

# A Cost-Effective Alternative

## Off-Grade Polypropylene Instead of Virgin Resin

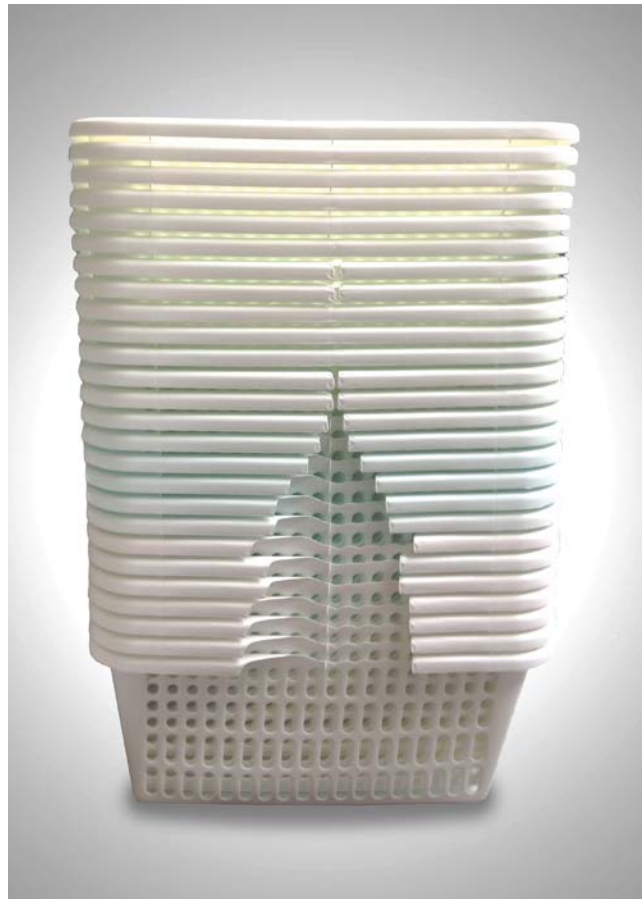
New, demanding applications raise the standards that need to be met by plastics. In addition, higher prices for raw materials and electricity translate into additional cost when manufacturing plastic products. Using less expensive off-grade material instead of expensive virgin resin represents one possible remedy. Specific processing aids make this possible.

**M**anufacturers of masterbatches are facing major challenges as the result of higher energy costs resulting from the EEG surcharge as well as increased raw material prices. From product development to volume production, producers of plastic need to respond cost-effectively, flexibly and rapidly to the needs and desires of the plastics processing industry. On the one hand, the material must reduce costs, while on the other it must satisfy the quality requirements by providing surfaces with a good feel and exceptional mechanical properties as well as a low weight.

For example, when manufacturing parts from polypropylene, the use of off-grade material such as PP-NT neat resin represents a cost-effective alternative to more expensive grade 1A resin. PP-NT resin, however, has a very low melt flow index (MFI), making the material more viscous. In contrast, grade 1A resin has a higher MFI, which means that it flows better and is easier to process. Processors often revert to use of the less expensive NT resin, especially for products with a low marginal return. Products with a complicated geometry and thin-walled parts can then be produced only with higher energy input and longer cycle times. The harder-flowing material does not fill the part as well and is thus more difficult to process.

### Improved Flow Characteristics

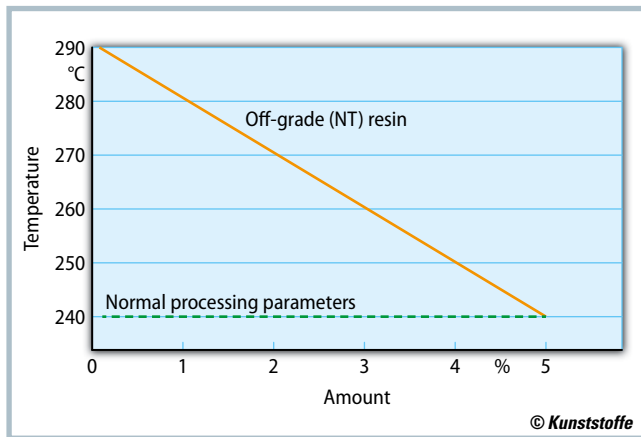
By adding the processing additive Flow Improver from Grafe Gruppe GmbH, Blankenhain, Germany, at a level of about



