

Improved Process and Component Quality when Using Recycled Materials



Part 4 of the Series “More Stability for Injection Molding with APC plus”

In the injection molding process, the addition of recycled material affects the processing viscosity of the melt and thus also the closing behavior of the nonreturn valve. The APC plus function of KraussMaffei compensates for these changes and prevents fluctuations in the component weight. The result is consistently high component quality while ensuring lower resource consumption.

The use of recycled material makes a lot of sense in many respects if the goal is to operate production lines efficiently and economically. For example, start-up parts and sprues can be processed easily this way and entire productions can be structured on the processing of regrind. Depending on the material and mixing ratio, however, the property patterns of the flow capacity of the plastic melt vary in the process. Usually, the addition of recycled material to new goods causes the melt viscosity to drop, as the polymer undergoes thermal damage during each processing cycle and because fillers such as fibers are crushed. A lower viscosity can, in turn, lead to the nonreturn valve closing earlier, improving the holding pressure effect such that the part mass increases.

Up to a certain extent, this is largely compensated for by the holding pressure effect in the conventional injection molding process. Irregularities in the processing viscosity cannot, however, be avoided. As a result, fluctuations arise in the plasticizing torque, in the melting time and in the melt pressure. They become evident on the finished component in the form of sunk spots or overpacking and scrap rates are increased. Depending on the injection mold and the material used, this requires a readjustment of the setting parameters. This task is handled by the APC plus (Adaptive Process Control) machine function from KraussMaffei and ensures that the machine control system behaves with a little more intelligence and autonomy.

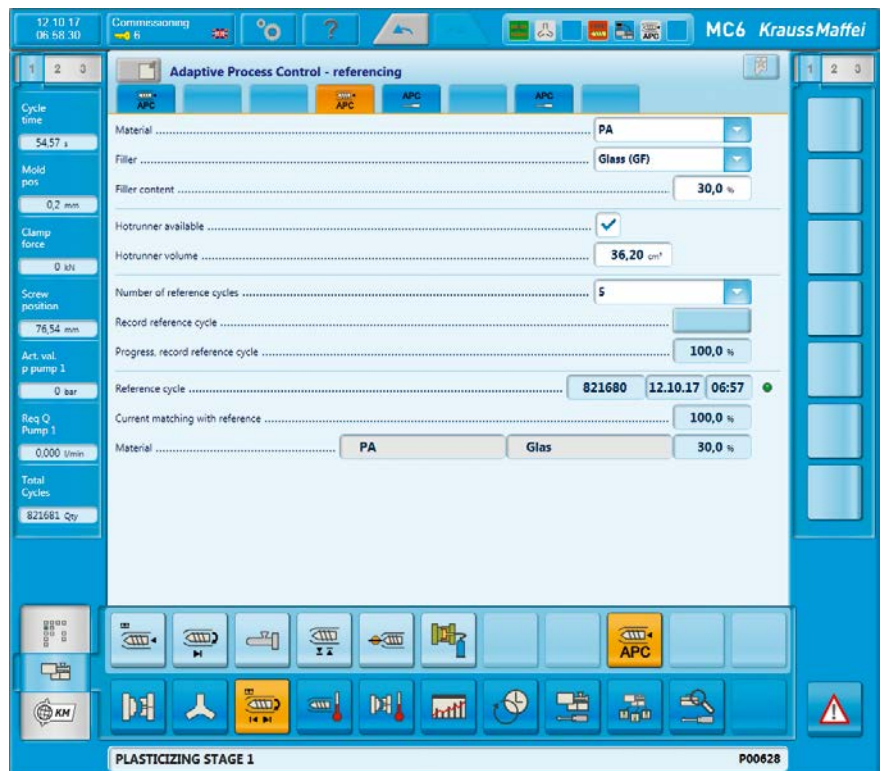


Fig. 1. The clear visualization of the configuration level on the MC6 control system makes it possible to specify the basic data quickly and easily (© KraussMaffei)

Adjustment within One Cycle

The operation and configuration of APC plus has been made intuitive and remains simple (Fig. 1): The operator must enter information into the system using the MC6 control system regarding the polymer type used, the kind of filler and its portion as a percentage. This data, together with the reference cycles recorded by the system, forms the basic framework of the

function. Another click activates the Adaptive Process Control system. A referenced part volume can now be reproduced with repeatable results.

To ensure the ability to compensate for the effects of the viscosity fluctuations in the raw material, the APC plus machine function detects changes in the viscosity as well as the closing behavior of the nonreturn valve. For example, a reduction in viscosity causes an increase in the mea-

sured melt pressure in the cylinder. One possible consequence of this is that the mold cavity may be overpacked and the components end up being part of the scrap statistics. Based on the information determined by the system, the process is adapted by APC plus to the reference sequences and their parameters. This happens online during the same cycle through adaptation of the changeover point and of the holding pressure profile. It creates a consistent mold fill level across all cycles.

