Accelothene®

Process Additive for Polyoefins

Product

What is accelothene®?

- **Additive process optimization and cycle time reduction of polyolefins**

1. Flow improvement
2. Crystallization accelerator
3. Lowering process temperature

- **Network-Agent (three-dimensional network)**

1. Patented technology
2. Physical crosslinking
3. Co-crystallization of polymers
4. No migration issues
5. No phase formation

Product

Your benefits

- Reduction of cycle times by 15% - 25% due to significantly shorter cooling times and increased crystallization speed. Requirement: plastic melting time < cooling time
- Significant improvement in flow properties
- Noticeable reduction in processing temperature (20 to 50°C)
- Lower energy consumption (5 to 10%)
- Less impact on material properties
- Better mechanical properties (under certain conditions)
- Better homogenization of recyclate and regrind

Product

Your possible additional benefits

- Energy savings
- Better filling of complex molds
- Use of heat-sensitive additives
- Use of cost-effective polyolefins
  (e.g. high-impact extrusion types in injection molding)
- Reduction of stress cracking
- Reduction of warpage

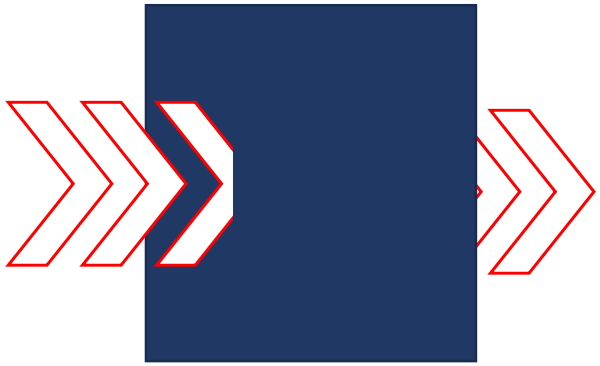
Product

What accelothene® is not

- a slipping agent
- a typical flow improver
- an unwanted substance in the product
- creating undesired side effects

Accelothene® is unique in

- lowering viscosity during process and
- synergistically interacting with the polyolefin
- while co-crystallizing with the polyolefin
- improving your process

