The extreme performance polymer: Exceed™ XP performance polymers

Mosha H. Zhao
ExxonMobil Chemical Company
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Overview

Introduction

Exceed™ XP family products values

Factors to design an extreme performance blown film

- Processability
- Mechanical strength

Market needs from around the world drive innovation

Flexible packaging market needs

Cost Savings	Integrity/Durability	Aesthetics	Convenience	Sustainability
Downgauging	Toughness	High gloss	Package features	Recyclability
Processability	Sealing	Transparency	Ease of use	Resource efficiency
Simplified solution	Shrinkability	Printability	Single serving	Reduce waste

Up to 15% output increase

with Exceed™ XP 6026 performance polymer vs. mLL rich skin reference

Refer slide 11 for processing data

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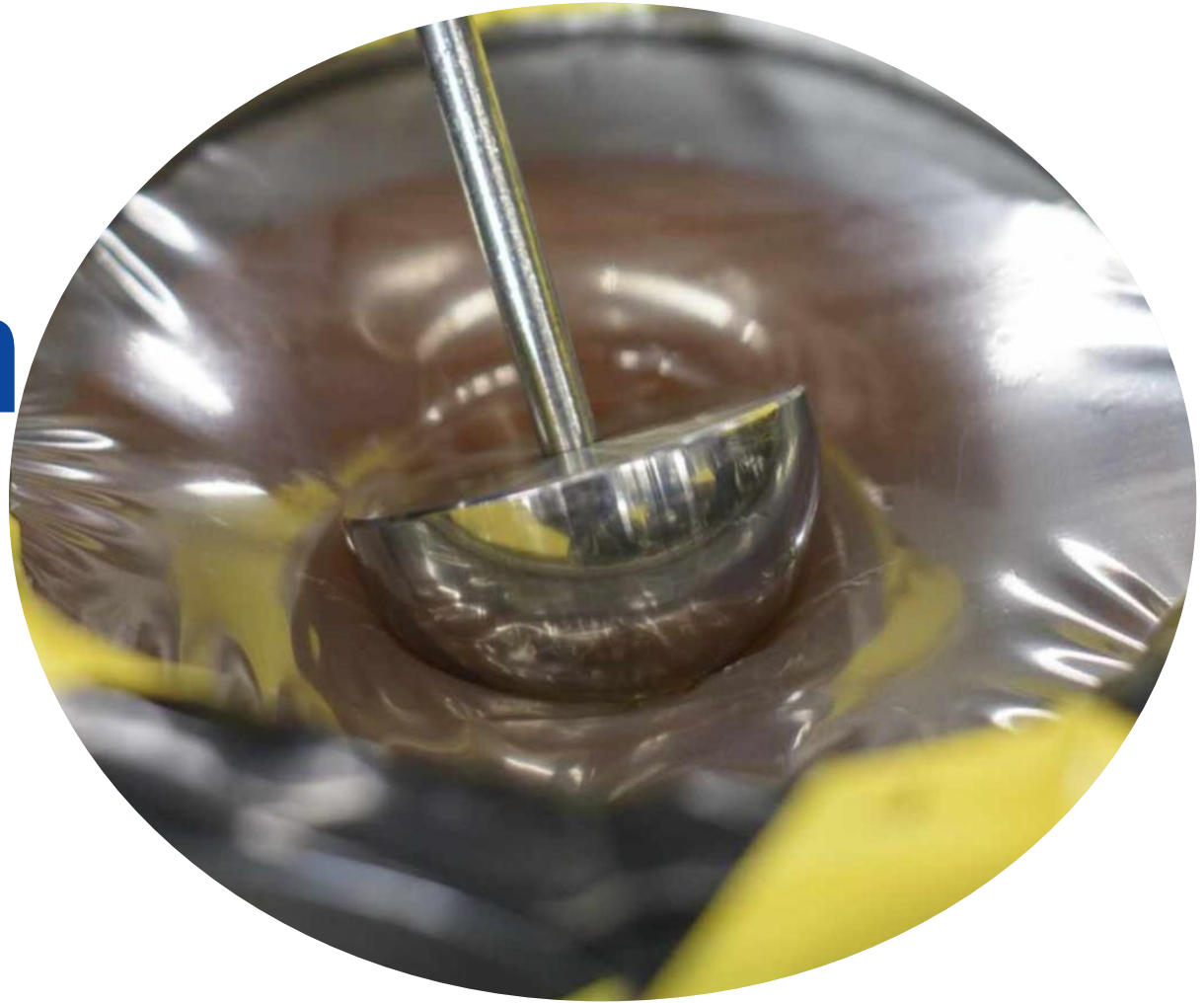
Exceed™ XP, Exceed™ and Enable™ performance polymers