What Happens when the Regrind Portion Increases?

The changes that are made automatically from shot to shot (adjustment of the holding pressure change-over stroke and of the holding pressure) by APC plus can be viewed quickly and easily in the MC6 control system (Fig. 2) and are documented in the report. To demonstrate this, a trial was run in which the regrind portion was varied from 0 to 100% using a material metering system. The part mass (m) and the viscosity index (VI) have been plotted correspondingly in the diagram (Fig. 3). This suggests that, when the regrind portion changes from 0 to 100%, the viscosity index drops by 20% and the shot weight increases by approx. 180 mg. An activated APC plus changes the process parameters from shot to shot, preventing an increase of the part mass.

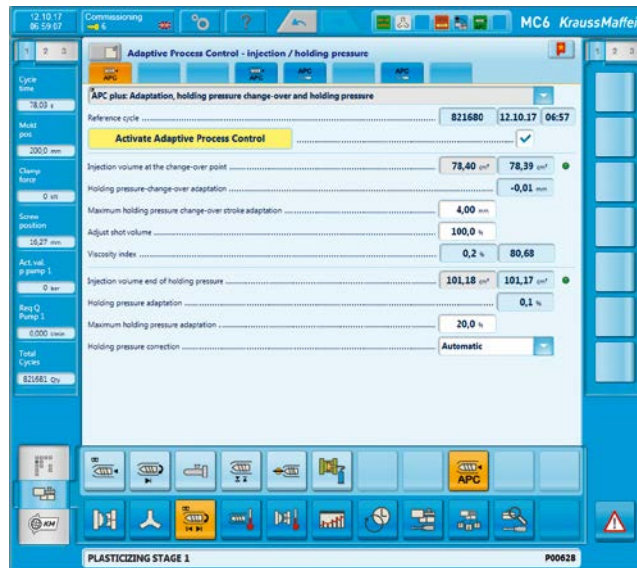


Fig. 2. The adaptations made by the APC plus machine function for the changeover point and the holding pressure can be viewed in the MC6 control system. The viscosity index is displayed as a key figure for the melt viscosity (© KraussMaffei)

Conclusion

The APC plus machine function from KraussMaffei makes it significantly easier to use recycled material in the injection molding process. Constant manual readjustment of the setting parameters by the machine setter is no longer required, because the control system now handles this task. Thanks to improved reproducibility for the part volume, consistent component quality can now be achieved successfully in most cases. This reduces scrap rates considerably and increases productivity. APC plus thus ensures a stable process sequence and is, thanks to its

easy and convenient operation, a valuable tool in injection molding production. ■

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Series

This part concludes the series "More Stability for Injection Molding with APC plus."

- Part 1 of the series ("Adaptive Process Control – What Is It for?") appeared in May on page 29.
- Part 2 of the series ("How Are Viscosity Changes Detected and Corrected?") appeared in June/July on page 45.
- Part 3 of the series ("Why Must the Process Control Make Corrections on Restart?") appeared in September on page 33.

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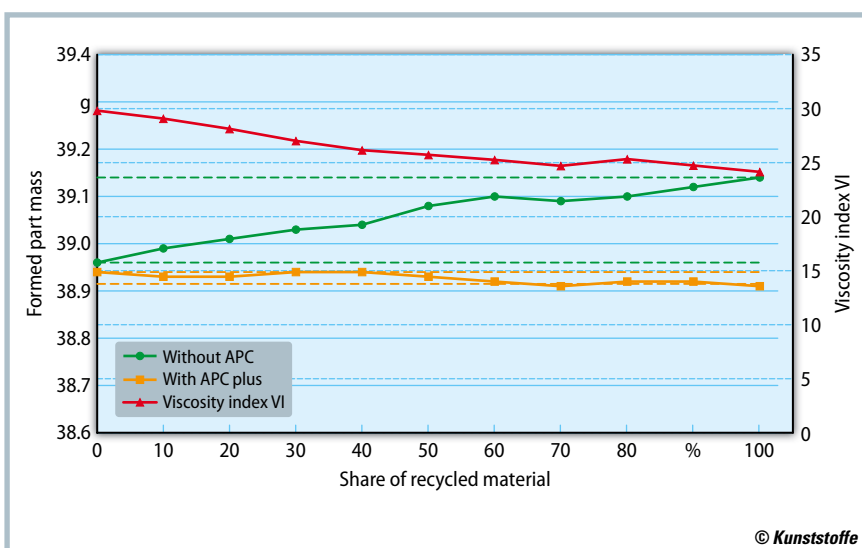


Fig. 3. Increasing recycled content lowers the viscosity of the melt (PA66-GF30). Without active APC plus, using a variety of materials will result in various part mass and component quality. When APC plus is used in production, however, the fluctuations in part mass can be reduced considerably between the individual cycles (source: KraussMaffei)