

High Performance **Olefin Oligomer**

for Polymer Processing

EXCEREXTM

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MITSUI CHEMICALS, INC.

Functional Polymeric Materials Group - Specialty Resins Div.

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- ◆ Needs and expectations of polymer processing
- ◆ EXCEREX™ - the new generation processing aid
- ◆ Examples of various moldings
- ◆ Molded product properties
- ◆ Summary

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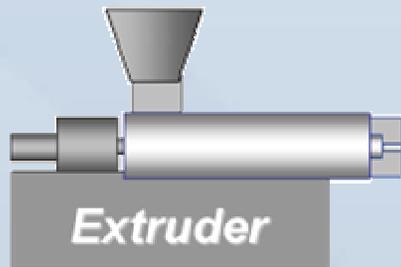


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Needs and expectations of polymer processing



 
Resins + **EXCEREX™**
PE, PP



Sheets



Blown films



Bottles



Containers

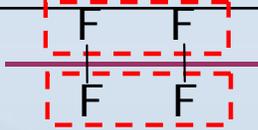


- ① **Increased productivity**
screw speed, cooling cycle time...
- ② **Decreased productivity loss**
scorching, die build-up, energy loss...

- ③ **Molded high quality products**
mechanical strength, optical properties, heat sealing, lamination...

Conventional processing aids



	Fatty Amide	Fatty Acid Soap	Fluoropolymer	Olefin Wax
Chemical structure	$R\text{-CONH}_2$	$(R\text{-COO})_2\text{Me}$ Me: Ca, Mg, etc.		$-\text{CH}_2\text{-CH}_2-$

Function	Lubricant	
	1- Increased productivity	2- Decreased productivity loss
Content	< 0.5 %	
Limitation	Poor compatibility	Low molecular weight ingredient

Disadvantage	Bleed out Lowering mechanical and optical properties	
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③ Molded high quality products

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- ◆ Needs and expectations of polymer processing
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- ◆ Examples of various molding conditions
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EXCEREX™- the new generation processing aid



“EXCEREX™”

is a **high performance olefin oligomer**.

It was commercialized for the first time in the world in 2004
by using **metallocene catalyst** technology.

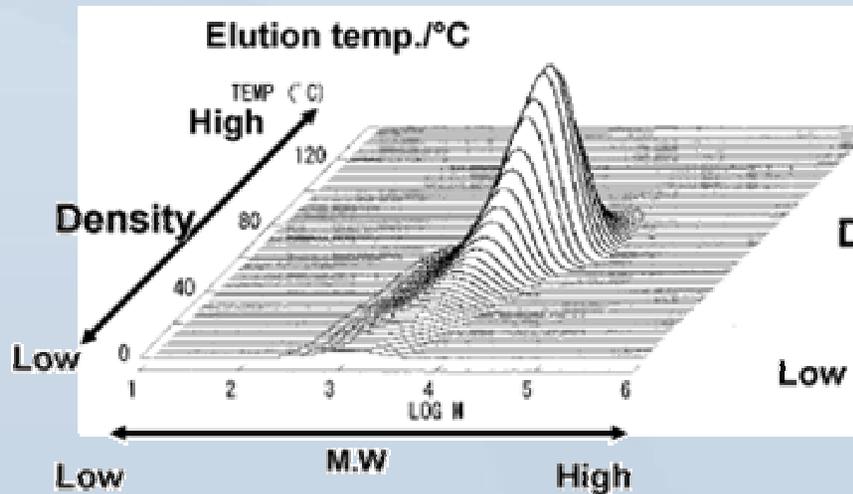
EXCEREX™ has many advantages as follows:

- Ø **Productivity improvement**
- Ø **Low process temperature**
- Ø **Decrease in scorching and die build-up**
- Ø **Shortening the turnover time between process changes**

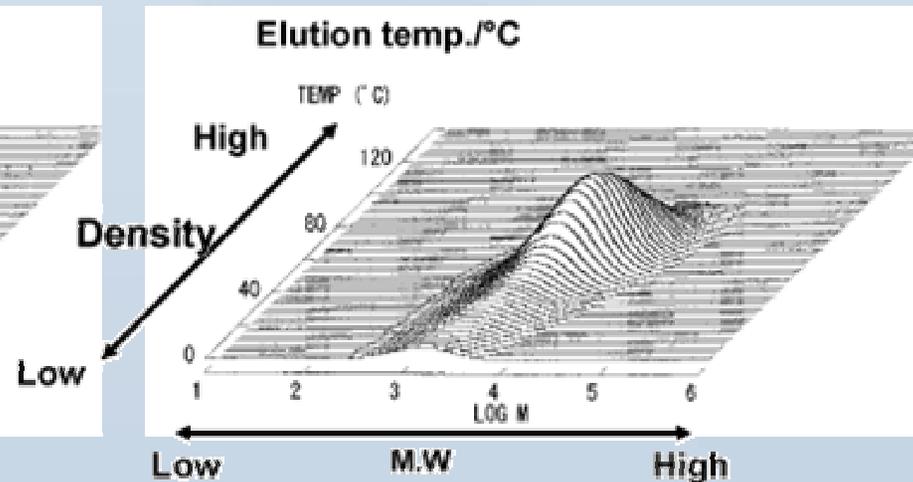
Narrow Molecular Weight Distribution Narrow Composition Distribution



Relation of composition distribution and M.W. distribution
Sharper elution temperature range means
narrower composition distribution



EXCEREX™
(Mv 4000, D 930 kg/m⁻³)



Olefin wax
(Mv 4000, D 930 kg/m⁻³)

