Why Must the Process Control Make Corrections on Restart?

Part 3 of the Series "More Stability in Injection Molding with APC plus"

In injection molding, repeated interruptions are a familiar problem. The aim is rapid restart without rejects and production loss. This challenge is met by the APC plus machine function from KraussMaffei.

Interruptions in the cyclical production can be caused by various factors: some molds must be regularly cleaned, problems occur with the demolding of individual cavities, or disturbances in the downstream process steps result in direct feedback to the injection molding process, bringing it to a standstill. In addition, in applications involving manual inserts, the cycle time often changes, which also influences the process. The human factor plays a major role in restarting the process; the machine start-up is often uneven.

Whatever the cause, a shutdown in injection molding machines leads to the thermal equilibrium in the plastication unit being re-established. The energy component that is introduced by the screw rotation (dissipation) during cyclical operation is no longer present. The fact that the energy stored in the melt is not removed at the same time typically causes a (slight) temperature overrun at the heating zones of the plastication cylinder. This effect has a direct influence on the melt state ahead of the screw. Irrespective of the injection molding process, this can increase or decrease the melt temperature. Since the viscosity is directly dependent on the temperature of the melt, even tiny differences have an effect on the flow behavior.

In addition, a machine shutdown has an effect on the thermal equilibrium in the mold and thereby influences the filling behavior. The APC plus machine function from KraussMaffei registers the totality of the effective changes, firstly by means of the viscosity deviation and secondly via a change in the closing behavior of the nonreturn valve, and can make corrections even in the same cycle.

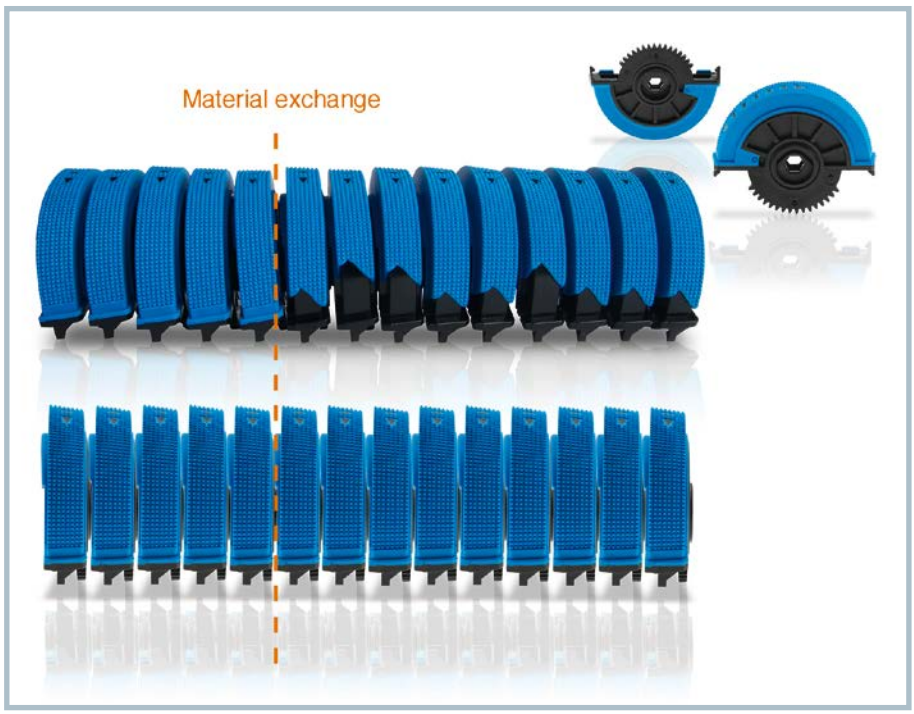

Fig. 1. Without APC plus, significant fluctuations in the part quality can be seen after a material exchange and restart (top). With APC plus (bottom) these fluctuations can be noticeably compensated. The side view of the part can be seen at the top right hand side of the picture
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Faster Start-up, Fewer Rejects

For restart after a machine shutdown, APC plus offers significant advantages. For example, the machine function recognizes precisely to what extent the material viscosity has changed during the shutdown and corrects it by adjusting the changeover point and holding pressure. Previously, the injection molding machine operator had to reduce the backpressure before start up, decrease the changeover point and slowly and cautiously return to the original values. APC plus makes these steps unnecessary.

