

Smart sensors and closed loops for improved process control

Martin Grönblad and Andreas Helfenstein describe some of the latest advances in integrated smart sensors and closed loop technology to achieve improved process control in glass container production.

More than six years ago, Bucher Emhart Glass introduced the first FlexIS closed loop to add value to the company's existing sensor systems. Together with the Plunger Process Control PPC, the 'FlexIS Plunger Up Control' makes the pressing process in press and blow production more stable. Additionally, customers quickly discovered that the start-up time after a job change is reduced significantly by this system.

Furthermore, the Plunger Up Control automatically adjusts up to three pressure steps during pressing, which is desired for certain articles but hardly possible with manual adjustments. In the meantime, this closed loop has been installed in many production lines throughout the world. Over the years, other sensor systems and closed loops have been added to the BEG portfolio, which will be described below.

Forming process monitoring

FlexRadar from Bucher Emhart Glass allows 24/7 forming process monitoring of all containers that pass the cameras. Once the forming specialists and operators leave their shift, the eyes of the FlexRadar will continue to monitor, to reject containers that are violating process limits and gather statistics for further process improvements.

The system acts as a pre-filter for the cold end inspection equipment and allows faster corrective action to the root cause of the defect. This reduces investment into unsellable containers by rejecting them at an early stage of the value chain. At the same time, FlexRadar performs simple tasks such as rejecting down/stuck ware, it detects critical defects (birdswings, thin spots, leaners etc) and collects process data about glass distribution and intensity. This makes the system a truly multi-skilled component, providing value in any glass plant.

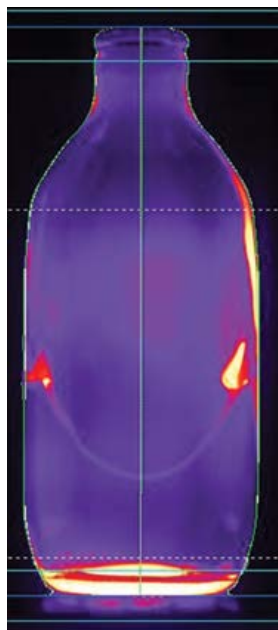
For Emhart, FlexRadar enables additional possibilities to develop process automation for the glass industry.

Weight control

Because FlexRadar samples data from every container that passes by the cameras, it is a valuable tool for any forming process. However, with the innovative weight control feature,



Choked bore.



Birdswing.



Mould seam.

the glass industry is also now able to achieve tight process limits in blow and blow operation.

FlexRadar weight control registers the average radiated energy from containers and with the aid of periodically weighed containers, correlates the intensity measured into actual glass mass. With an interface to the tube, the system automatically keeps the weight steady at the setpoint (down to $\pm 0.5\%$).

In many glass plants, the weight can fluctuate by $\pm 10\text{g}$ during 24h

during normal production. Common practice in the industry is to manually adjust the weight setpoint a few grams higher than ideal to create a safety margin for the process. The FlexRadar weight control does not only offer savings by automatic tube adjustments and reductions of process variations, it also allows the user to reduce the weight setpoint and save glass, i.e. lowering the setpoint by 2g saves €200,000 for a production line at an annual price per gram of €100,000.

Bottle spacing control

FlexIS Bottle Spacing Control adjusts and keeps the ware spacing at an equal distribution on the conveyor. It receives the position deviation of each bottle from the FlexRadar measurements and calculates correction for the push out angle of each section. The push out angle can only be changed within certain limits and these are directly calculated from the control parameters for each section.

Bottle Spacing Control also takes care of moving other events related to



Glass savings.

the push out angle, eg pocket air. Full integration into FlexIS allows changing FlexPusher parameters or even the conveyor offset, while the closed loop is running. The system will not fight against these user inputs but keeps ware spacing equally distributed, as the operator would expect.

Gob loading

How many defects can be related to loading? Gob loading is one of the key parameters that need to be ruled out when conducting a root cause analysis for process problems. When measuring the temperature and using automatic cooling control, for example, it is necessary to avoid 'over painting' loading problems. It is also desirable to reduce man-machine interaction to reduce hazards and improve ergonomics and wellbeing for humans involved in the forming process.

However, as human interaction with the process is reduced, the glass industry will depend increasingly on sensor systems to provide information about the process. BlankRadar fills this void and at the same time, is a key component for existing and future closed loop developments.

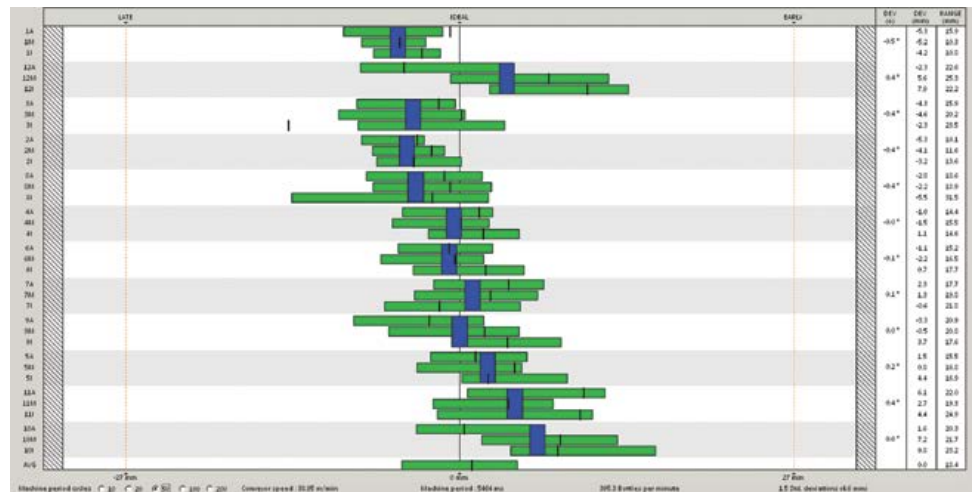
Blank cooling control

Together with BlankRadar or TCS, 'FlexIS Blank Cooling Control' keeps blank mould temperatures in a much tighter band than with manual adjustments. For AIS and BIS machines especially, with individual cavity cooling with up to six cooling valves per section in triple gob, the operator is heavily relieved from permanently monitoring and adjusting. This time can be used to work on other areas.