Data fom tests performed by or on behalf of ExxonMobil

40g/µm

Dart impact with Exceed™ XP 8656 performance polymer



Refer slide 13 for data

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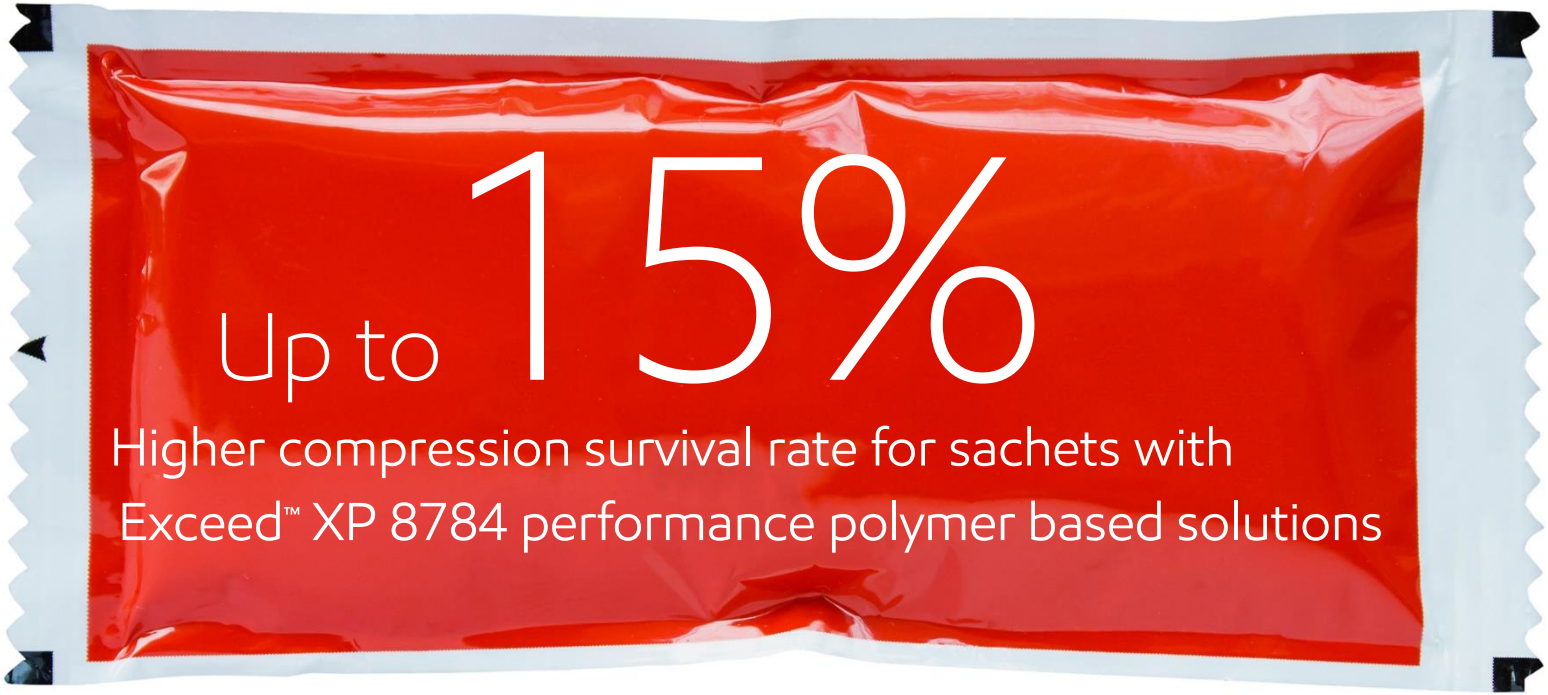

Refer slide 15 for data

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Introducing Exceed™ XP performance polymers

Exceed™ XP

when eXtreme Performance matters

A new balance of toughness, sealing, and stiffness, combined with easier processing at lower energy