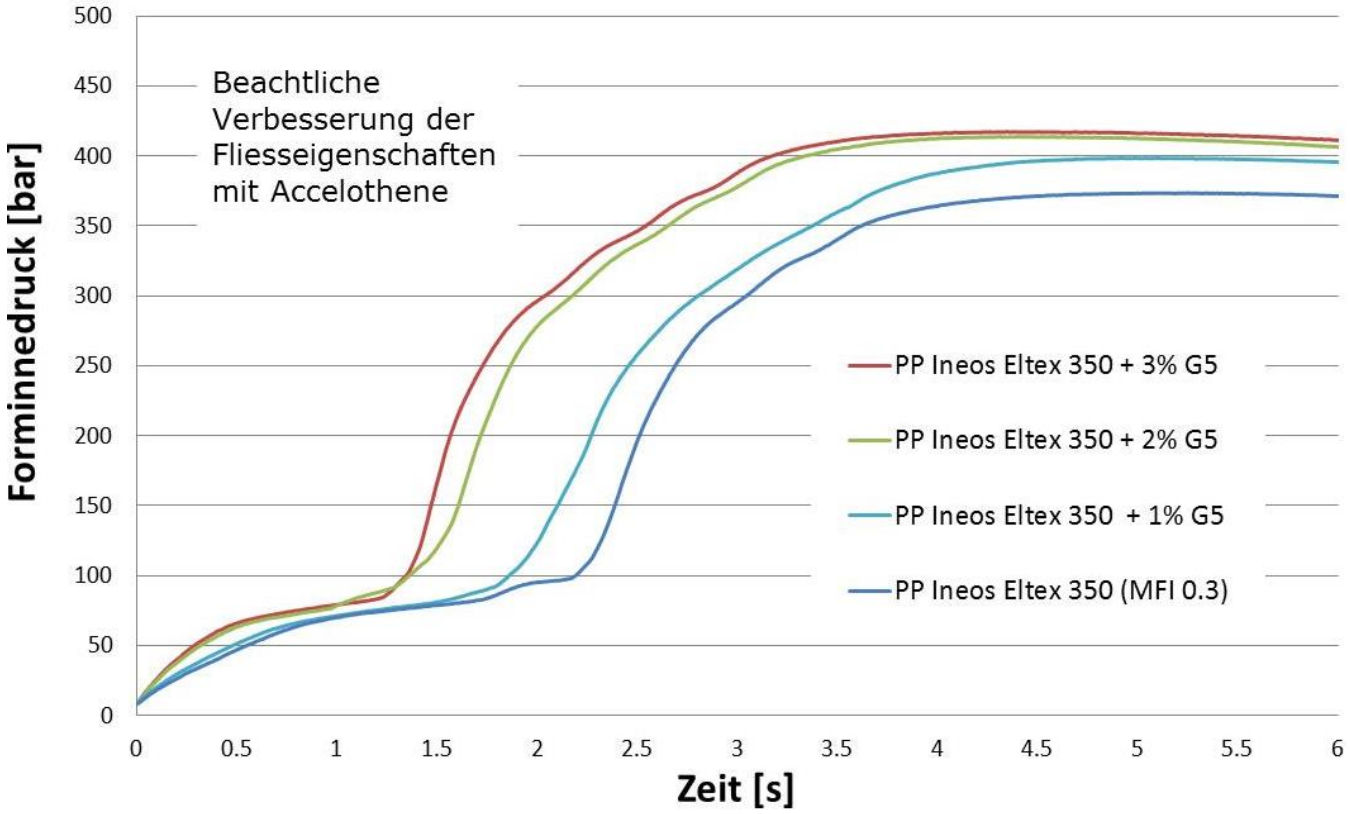


It's like a flow improver which after having done his job, . . . disappears . . .

…patented technology !

Product

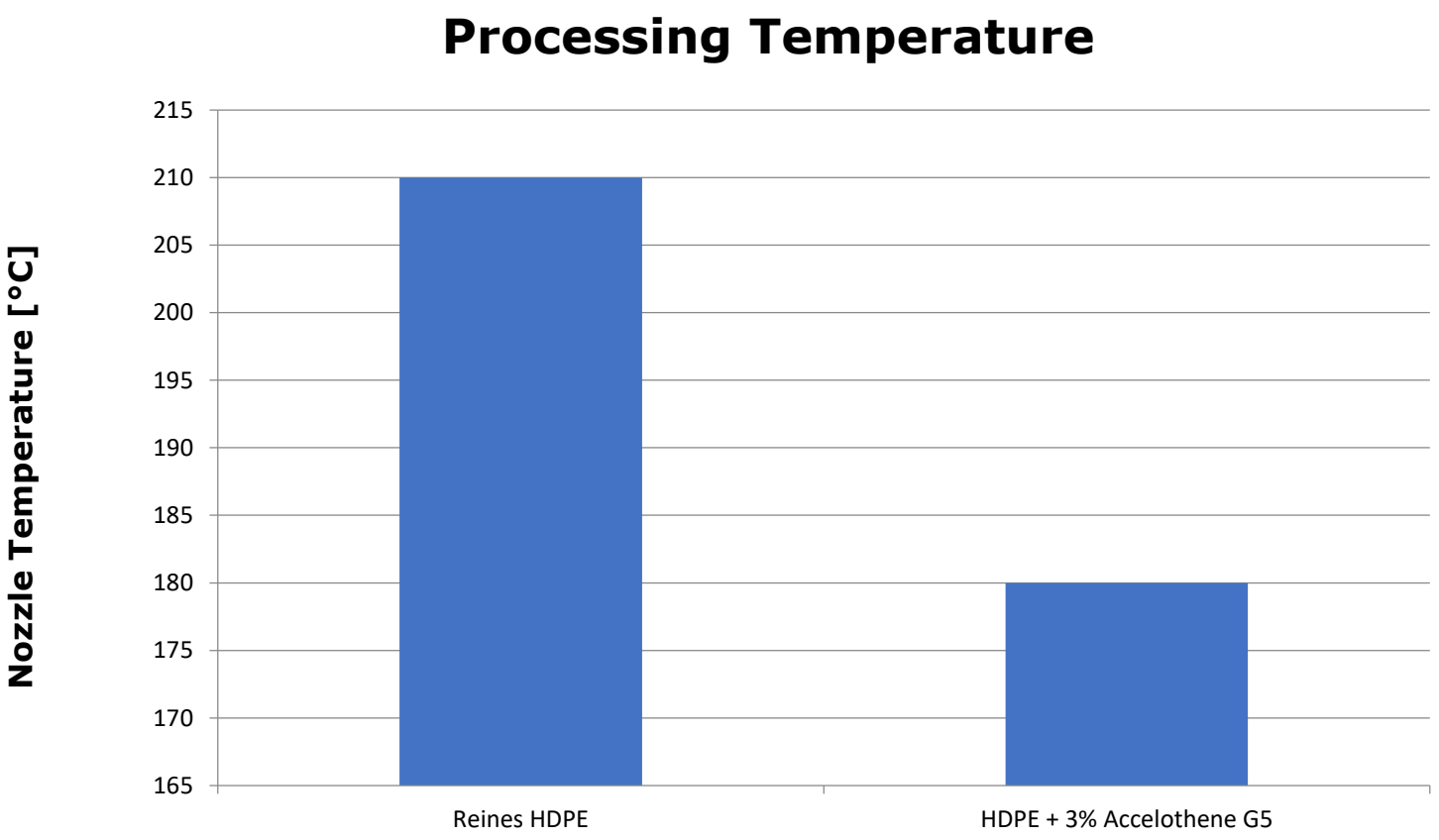
Influence of accelothene® on flow behavior