Features of EXCEREX™



EXCEREX™

Olefin Oligomer

Mv: Under 10000



**Nonsticky solid
at room temperature**

Pellet EXCEREX™



Powder EXCEREX™



EXCEREX™ is easy to handle

Expected Main Effects

- Characteristics of an Olefin Oligomer -



Characteristics of an olefin oligomer

Olefin oligomer

Low viscosity
Low friction

Low surface tension

Functions in the extruder

Internal and external lubrication
Improvement of flow quality

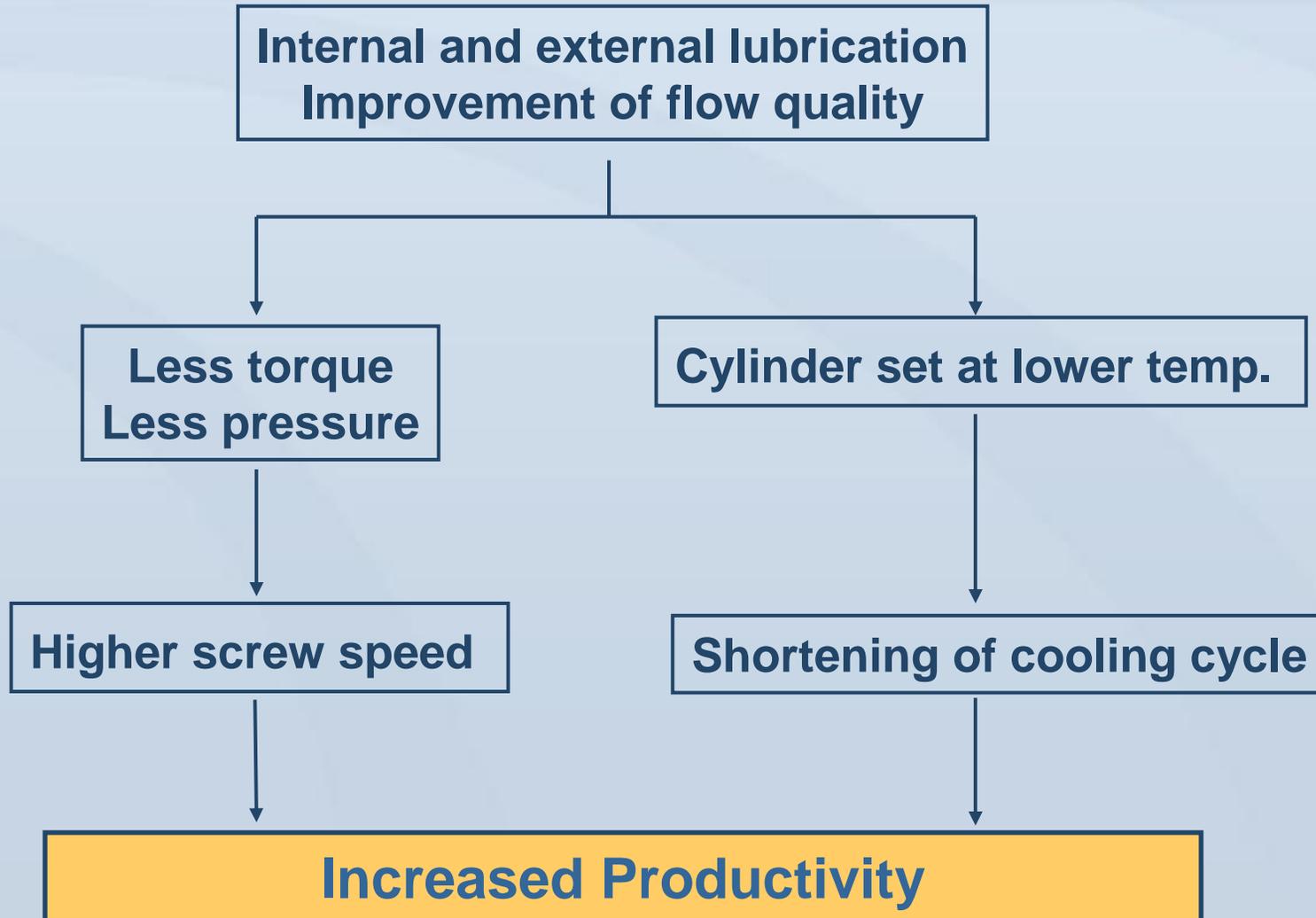
Good wettability

1- Increased productivity

2- Decreased productivity loss

