VOELPKER

TECHNICAL STUDY

PBT: EJECTION FORCE REDUCTION ENABLED BY MONTAN WAX

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Abstract

The montan wax WARADUR® E acts as excellent thermal stable and low volatile release agents when used in PBT (Polybutylene terephthalate). To improve the flow properties and mold release, the addition of up to 1.0 % in the case of filled or reinforced materials has been proven to be advantageous. Concentrations of 0.3 – 0.5 % are recommended in unfilled PBT.

In the present studies it was analysed what effect the montan wax WARADUR® E has on the demolding properties, as additive in PBT. The ejection force was analysed in particular. The ejection force (or demolding force) is defined as the force needed to strip the moulded parts from the mould cores. It was demonstrated that using WARADUR® E the ejection force can be significantly lowered.

Material and equipment

The analysed material recipes are summarised in Tab. 1.

Matrix	Additive	Additive [phr]	Comments
SHINITE D201NA (PBT Base polymer grade) + Irganox 1010 [0.5 wt.%]	none	0.0	Reference/blank
	WARADUR® E	0.4	Montan ester wax
	PETS	0.4	Pentaerythritolester
	Calcium stearate	0.4	

Table 1: Dosage of wax additives in PBT

Compounding: Brabender twin-screw extruder (Compounding)
Injection moulding: Arburg Allrounder 420C 1000

Compounding of the PBT formulas

The compounding of the materials was performed in a two-stage process:
1. Master batch production
2. Dilution to the end formula to be tested (4 kg in each case).
The formulas were compounded at a mass temperature of 260°C and a mass flow rate of 2 kg/h.

Injection moulding trials to determine the ejection force

To determine the ejection force, the ejector package from Arburg Allrounder 420C 1000 was adaptively extended by a load cell. For this purpose, the load cell (U2B [5 kN] from the company Hottinger Baldwin Messtechnik GmbH) was axially integrated into the ejector rod. The ejection force was calculated by means of a measuring computer (software: KATMAN easy).

For the tests, an injection molding tool was used with a particularly high shell surface.

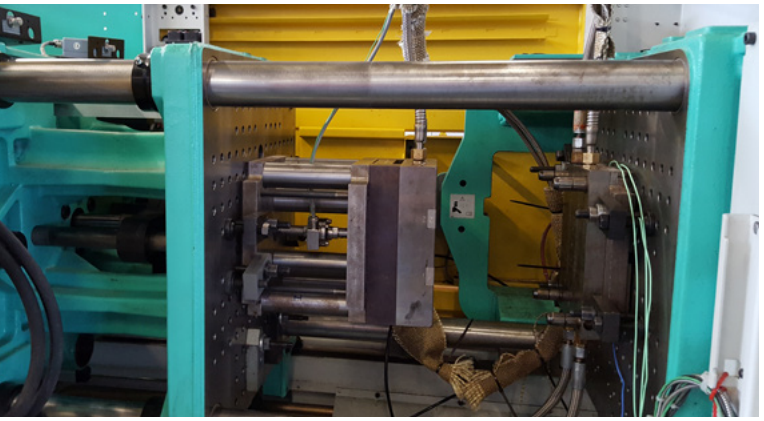

Figure 1: Clamping unit for the injection mould system / Integrated load cell (from left to right)

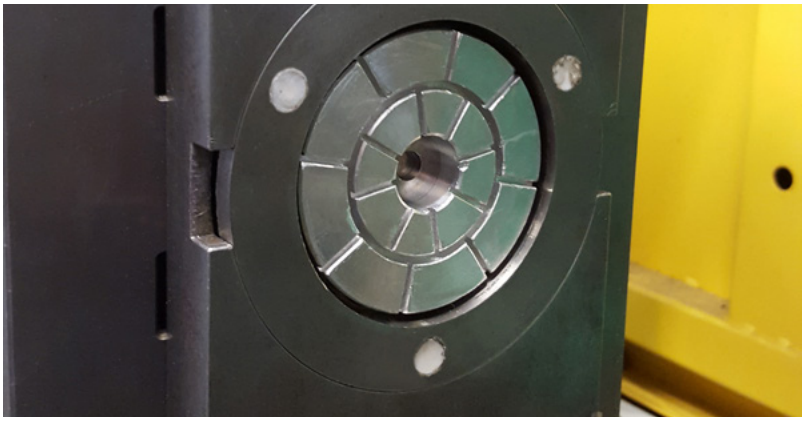

Figure 2: Tool cavity with core setter

All PBT formulas were pre-dried in the granulate dryer at 110°C to a residual moisture of 0.03% before the injection mould trials. The injection mould trials were conducted at a mass temperature of 240°C. When a stable injection mould process had been established (after material change, approx. 40 injection mould cycles), the ejection forces were calculated from 20 measured injection mould cycles.

Results / Conclusion

The results show that the ejection forces can be reduced by approximately 20% with Waradur® E.

In particular, for box-shaped injection molded parts with a high depth and little or no draft angle or parts with a special surface texture, a reduction of the demolding force is of high priority in order to reduce the cycle times and to produce less rejects.

The additives PETS and calcium stearate only reduced the ejection forces by 8% and 11% respectively.

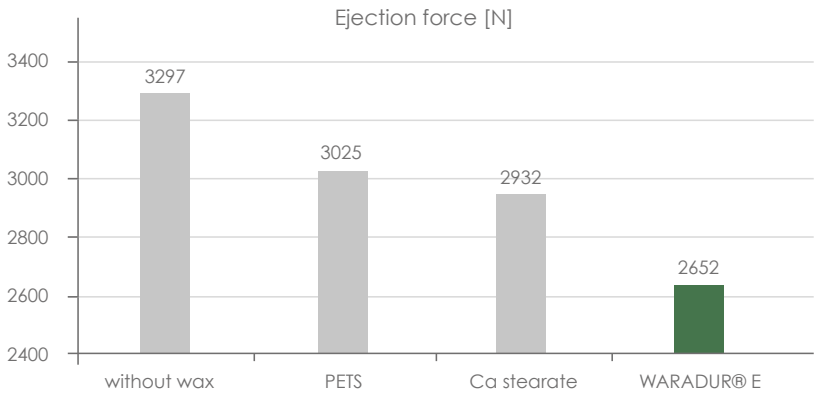

Figure 3: Ejection forces for the formulas tested

Voelpker – a family-owned company with innovative strength

With more than 115 years of production history, Voelpker is among the most long-standing wax producers in Europe and is renowned worldwide as a reliable manufacturer and supplier of montan waxes and special wax blends. Due to their unique properties, montan waxes produced by Voelpker are used as high-performance additives in the plastics industry. They serve as combined external and internal lubricants, nucleation additives and dispersing agents in many types of plastics and processing methods.

True to the motto 'to make ideas work', we do everything to improve and optimize our customers' products and processes. We design special waxes that are precisely tailored to their requirements. We served our customers as a reliable partner and have developed individual solutions for many branches over the last few decades.

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