Accelothene® G5 enables significantly faster mold filling.

Test method: Injection molding machine KraussMaffei KM30-55C with 80 $^{m}/_{min\,i}$ injection speed and 550 bar injection pressure. T=260°C. ISO 527 1A test specimens (L3=168mm).

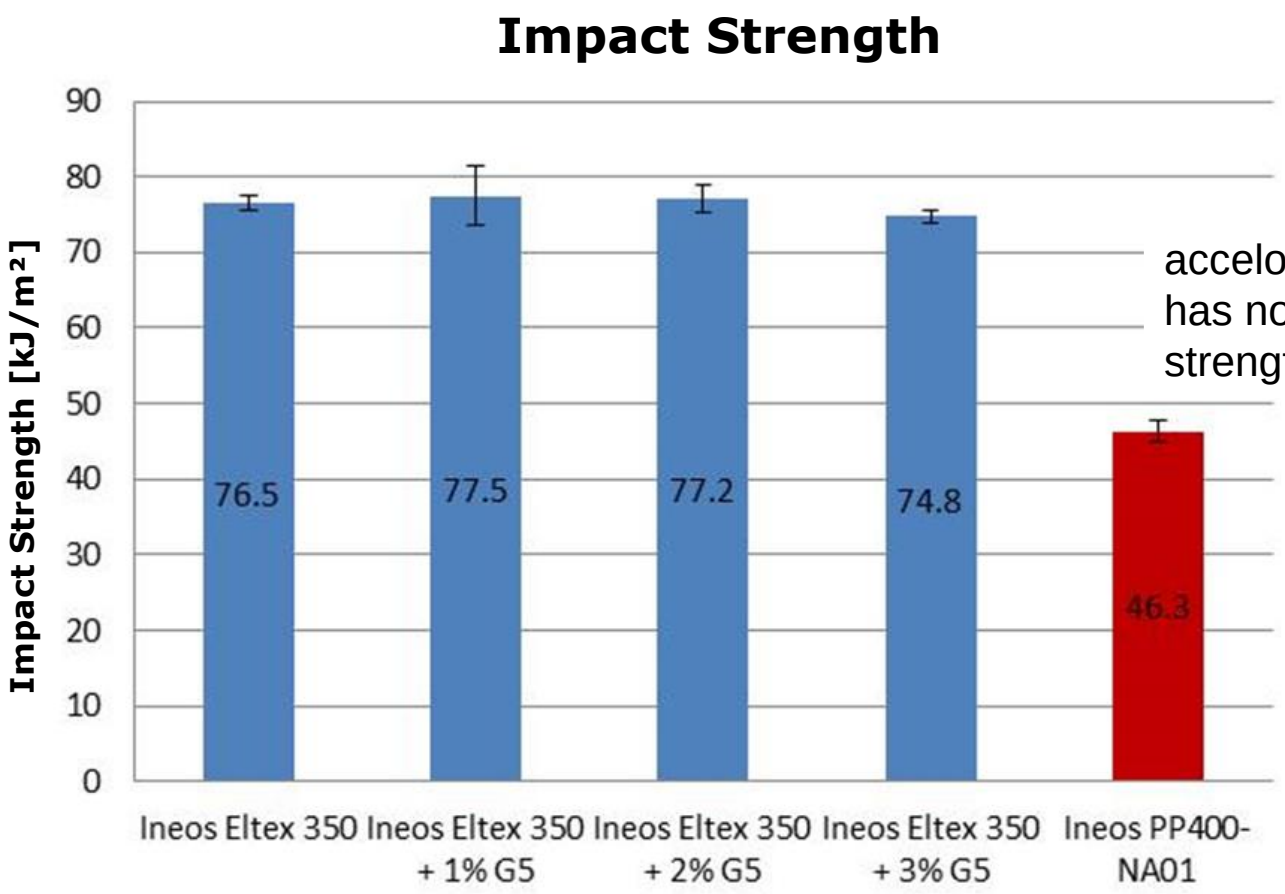
Product



With 3% accelothene® G5 the processing temperature can be reduced by 30°C.