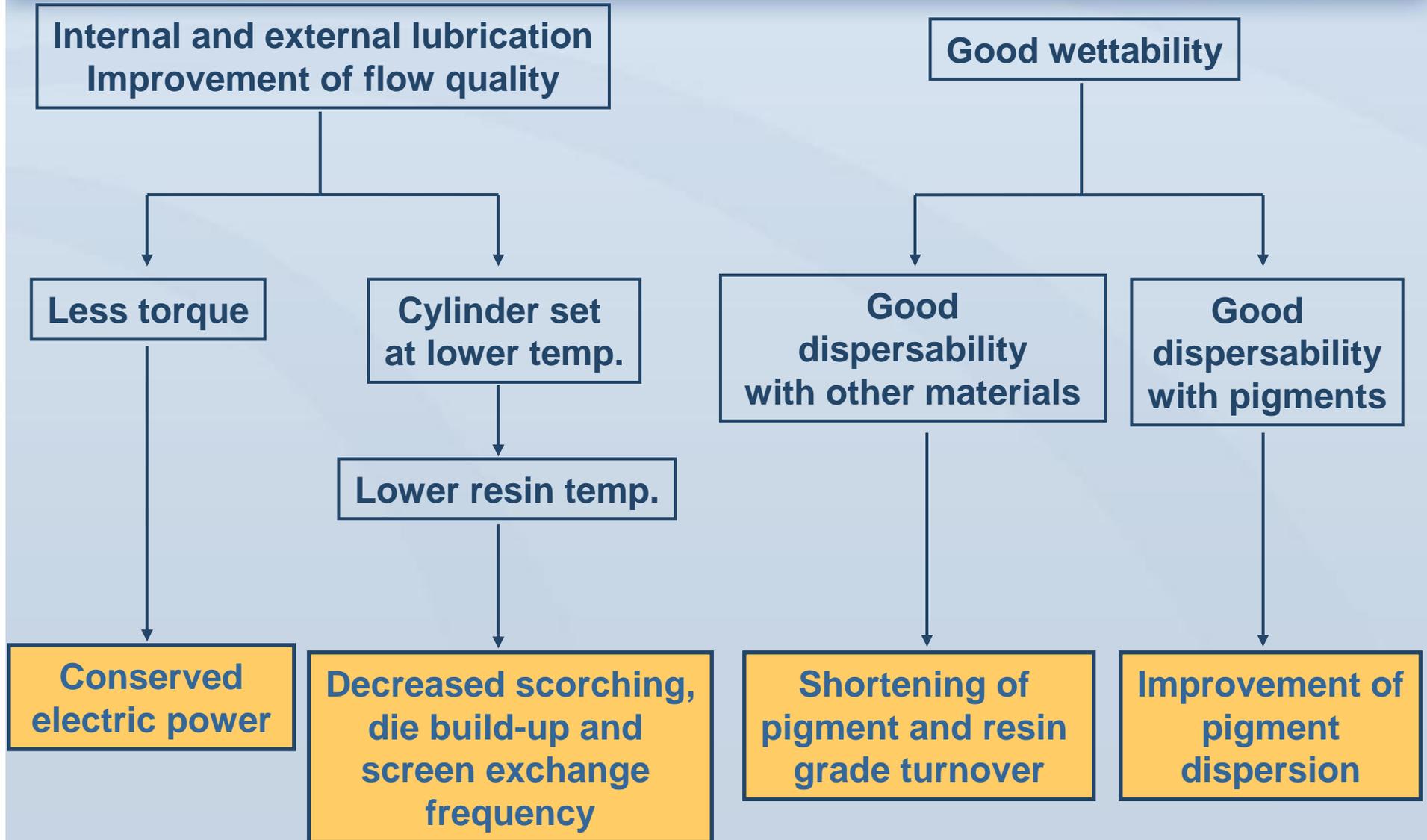
Expected Effects

- 1. Increased Productivity -



Expected Effects

- 2. Decreased Productivity Loss -



Mechanism

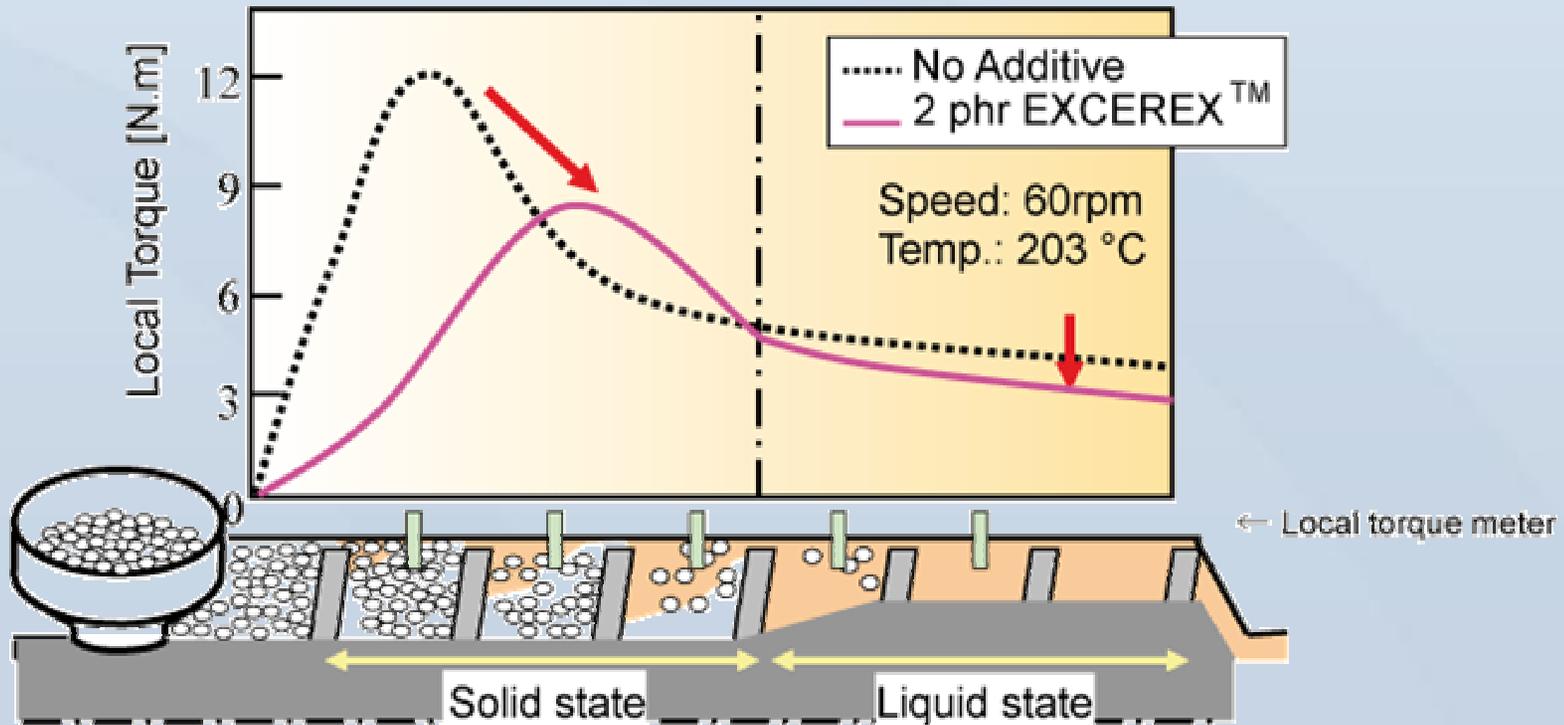
- Local Torque in the Barrel -



Extruder: $\phi 36$ mm single extruder

Resin: PP (MI 3 g/10 min., Density 910 kg/m³) 100 phr

EXCEREX™: 2 phr



Torque is lowered at feed zone and compression zone

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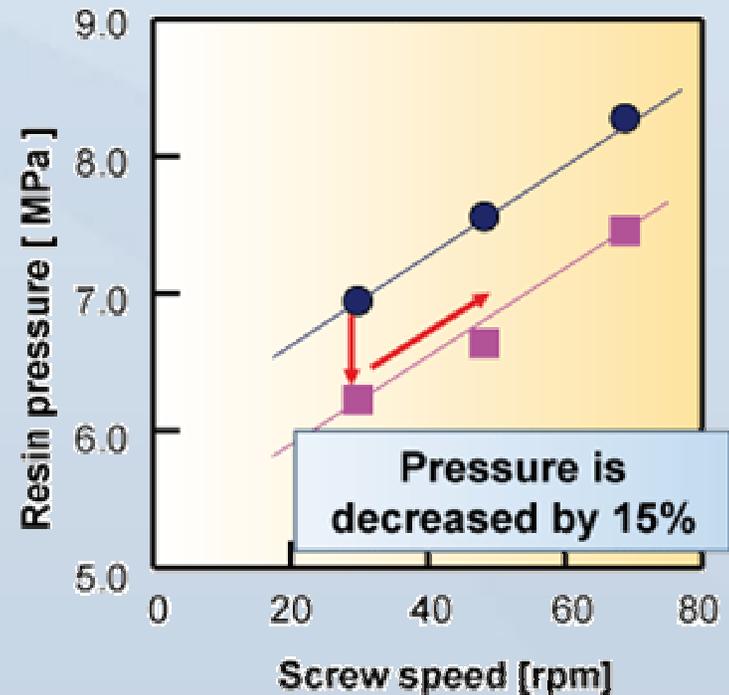
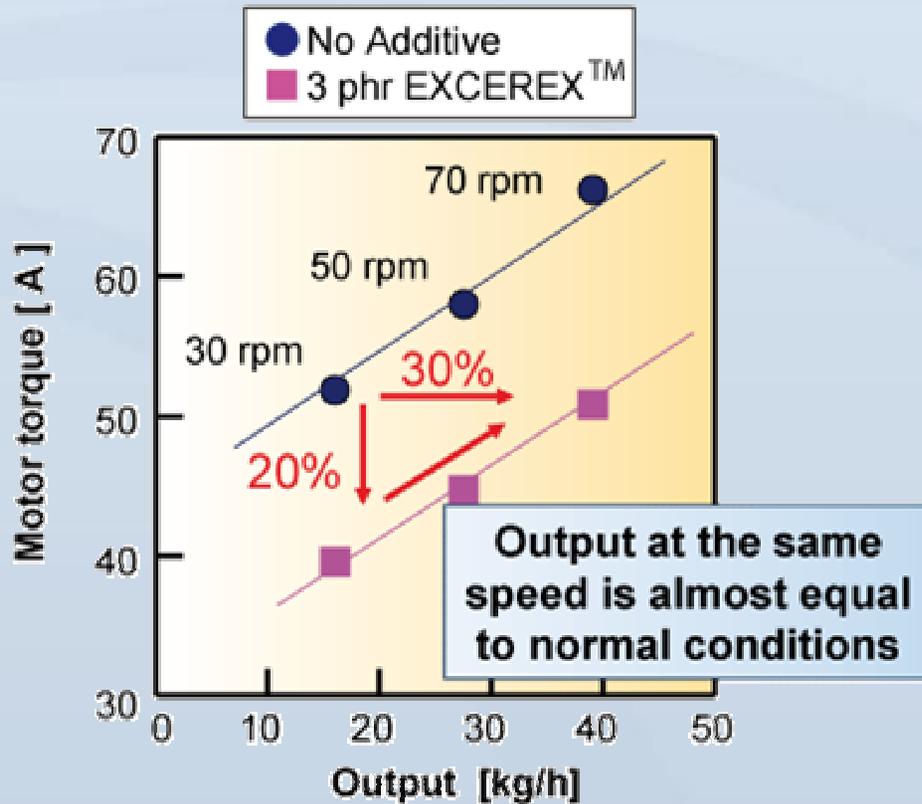