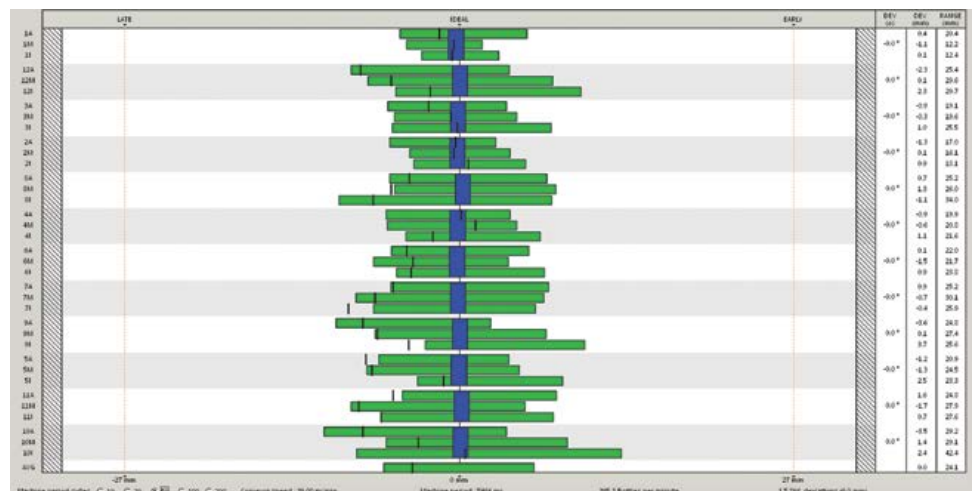
Of course, Blank Cooling Control is also a great help to start a new production run. Production benefits from constant temperature conditions in the blank moulds, even if the desired glass temperature and conditions in the feeder/forehearth are not yet stabilised. The closed loop can be configured for all types of machines. A similar closed loop exists for plunger temperatures – 'FlexIS Plunger Cooling Control'.

The future

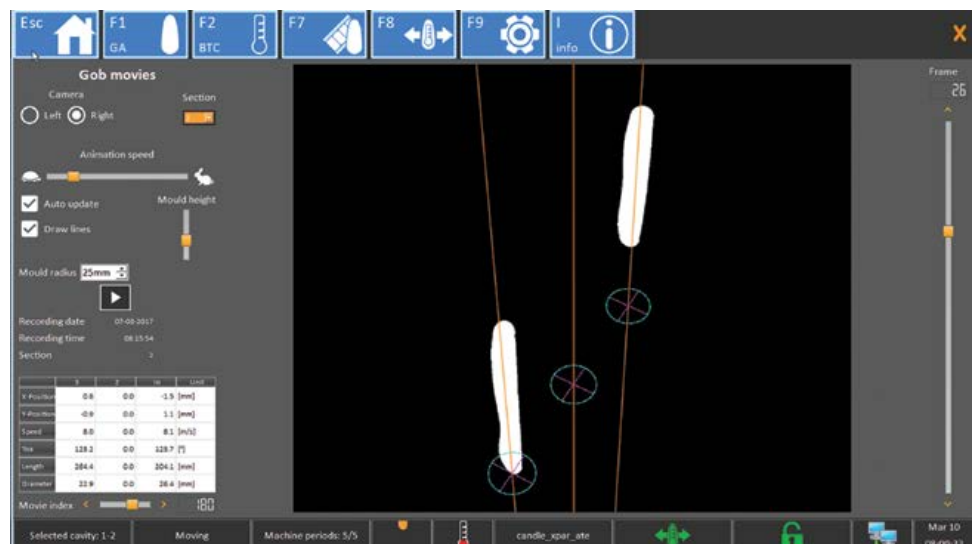
With these systems under the Bucher Emhart Glass umbrella, the company can provide integrated, smart, safe and conformance solutions together with its forming machines. They allow customers to deal with a single partner, providing a reliable and complete solution. Bucher Emhart



FlexRadar 'transportation screen', showing bottle position deviations with manual adjustment.



FlexRadar 'transportation screen', showing bottle position deviations with FlexIS Bottle Spacing Control.



Blank Radar screen.

Glass is currently developing further automation solutions that will further increase production efficiency and flexibility.

For Bucher Emhart Glass, process automation is also about reducing hazards, improving ergonomics and wellbeing. The company's technology is available to serve customers and their businesses. ●

About the authors:

Martin Grönblad is Product Manager, Process Products and Andreas Helfenstein is Product Manager, Closed Loops at Emhart Glass

Further information:

Emhart Glass SA, Steinhausen, Switzerland
tel: +41 41 749 42 00
email: webmaster@emhartglass.com
web: www.bucheremhartglass.com