Test method: Injection molding machine KraussMaffei KM30-55C mit 80 $^{m}/_{min}$ injection speed, and 550 bar injection pressure.

Product



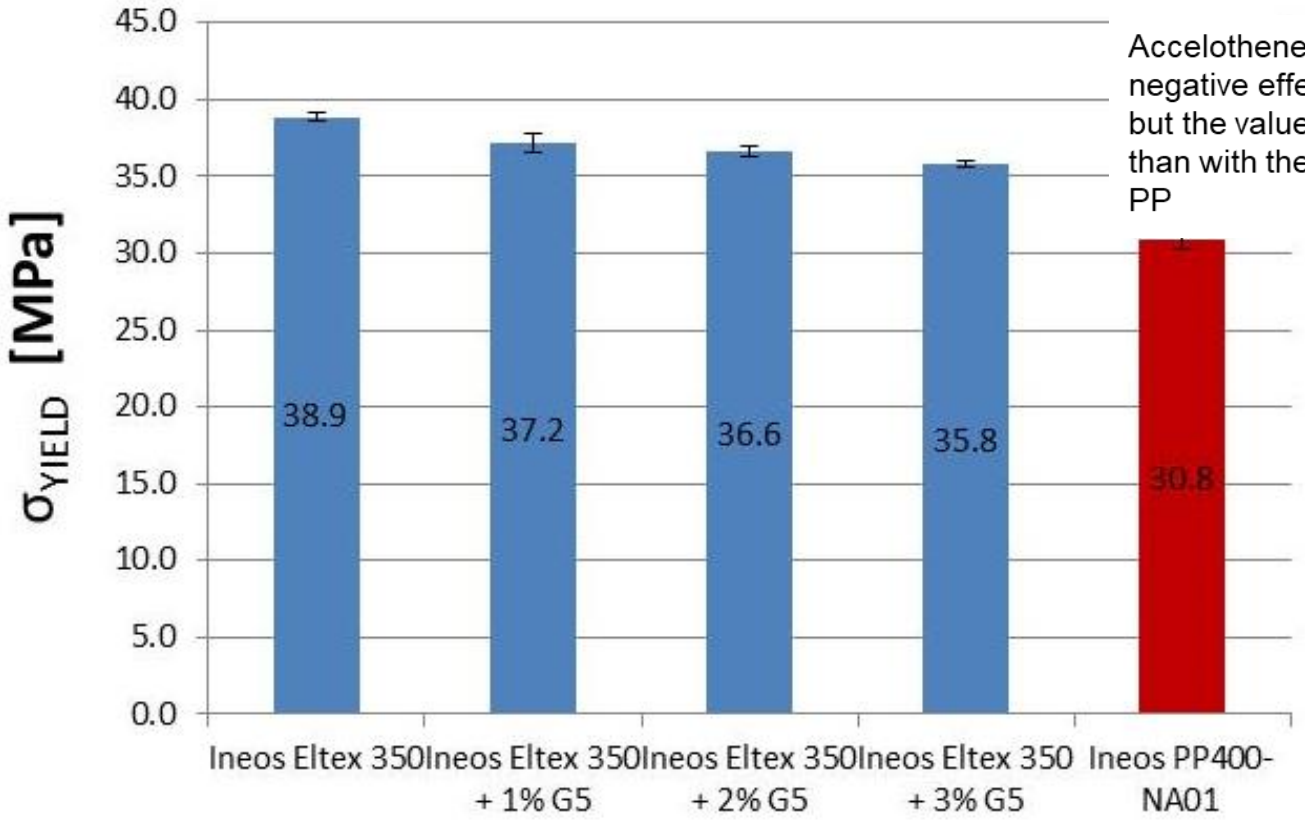
accelothene® G5 has no effect on impact strength

Graphic: Measurements (DIN EN ISO 179/1) by the East Thuringian Materials Testing Society on ISO 527-1A test specimens.

Comparison between an impact-resistant PP (MFR 1,5) and a high molecular PP (MFR 0,3), injection molded with ACCELOTHENE® G5

Product

Tensile stress at yield point



Accelothene® G5 has a slight negative effect on the tension, but the values are still higher than with the impact-resistant PP

Comparison between an impact-resistant PP (MFR 1,5) and a high-molecular-weight PP (MFR 0,3) that was injection molded with accelothene® G5

Graphic: Measurement method based on ISO 527 using a Shimadzu tensile testing machine (Model AG-X 10) with a 20 N preload, 1 mm/min test speed up to 5% strain, and then measured at 50 mm/min until break.