Enable™

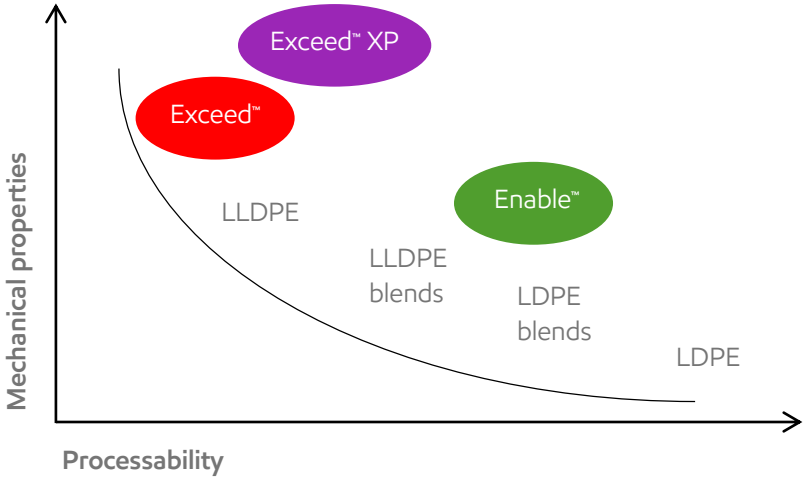
for optimum solutions

Combining excellent processing and bubble stability with toughness not realized in LDPE blends

Exceed™

for superior toughness

Excellent mechanical performance for down-gauging/light-weighting, with outstanding sealing properties and best-in-class optics



Exceed™ XP, Exceed™ and Enable™ performance polymers

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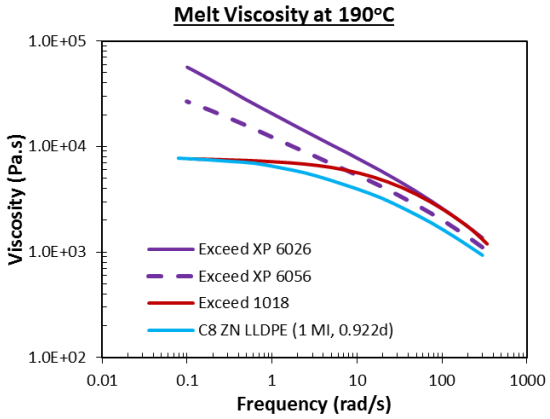
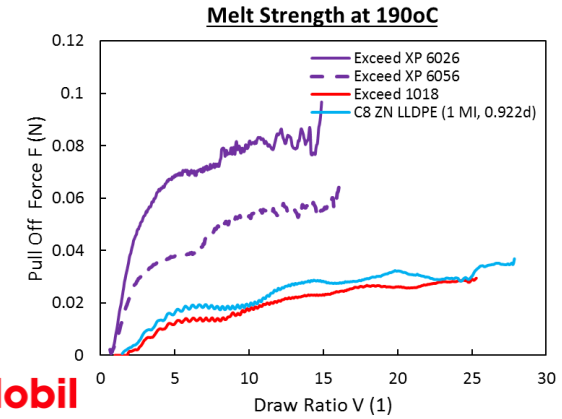
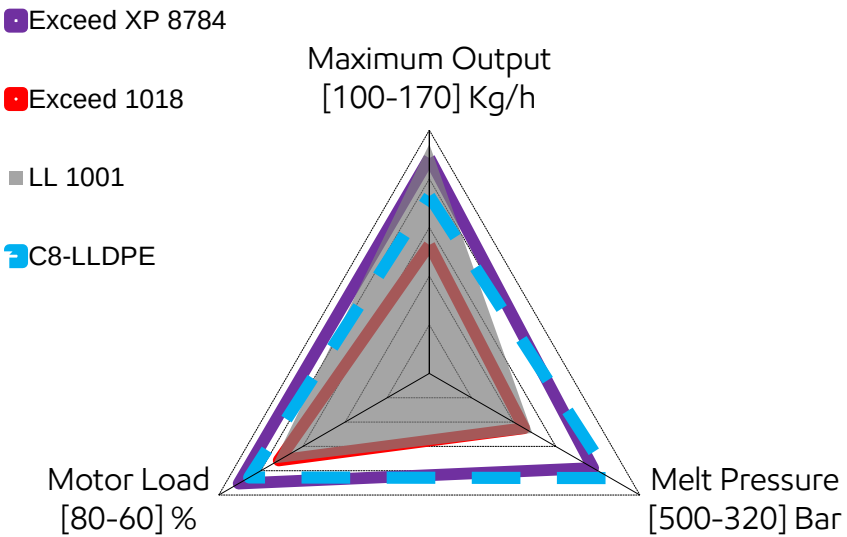
High melt strength with easier extrusion