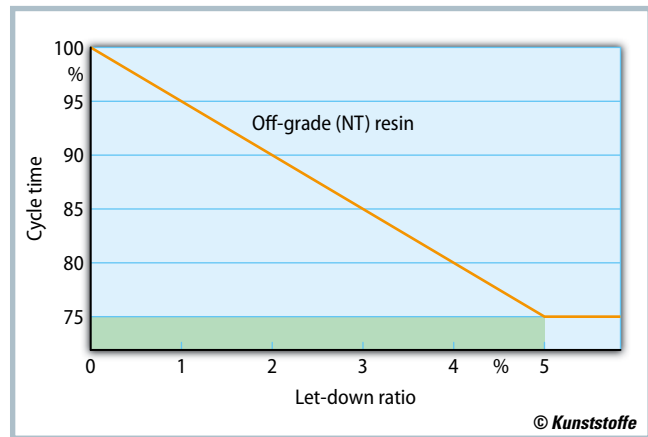
With the aid of custom-tailored processing additives, the required part quality can be achieved even with off-grade resin (figures: Grafe)

5%, the melting point of the melting PP mass is lowered considerably during plastication. As a result, the cooling times are reduced, since crystallization is initiated faster over an area and not only as stelliform crystals at individual spots. Depending on the modified polymer, addition of the additive in the form of a masterbatch does not adversely affect the final characteristics of the molded

part, for instance, the impact strength. In addition to shorter heating times, the stock temperature can be reduced by about at most 70 °C (depending on the part geometry). Overall, Flow Improver yields improved flow characteristics, lower melt temperature, shorter cooling times and thus a reduced cycle time. Production and energy costs are lowered.



**Fig. 1.** Illustrative example: After addition of the flow additive to NT resin, the processing temperature is reduced for the same cycle time



**Fig. 2.** Demonstration of the processing behavior of NT resin after addition of the processing additive as cycle-efficient aid

By adding the advanced additive masterbatch “Flow Improver” to NT resin at a level of about 5%, even better flow characteristics and thus a higher MFI are achieved, so that processing of NT resin becomes similar to that of grade 1A resin (**Title figure**). Since the amount of flow additive added depends on the quality of the NT resin, i.e. the MFI of the NT resin is not constant, flexibility is required. This means that for NT resin with a lower MFI addition of about 5% is needed, while for NT resin with a higher MFI addition of 2% is enough. This then results in optimal mold filling. In this way, thin-walled parts can be produced under stable production conditions at a normal processing temperature. **Figure 1** shows that by adding flow additive masterbatch at a processing temperature of 240°C optimal production stability is achieved when using more cost-effective PP-NT resin. In addition, the PP-NT resin responds more flexibly under mechanical loads.

### Comparable Processing

As a processing aid, the (cycle-efficient) additive masterbatch Flow Improver reduces the cycle time. The principle on which this result is based is friction. The temperature of the machine is lowered,

making it necessary to generate increased shear to raise efficiency. Addition of Flow Improver as a cycle-efficient processing aid can thus save energy by lowering the temperature while at the same time shortening the cycle time (**Fig. 2**).

By combining both melts (PP + additive batch), Flow Improver (as processing aid) improves the processability of hard-flowing PP-NT resin. The temperature of the production machine can, in turn, be lowered to the normal PP processing temperature. As a result, the NT resin can be processed with the same processing parameters as grade 1A PP resin. The previous drawback when using the additive Flow Improver was the slightly yellow natural color. The newly developed Flow Improver is nearly transparent and does not have this yellowish natural color. Moreover, the product imparts less warpage and reduces mechanical properties only minimally. The product finds use for production of articles with an attractive transparent or translucent appearance as well as for components with complicated technical requirements. Applications in sheet extrusion are also conceivable. In this case, the sheet retains its shape despite a higher intrinsic temperature. Furthermore, the cooling stage can be short-

ened, since the cooling time is reduced (**Table 1**).

### Conclusions

The Flow Improver product family of additive masterbatch offers custom-tailored solutions for upgrading off-grade resins to the virgin grade level. The additives improve either the flow characteristics of the melt, lower the temperature of the machine or contribute to improved homogeneity through better dispersion of the melt.

Overall, energy consumption is lowered and the cycle time reduced with the aid of this custom-tailored processing additive.

The sum total is virgin grade-like quality at lower costs. ■

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Flow Improver (cycle-efficient)	Flow Improver (flow enhancer)
<ul style="list-style-type: none"> <li>■ Reduce temperature</li> <li>■ Save energy</li> <li>■ Shorten cycle</li> <li>■ Acts via friction</li> </ul>	<ul style="list-style-type: none"> <li>■ Increase MFI</li> <li>■ Improve processability of hard-flowing materials</li> <li>■ Low warpage</li> <li>■ Completely transparent – no natural color</li> </ul>

**Table 1.** Comparison of processing additives for reducing the cycle time and improving the flow characteristics of NT resin