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Examples of Extrusion Molding

Performance on PP Sheet

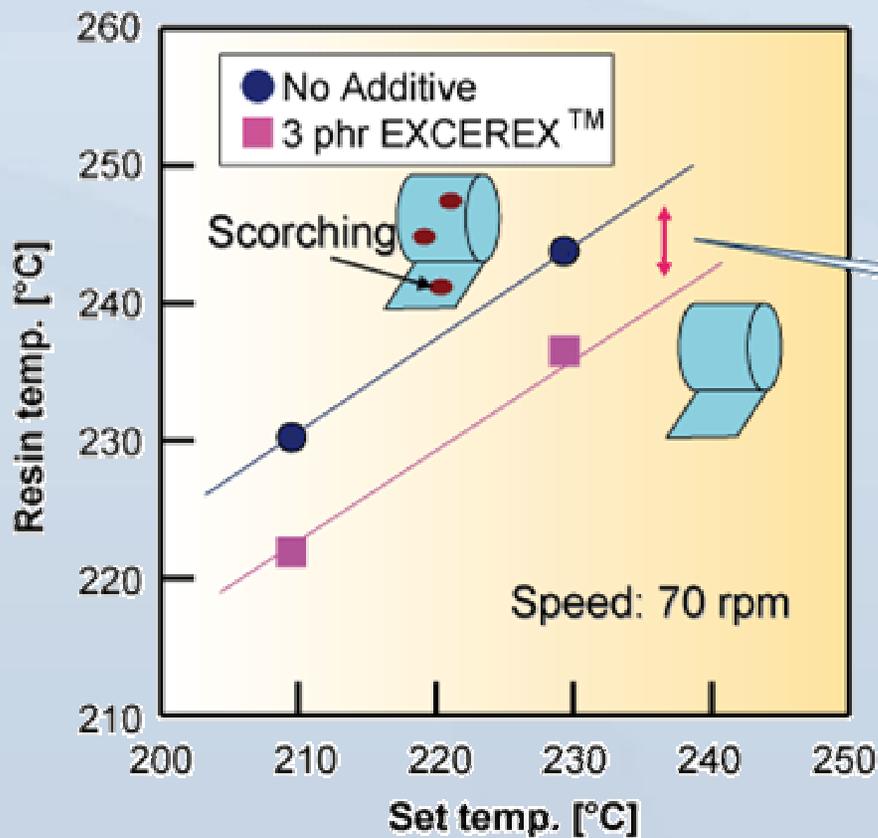
- 1. Less Torque and Resin Pressure -



Increased output is over 30%
Decreased motor torque and resin pressure

Performance on PP Sheet

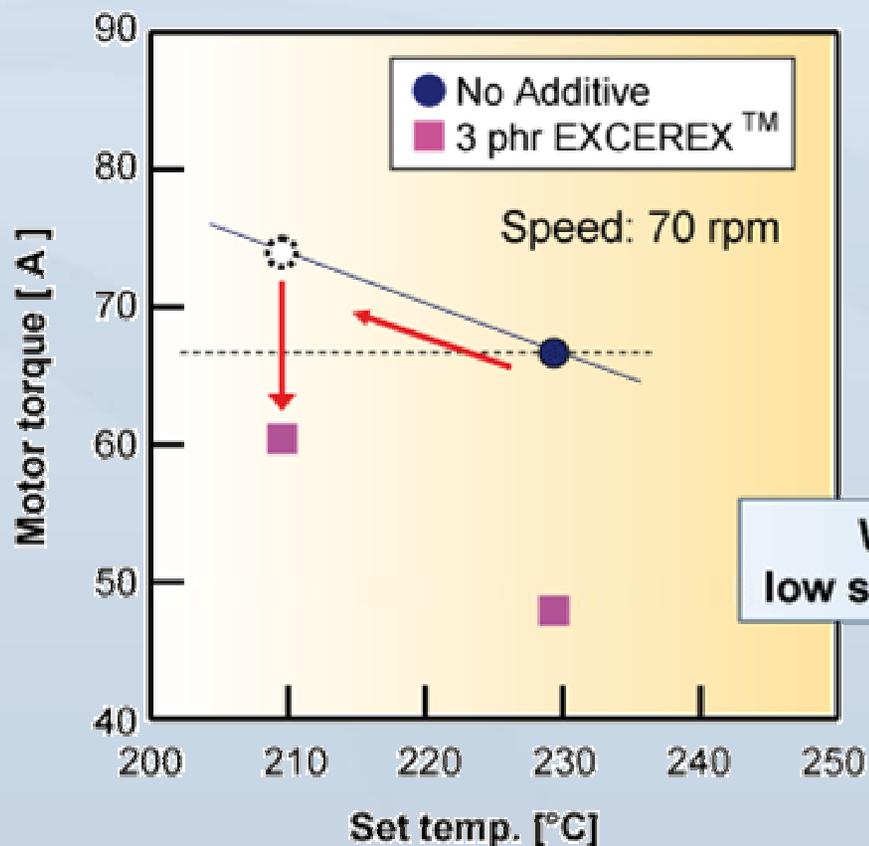
- 2. Lower Resin Temp. -



Outlet resin temp. is lowered by 5~10 °C

Resin is protected from heat degradation

Performance on PP Sheet - 3. Lower Set Temp. -

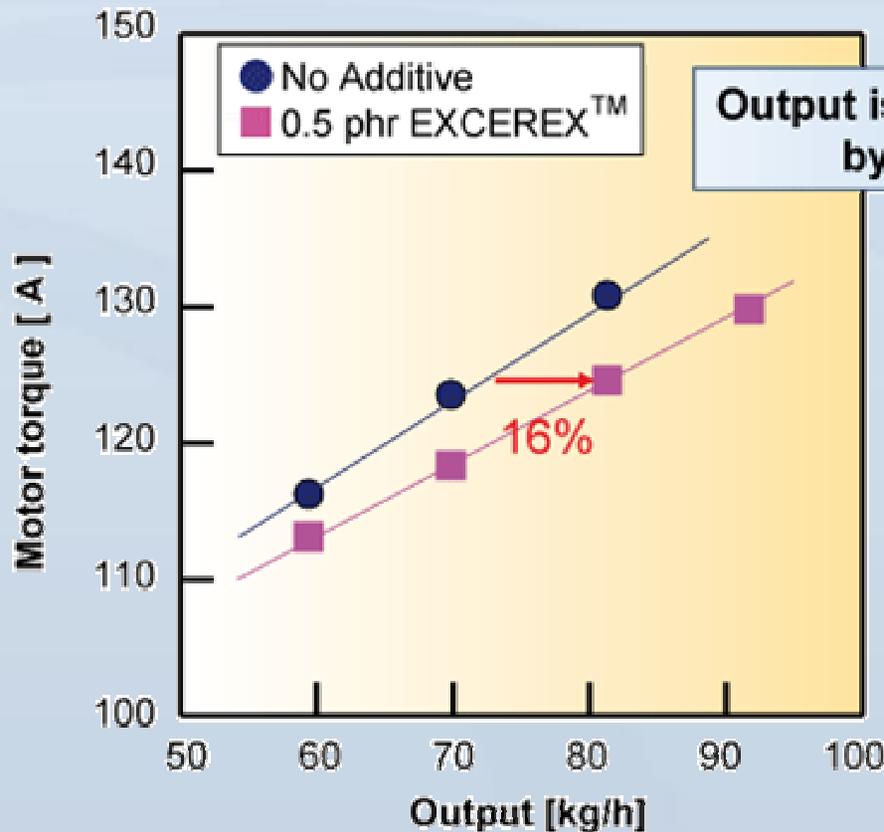


With EXCEREX™,
low set temp. is successful