Besides the time loss due to manual adjustment, a not inconsiderable »

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To Be Continued

Part 1 of the series ("Adaptive Process Control – What Is It for?") appeared in May (p. 29).
Part 2 of the series ("How Are Viscosity Changes Detected and Corrected?") appeared in June/July (p. 45).

The fourth and last part of the series follows in the November edition of ***Kunststoffe*** international, and is dedicated to the topic of "Improved Process and Part Quality When Using Recyclates".

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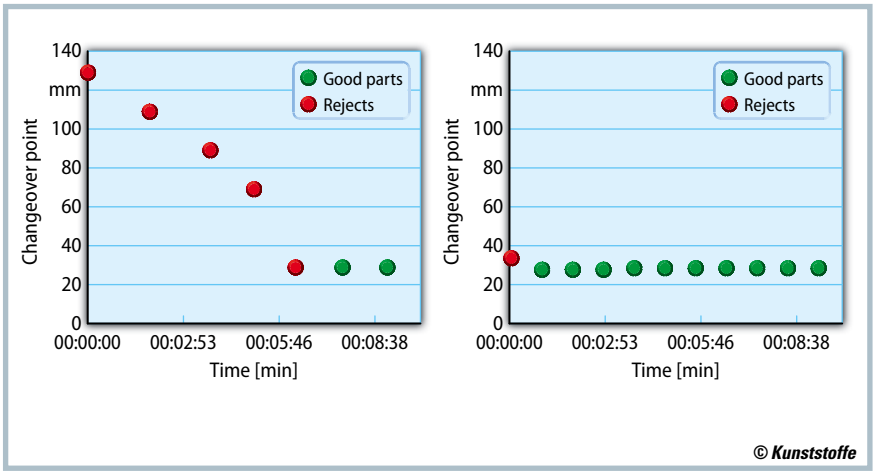

Fig. 2. On manual start-up (left), the changeover point is reduced to a low level and returned to the target value in five shots. On start-up with APC plus activated (right), the changeover point is only reduced as far as necessary; the number of defective parts is reduced from 5 to 1 (source: KraussMaffei)

proportion of reject parts occurs on start-up of the production line because the parts are incompletely filled (**Fig. 1**). The operator therefore chooses the more cautious settings in order not to overfill the mold, thereby avoiding damage. A changeover with APC plus, on the other hand, takes into account the rise in the pressure profile and prevents overpacking or underfilling of the cavities from the very first production cycle. Though, in the first shot, effects such as a cooled down mold still lead to underfilling, overall, the start-up phase is significantly shortened and the start-up rejects are reduced by 80 % (**Fig. 2**).

Summary

The APC plus machine function reliably compensates for deficiencies in machine shutdown and on restart. Rejects are significantly reduced. In total, the machine operator benefits from the easy, automated resumption of production. ■

Mixing Concept Mix Tip Extended

Eliminating Flow Lines Cost-Effectively

Promix Solutions AG, Winterthur, Switzerland, has extended its well-proven Mix Tip series, an easy-to-install mixing nozzle for the injection molding sector. The solution specially developed for small injection molding machines is now also available for machines with clamping forces of up to 2000 kN. By replacing the standard nozzle tips with a Mix Tip product, flow lines can be eliminated cost-effectively and easily. According to the manufacturer, the masterbatch consumption can be reduced by 20 to 30 %.

To the manufacturer's product presentation:
www.kunststoffe-international.com/4212170

The mixing nozzle Mix Tip is now also available for injection molding machines up to 2000 kN clamping force (© Promix)