Application

Cycle time reduction

➢ Primary savings result from the reduction in cooling time

- Lower melt temperature possible due to better flow properties
- Demolding possible at a higher temperature

➢ Further savings potential

- Shorter holding pressure time
- Shorter injection time

Cycle time analysis (example)

	Without accelothene V	With accelothene V
Tool closing	4,2 Sec.	4,2 Sec
Injection	4,0 Sec	3,3 Sec
Holding pressure	6,0 Sec	4,0 Sec
Cooling time	27,0 Sec	17,1 Sec
Plasticizing	13,5 Sec	12,0 Sec
Tool opening	3,2 Sec	3,2 Sec
Ejection	2,3 Sec	2,3 Sec
Total	**60,2 Sec**	**46,1 Sec**

Application: Material transport container (part weight: 2 kg), produced on an injection molding machine with 850-ton clamping force.

Application

Example dowel

- Dowel 12 x 60 (64 cavities / HDPE)
- Total cycle time
  - Reduced from 35 to 26 secomds (25,71 %)
  - Reduction of holding pressure time from 8,5 auf 5,5 seconds (35,29 %)
  - Reduction of cooling pressure time from 20 auf 14 seconds (30 %)
- Processing temperature
  - Without accelothene => 275 / 270 / 265 / 260 / 255°C
  - With 5% accelothene V => 245 / 240 / 235 / 225 / 220°C
- Hot runner channel
  - Lowered from 280° to 225° C

Improving your production

Injection moulding of doorsill (automotive)

Add 3% accelothene®

Process T = 240°C

Injection time	8 s	
Holding time	7 s	
Cooling time	20 s	
Total cycle time	**50 s**	**1 piece = 2.25 €**

Process T = 200°C

Injection time	6 s	
Holding time	5 s	
Cooling time	12 s	
Total cycle time	**38 s**	**1 piece = 2.00 €**

➔ **Cycle time reduction of 24%**

➔ **Cost savings of 12%**

➔ **Energy savings of 10%**

Application

Example: waste container made of HDPE-Compound +5% accelothene®

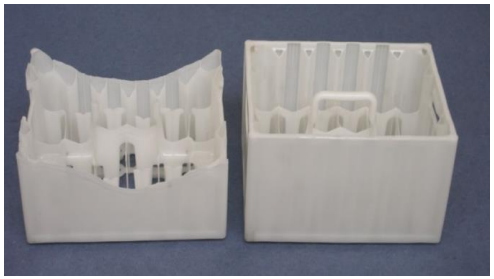
- ➢ Reduction of stress cracking
- ➢ Significantly improved impact resistance in the final product
- Especially at low temperatures
- Ball drop test

Solving problems: viscosity

Difficult form filling for an object with thin walls

- A HDPE with MFI 6 was used to injection mould a bottle box
- It was not possible to fill the form
- Then, 5% accelothene® was added

without | with accelothene®



- This increased the MFI only slightly to 6.9, but it made the HDPE flow as if MFI would be about 18.
- The high toughness of the HDPE with low MFI of 6 was retained

With accelothene® difficult forms can be filled easily

Application

Flow Path Comparison accelothene® V

Lab Conditions

Inj. Molding:	Battenfeld HM110 / 350H / 130V	
	Clamping force	1100 kN
	Screw diameter	40 mm
	Screw length L/D	22
	Max. inj. presure	1595 bar
Mold:	Campus system	
Parameters:	Barrel temperature (entire cylinder)	230°C
	Mold temperature	50°C
	Injection speed	50 cm³/s
	Set injection pressure	1500 bar
Flow spiral:	Thickness	2mm
Materials:	- Total PPC 4663 (PP-Copo) MFI 3,5 g/10 min (230°C/2,16 kg)	
	- PP-Regrind	

	without	with 5%	with 5% (max. injection speed 150 cm³/s)	with 5% (lowered temp. + same flow path)
Total PPC 4663 Flow path in mm	557	620 (+ 11%)	668 (+22%)	561 218°C (-5,2%)
PP-Regrind Flow path in mm	537	581 (+ 8%)		528 210°C (-8,7%)

R&D

Accelothene color compound batches

- **Coloring and process mprovement combined in one additive**
- **Total dosage lower than with separate use of ACCELOTHENE® color**
- **Cycle time reduction similar to G5**
- **Improved mechanical properties**
- **No additional dosing required**

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