Lower process temp. from 230°C to 210°C
Resin is protected from heat degradation

***Examples
of
Blown Film Molding***

Performance on HDPE Blown Film - Less Torque and Improved Output -



Output is increased
by 16%

Results (3 weeks)

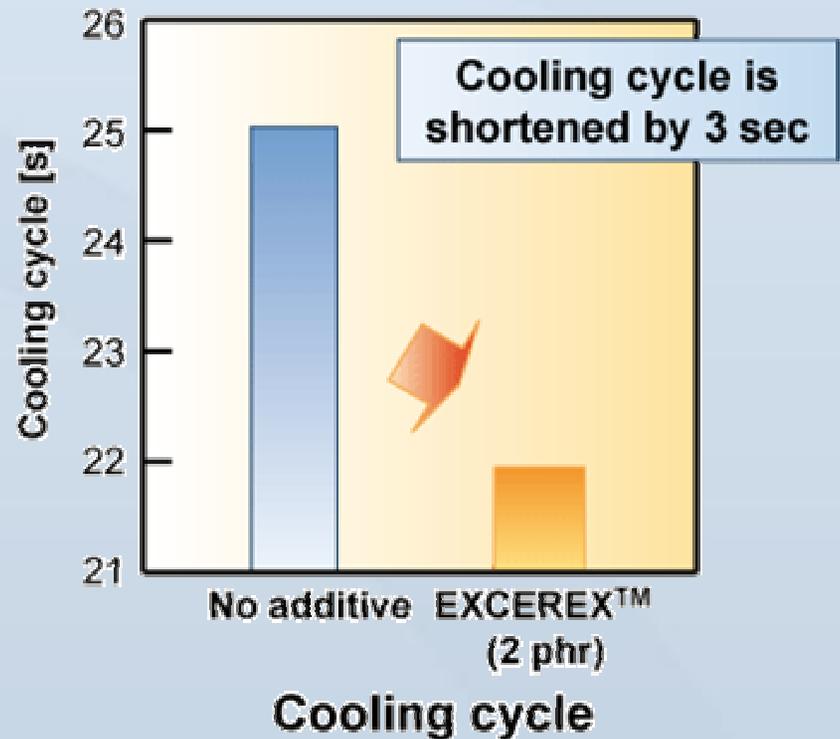
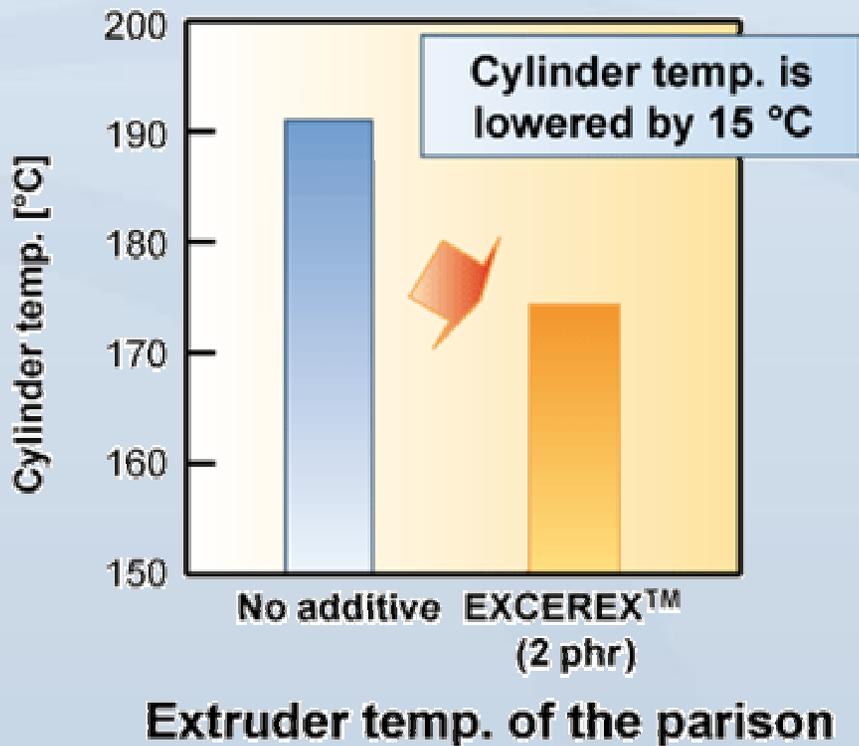
Continuous running for
3 weeks is successful without
exchange of screens and
film loss by die build-up

Output is increased by 16% with 0.5 phr EXCEREX™
Does not affect film properties
(Tensile, impact, optical, heat seal, etc.)
Does not affect heat sealing and printability