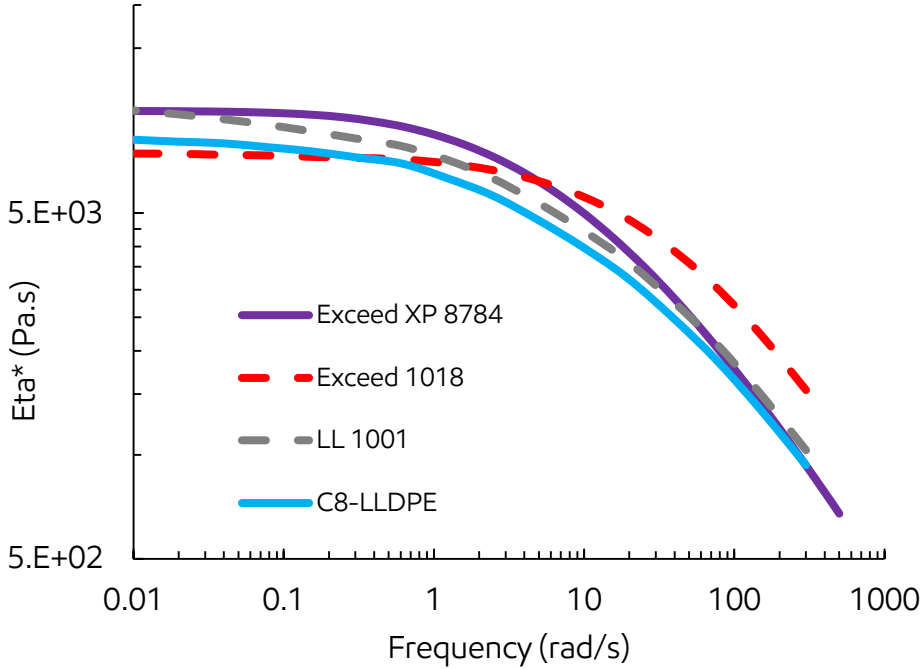




- Exceed™ XP grades are designed to deliver
  - Higher zero-shear viscosity translating to higher melt strength for **greater bubble stability**, especially for Exceed XP 6026 performance polymer
  - Increased shear thinning for **lower-energy extrusion**, especially for the higher MI Exceed XP 6056 performance polymer

Exceed™ XP rebalancing processability





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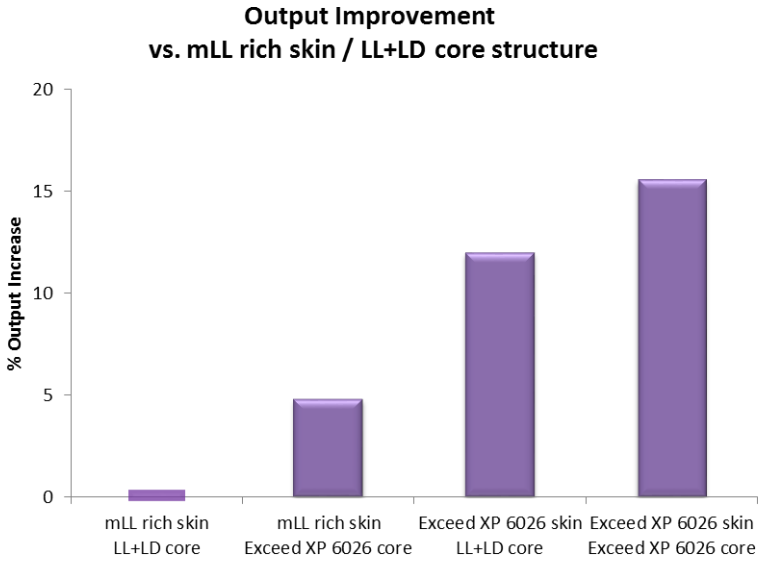
Increased blown film output



