloaded instantly following a job change.

During operation, operators receive feedback via the UC, so they can see if a particular cavity is operating at the adjustment limit and which settings are being automatically adjusted by the closed loop. These user-interface features help operators get up to speed quickly with the new technology and get the best from it.

Feedback

FlexIS Plunger Up and Blank Cooling Control are both commercially available and installed at glass plants in Europe and South Africa ***(Fig 2)***. The technology is also making inroads into South American markets. Some installations were carried out during the development process and customers' early feedback was used to refine the equipment before its commercial release.

In general, the response from the market has been positive.

"The TCS gives us finer control over the heat exchange on the blank side," stated Carlos Barranha of Vidrala. "Mounted on an AIS machine, the Blank Cooling Control closed loop can take advantage of separate valves for each mould half in the section, compensating for any imbalances in the cooling process. This contributes, for example, to greater stability of the vertical glass distribution and the mitigation of the settle blow wave.

"Furthermore, the option to automatically and systematically measure neckring and plunger temperatures allows us to detect problems more quickly and thus prevent or minimise defects from broken plunger cooling tubes, for example."

"We've been using the Plunger Up Control for over a year now," added Karl-Heinz Mann of Wiegand-Glas. "Through the use of constantly adjusted multi-pressure pressing, we can avoid blank seams and achieve reasonable dwell times more effectively – even for plungers with more friction. The fact that the dwell time is kept so constant also reduces sugary finish. Also, we've been able to stretch the intervals for changing the moulds and starting up after job changes is smoother and faster."

The future

Process control is a priority area of development for BEG. At the moment, a closed loop for controlling plunger temperature is under test and another to achieve equalised bottle spacing on the conveyor is scheduled to be installed in a glass plant for hte first time.

Finally, a forthcoming iteration of the TCS software will give users more flexibility in terms of defining the measurement sequence; the FlexIS should also be able to use this flexibility to support the section start-up sequence.■

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