Examples of Blow Molding

Performance on PP Blow Molding

- Lower Set Temp. and Shortened Cooling Cycle -

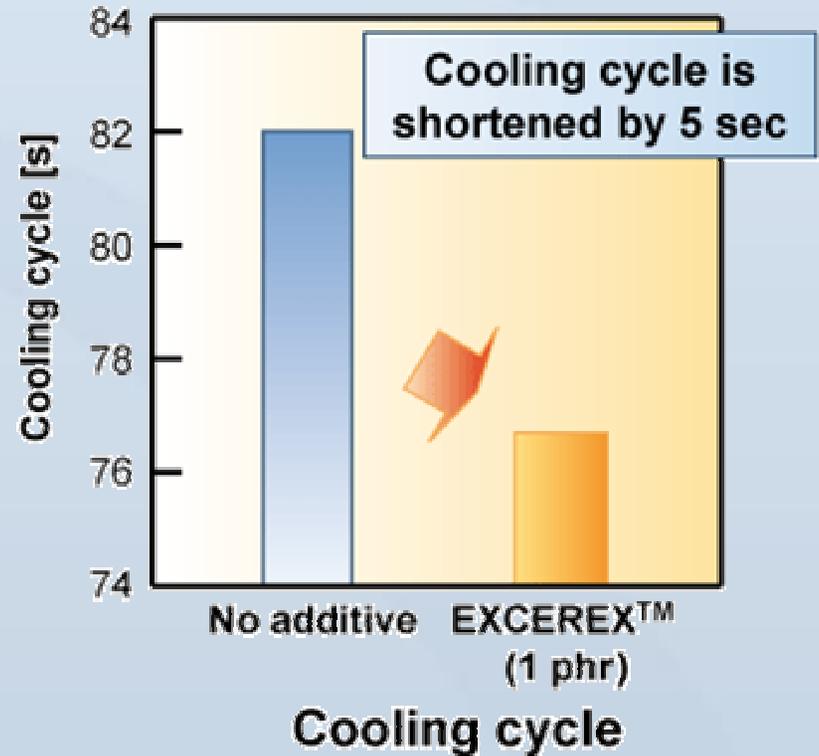
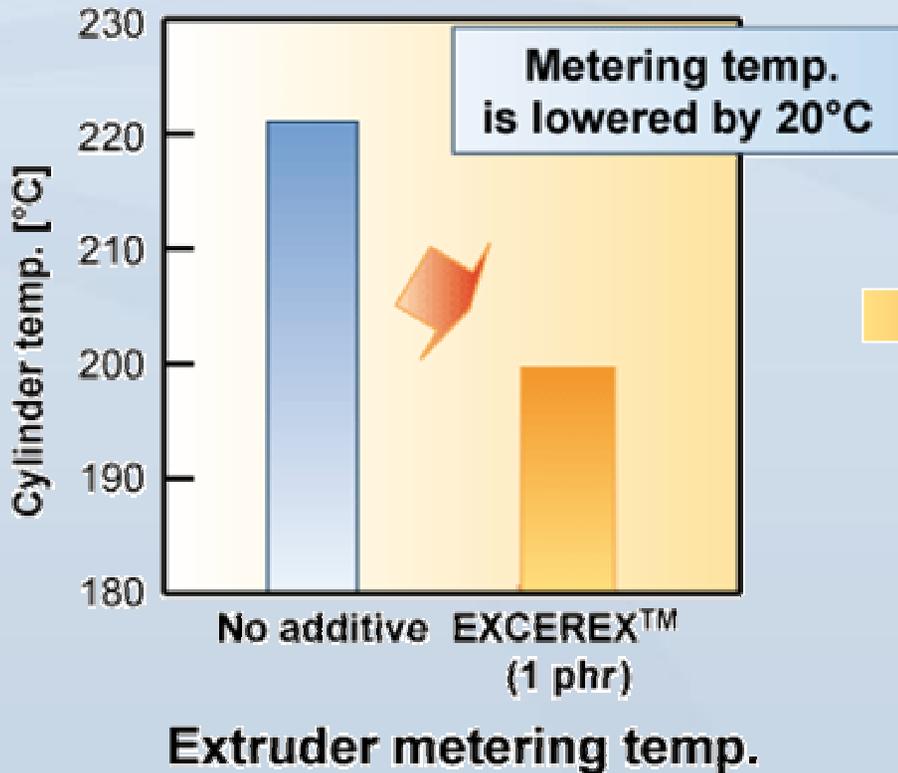


Processability is improved by 13%.
(Shot number 144 → 164 pieces/hr)

Examples of Injection Molding

Performance on HDPE Injection Molding

- Lower Set Temp. and Shortened Cooling Cycle -



Processability is improved by 6%.

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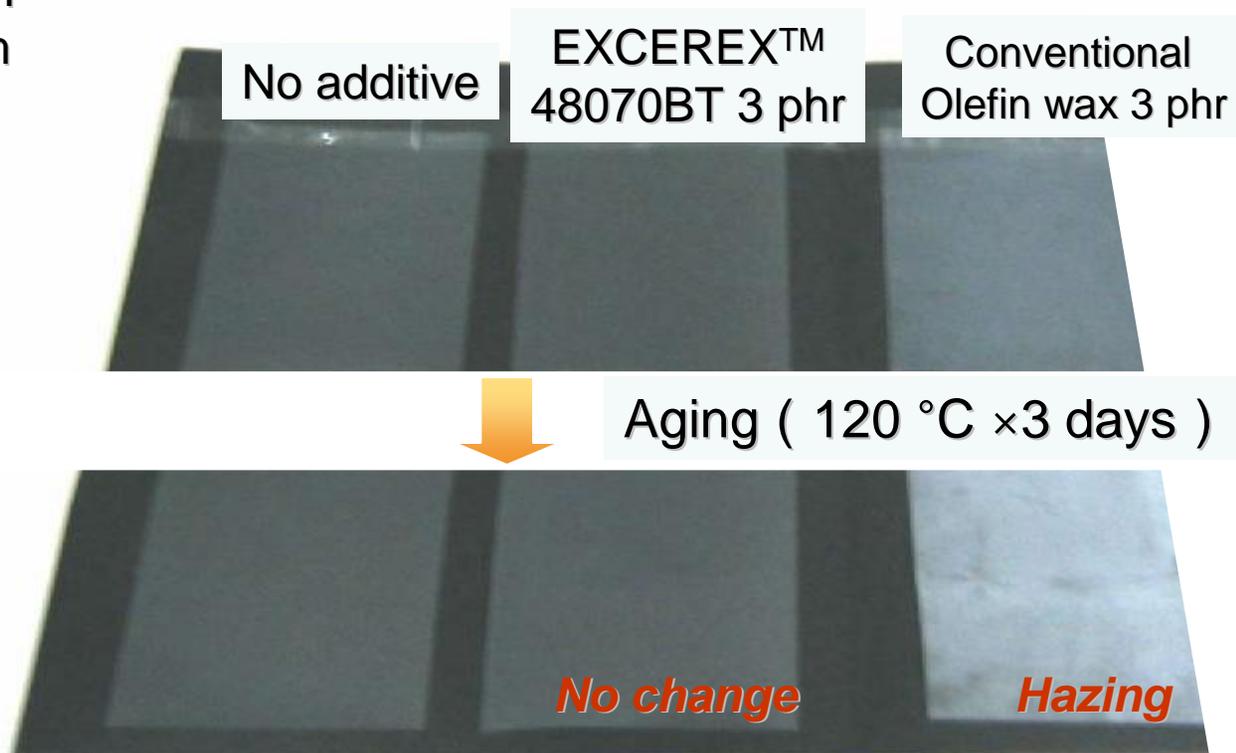