- Traditional 3-layer packaging film with
  - Metallocene sealants in the skins
  - And LLDPE/LDPE blends in core
- Saw more stable bubble/higher rates with
  - Exceed XP replacing the LDPE blend
- And even more stable bubble with Exceed™ XP sealant skins
- Leading to core and skins using the same resin
  - To allow higher rates
  - Eliminating blends
  - And simplifying operations

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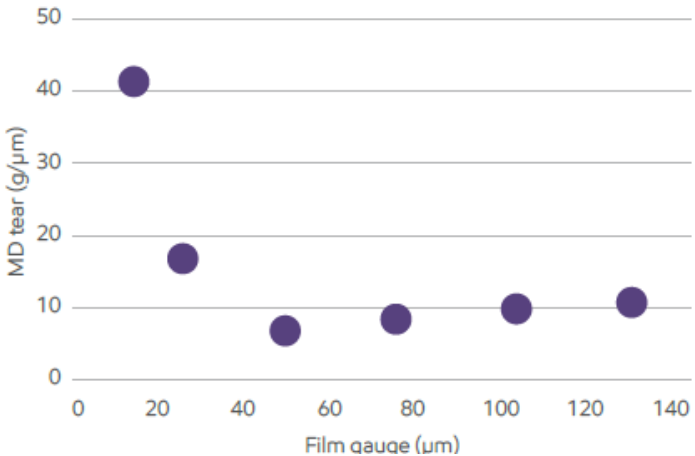
Extreme MD tear



Exceed™ XP 8656 demonstrates extreme MD tear resistance in blown films when processed with

- high machine orientation – low blow-up ratio (BUR)
- high outputs
- low frost line height (FLH)
- wider die gap.

This attribute is specifically demonstrated in thin films, which is a unique feature versus conventional polyethylene grades.

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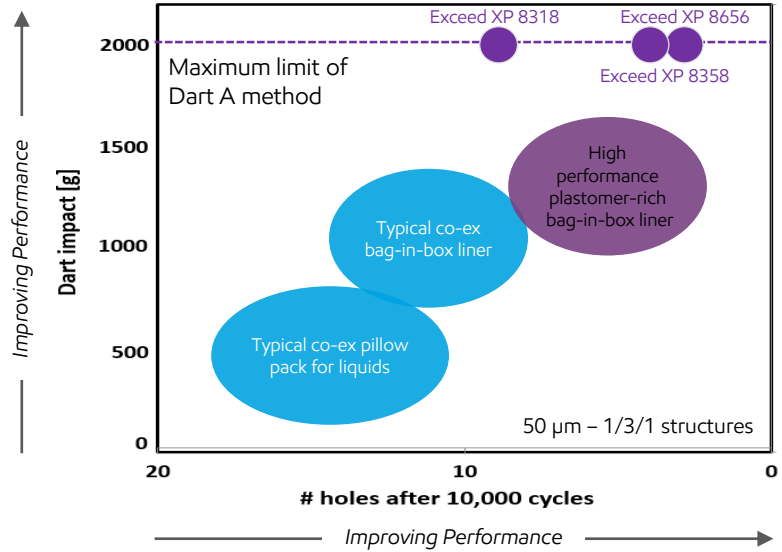
Step-out mechanical properties



Product (for 25 µm mono film)	MD Tear (g)	TD Tear (g)
Exceed XP 8318	370	470
Exceed XP 8656	500	540
Exceed XP 8358	530	500
Exceed 1018	255	413
C8 ZN LLDPE (1.0, 0.920)	425	625
C8 mLLDPE (1.0, 0.916)	232	600

- Extreme **Dart impact**
  - Dart ≥ Leading C6 / C8 mPE; FMI Super C6
- Exceptional **flex-crack resistance**
- Outstanding **MD tear** with high machine orientation (gauges ≤ 25µm) and no long-chain branching in formulation
  - MD Tear ≥ Super C6 / Solution C8 on thin films

Exceed™ XP performance polymers enables up to 30% downgauging with eXtreme Performance attributes

