VOELPKER | plastic series

TECHNICAL STUDY

Nucleation

Cycle time reduction

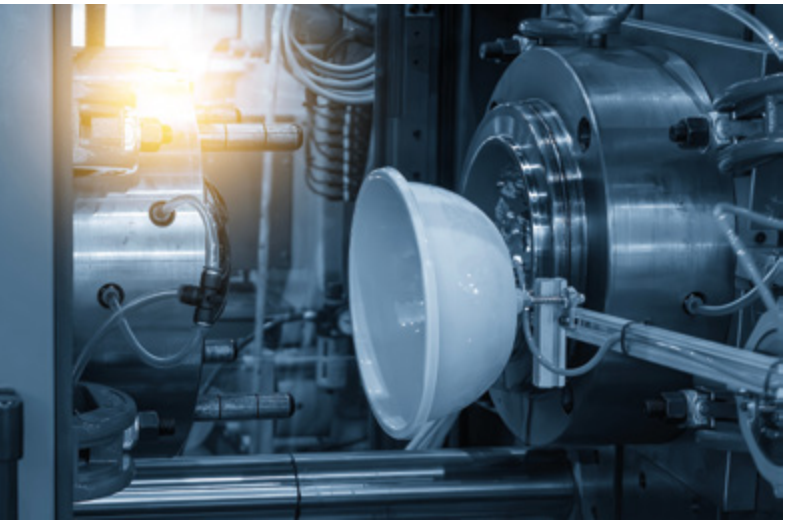
Reduced costs

Demolding

THE EFFECT OF WARADUR® OP*plus* ON THE NUCLEATION BEHAVIOUR OF PET

Introduction

WARADUR® OP*plus* is a proprietary formulation based on polar montan ester wax with a particularly high proportion of calcium montante.
In the present study the crystallisation temperature of PET with 0,5 % WARADUR® OP*plus* has been DSC-analysed in comparison to the non additivated polymer. The aim of the study was to demonstrate a nucleation effect of WARADUR® OP*plus* by increasing the PET crystallization temperature.



	Target value	Unit	Method
Acid number	< 10	[mg KOH/g]	ISO 2114
Melting range	88-114	[°C]	DSC
Solidification range	92-65	[°C]	DSC
Ca content	3,5 – 5,0	[%]	RFA

Table 1: Characteristics of WARADUR® OP*plus*

Test material
1. PET: Lighter C93, unfilled (Equipolymers)
2. WARADUR® OP*plus* (VOELPKER)
Pretreatment of PET: dried at 120 °C / 2,5 h

Test equipment
Injection molding: Arburg Allrounder 320 C 500-170
Temperature profile: 250/265/275/285 °C
Differential Scanning Calometry (DSC): Mettler Modul: 822e/1344/500
Method: PET ASTM D 3410 40-300: Dt 0,5 s [1] 40 °C, 5 min [2] 40,0..300 °C, 10,00 K/min [3] 300°C, 5 min [4] 300,0 °C..40 °C, -2,00 K/min [5] 40,0 °C, 5 min [6] 40,0 °C..300,0 °C, 10 K/min

Results

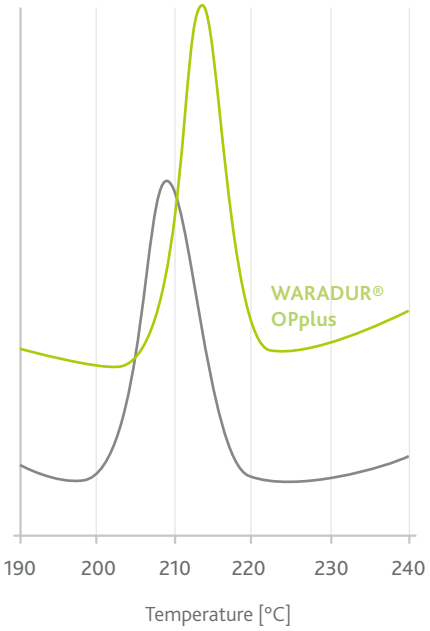


Table 2:
Shift of the DSC Crystallisation temperature PET → and PET with WARADUR® OP*plus*

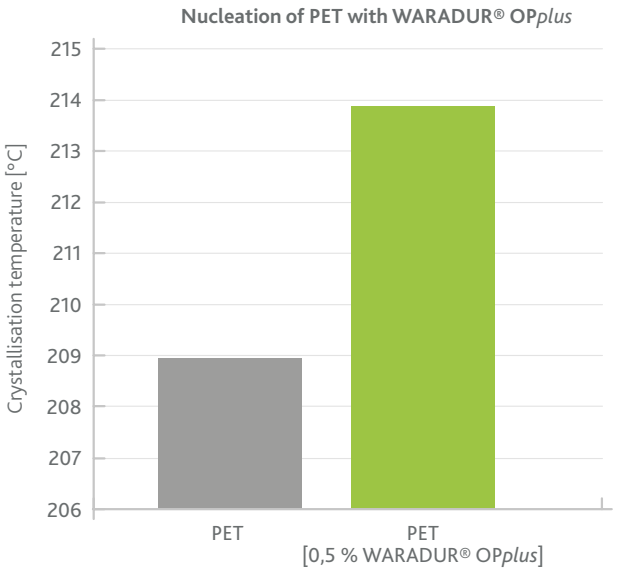


Table 4: Difference of the DSC Crystallisation temperature PET and PET with WARADUR® OP*plus*

Nr.	PET/PET Formulation	Solidification temperature [°C]	Solidification temperature Difference [Δ °C]
1	100 % PET	208,9	–
2	99,5 % PET + 0,5 % WARADUR® OP*plus*	213,7	+ 4,8

Table 3: Formulation and solidification temperature difference

Summary

WARADUR® OP*plus* acts as a suitable nucleating agent in PET. It can enhance the crystallization rate of PET and provide reduced cycle times in injection molding.
WARADUR® OP*plus* is effective at concentrations of 0.1 – 0.5 % in polyester. It exhibits additional desirable properties for PET injection molding, for example: low volatility and favourable lubrication, mold-release and surface improving effects. WARADUR® OP*plus* thus contributes to improved PET processing and and final product performance.

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