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Bleed-out - PP Film -



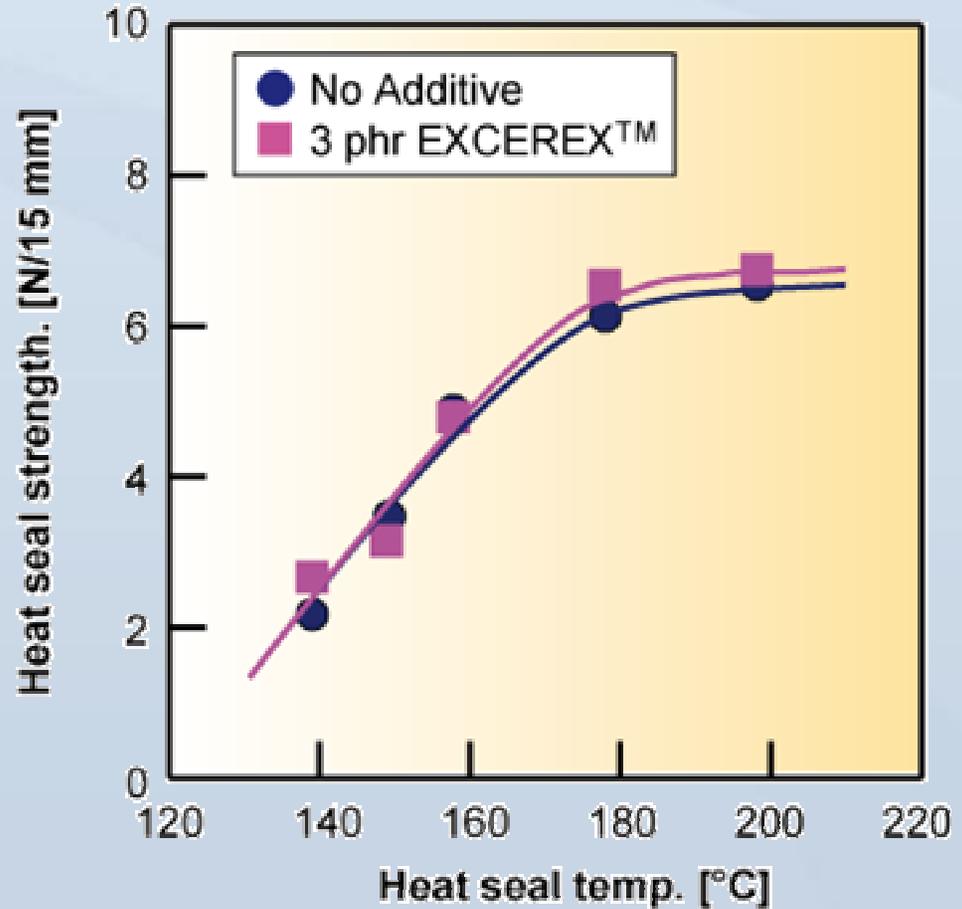
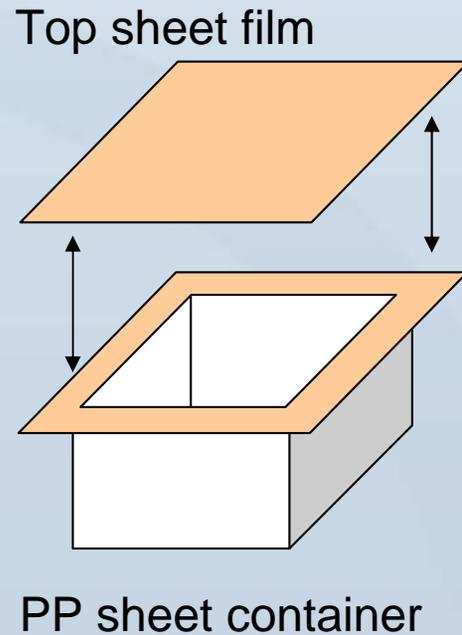
Mono-PP
cast film



Does not affect bleed-out

Heat Seal Strength

PP sheet : 650 μ m
Top sheet film : 40 μ m



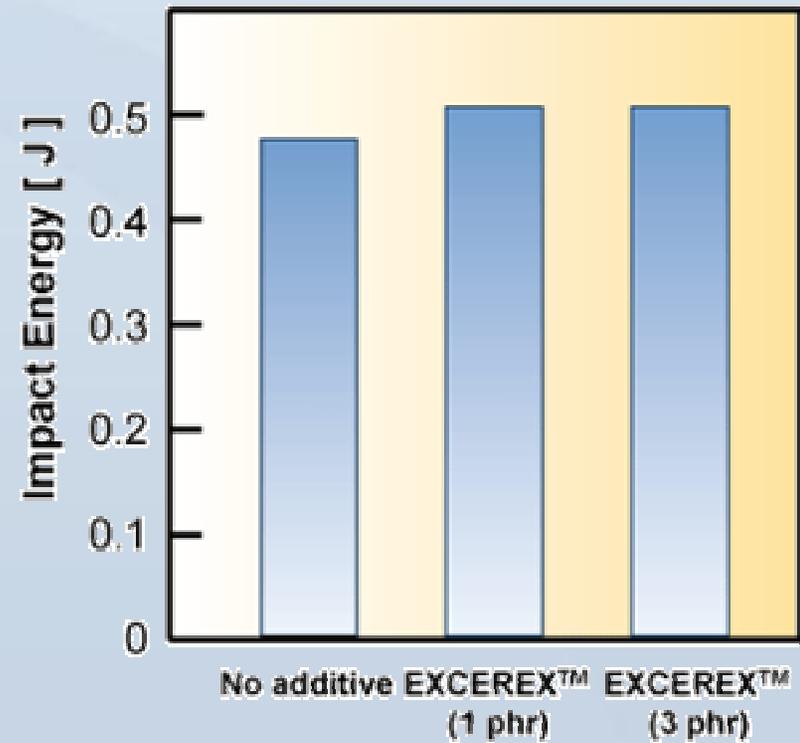
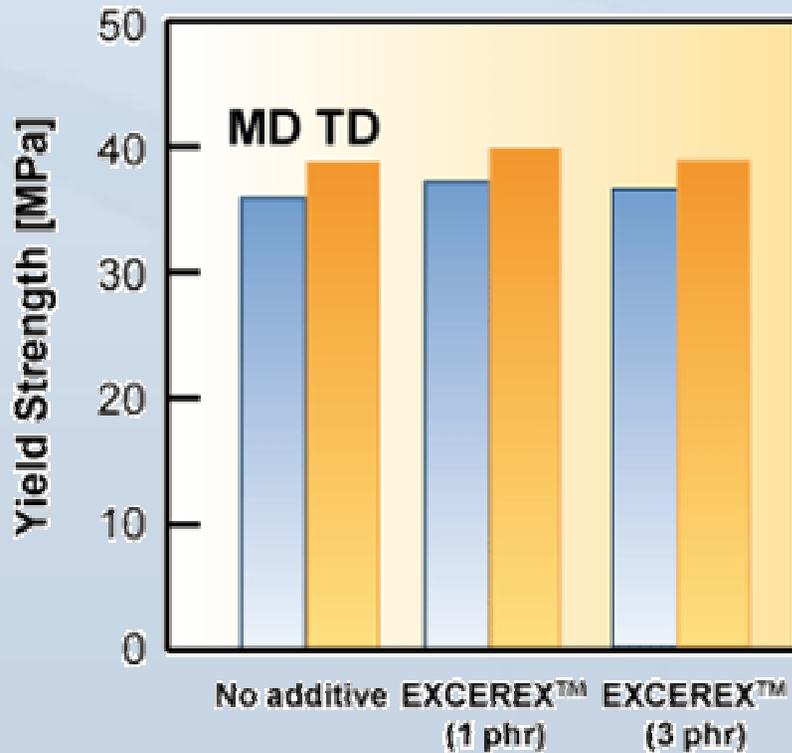
Does not affect heat seal strength