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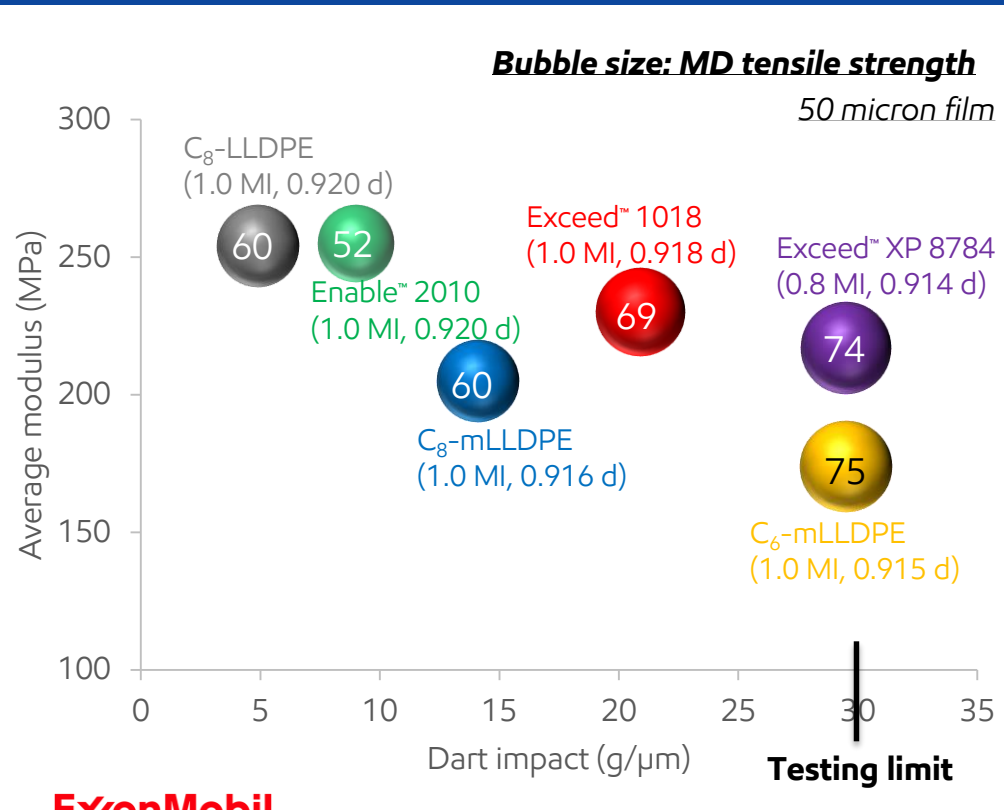
Superior toughness and stiffness balance



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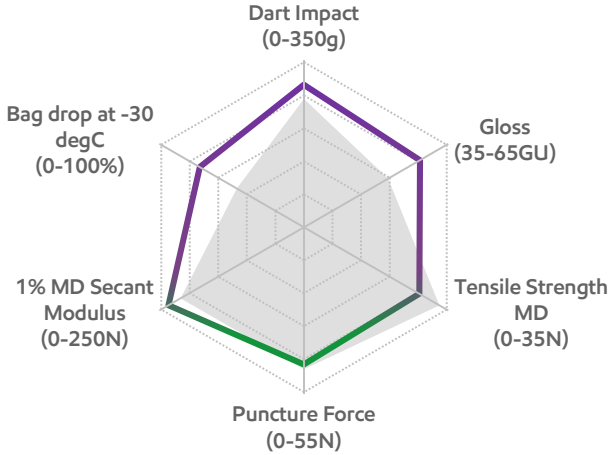
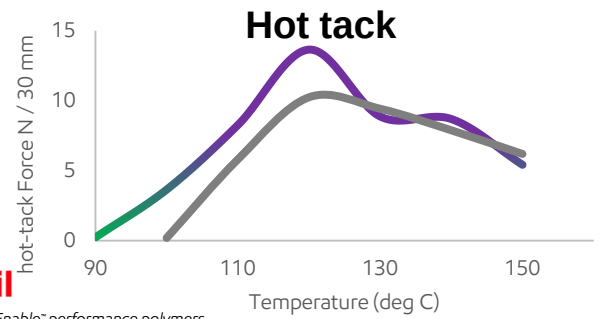
Freezer film: non-laminated





Exceed ™ XP 8784 performance polymer solution provides:

- Opportunity of ~33% downgauging
- Excellent low temperature bag-drop performance
- Great hot-tack performance
- Superior stiffness despite downgauging
- Enhanced dart and gloss

	Reference 60µm	EMC 40µm
Ratio	1 / 2 / 1	1 / 2 / 1
Outer/Inner	90% C8-LLDPE 10% LDPE	75% Exceed XP 8784 25% Enable 2005
Core	70% C8-LLDPE 30% LDPE	40% Exceed XP 8784 60% HDPE

C8-LLDPE (1 MI; 0.920 d); LDPE (0.3MI; 0.923 d); HDPE (0.7MI; 0.961 d)

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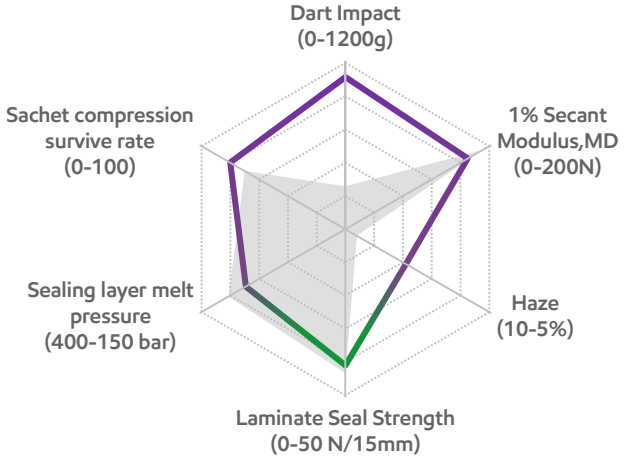
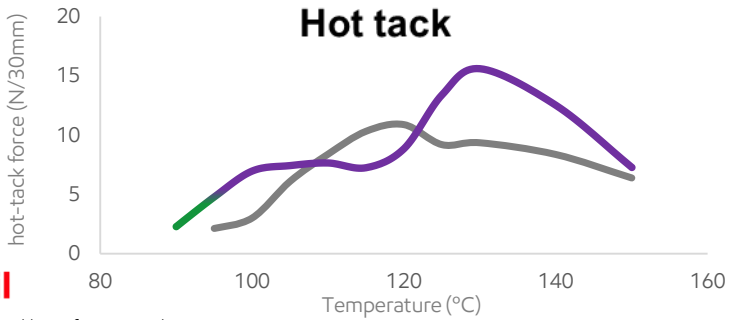
Sachets



Exceed ™ XP 8784 performance polymer solution provides:

- Opportunity of ~12% downgauging
- Excellent compression resistance
- Superior dart impact
- Maintained stiffness after downgauging
- Improved film optics
- Excellent hot-tack performance



	Reference 45µm	**EMC:** 40µm
Ratio	1 / 2 / 1	1 / 2 / 1
Outer	100% C8-mLLDPE	100% Exceed XP 8784
Core	90% MDPE 10% HDPE	70% Exceed XP 8784 30% HDPE
Sealing	30% C8- plastomer 30% LDPE 40% C8-mLLDPE	100% Exceed XP 8784

Hot tack and seal strength were tested on laminates, PE//OPET.
Dart impact, secant modulus and haze were tested on PE film.

C8-mLLDPE (1 MI; 0.916 d); LDPE (2 MI; 0.923 d); C8-plastomer (1 MI; 0.904 d); HDPE (0.7MI; 0.961 d); MDPE (0.2MI; 0.923 d)

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Summary

New Exceed™ XP performance polymers

- Expand the useful MI range for film materials
- While increasing throughput on existing lines
- Allowing increased toughness and good sealing capability

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Collaborating with the value chain