Mechanical Strength

- PP Sheet -



Sheet	0.5 mm
Resin	homo-P P (MI 0.5 g/10 min)
EXCEREX™	48070BT (Mv 4600, Density 902 kg/m ³)



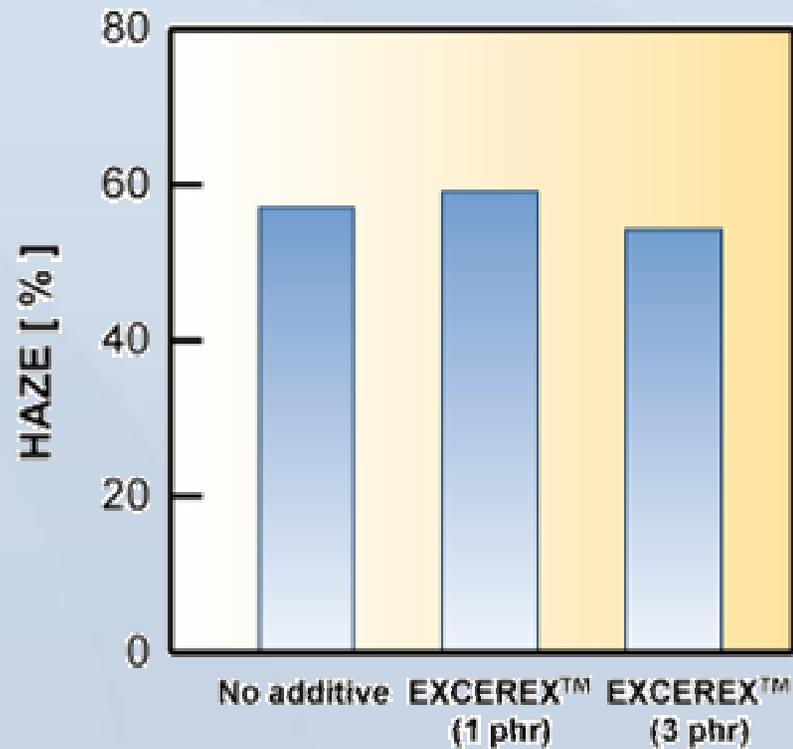
Does not affect tensile and impact strengths

Haze

- PP Sheet -



Sheet	0.5 mm
Resin	homo-P P (MI 0.5 g/10 min)
EXCEREX™	48070BT (Mv 4600, Density 902 kg/m ³)

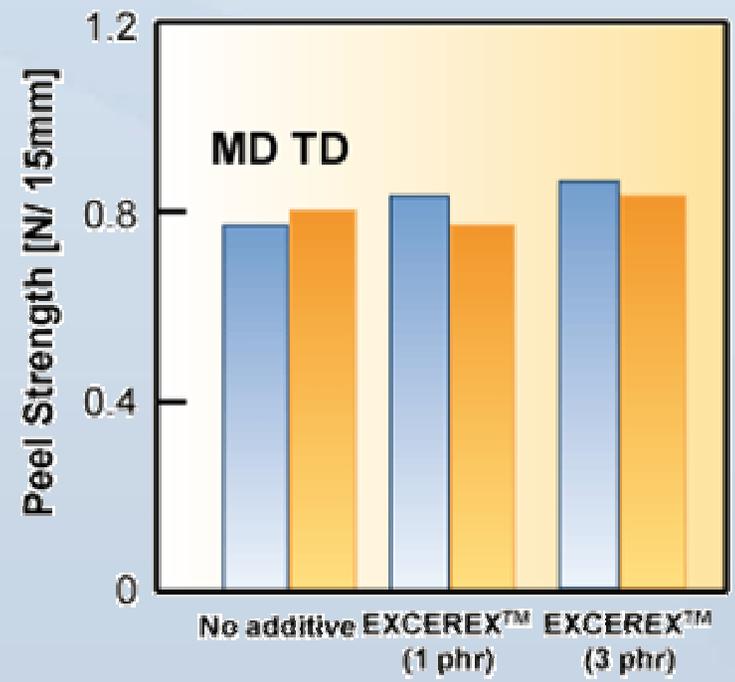


Does not affect optical properties

Lamination



Base material	OPP
Lamination layer	random-P P (MI 25 g/10 min)
EXCEREX™	30200BT (Mv 2900, Density 913 kg/m ³)



Peel strength (Surface of lamination)

Does not affect lamination

EXCEREX™ Grades



	Units	30200BT	48070BT	40800T
Molecular weight	Mv	2900	4600	4000
Density	kg/m ³	913	902	980
Melting point	°C	102	90	128
Viscosity (140 °C)	mPa·s	265	1300	750
Applied resins		LLDPE, LDPE, PP		HDPE

These figures are representative data.

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Summary



Advantages of EXCEREX™ as a processing aid

1. Increased productivity

- High screw speed
- Shortening of cooling cycle

2. Decreased productivity loss

- Decreased scorching and die build-up
- Improving of pigment dispersion

3. Molded high quality products

- Low bleed-out
- Does not affect product properties