Equipment Suppliers

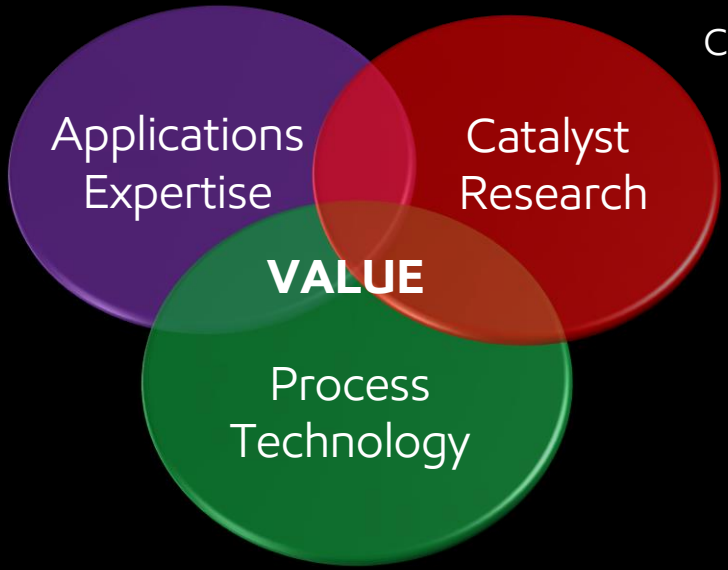
Converters

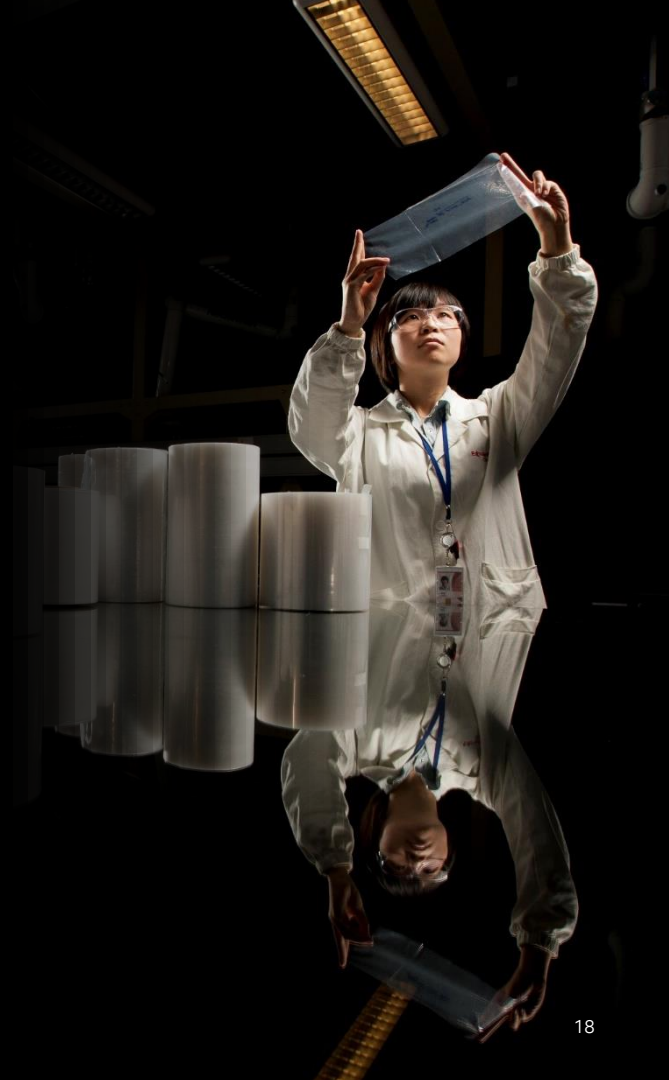
Brand Owners

Packagers

Retailers

Consumers





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Test methods

Test	Method based on
MI (Melt Index)	ASTM D-1238
Density	ASTM D-4703 and ASTM D-1505 / ISO 1183
Melt Flow Ratio (MFR)	ASTM D-1238
Flow behavior- Capillary and Oscillatory Rheology	EMC methods
Tensiles tests	ASTM D-882
Dart Impact	ASTM D-1709 (procedure A)
Elmendorf tear	ASTM D 1922-09
Puncture resistance	EMC method
Puncture needle test	CEN 14471 (probe diameter = 0.8 mm)
Seal Strength sample preparation : Heat Seal mode	ASTM F-2029
Hot-tack	ASTM F-1921
Holes after flex	EMC method (Gelbo device)

Test methods

Test	Method based on
Haze	ASTM D-1003
Shrinkage tester: Betex	EMC method
Shrink force measurement by Retratech	ISO14616
Clarity measurement	ASTM D-1746
Thermicity	ASTM E-1421
Lab aging test • Tensile test • Carbonyl test	ISO 4892-2 at Norner • ISO527-3 • Norner method M730849