TAPPI INTERNATIONAL FLEXIBLE PACKAGING & EXTRUSION DIVISION

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A Novel Sealant Solution for Primary Packaging

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**ExxonMobil Product Solutions Company

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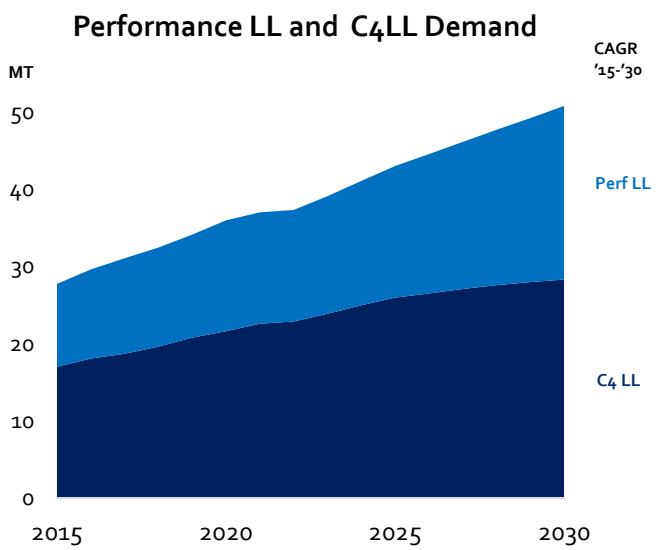
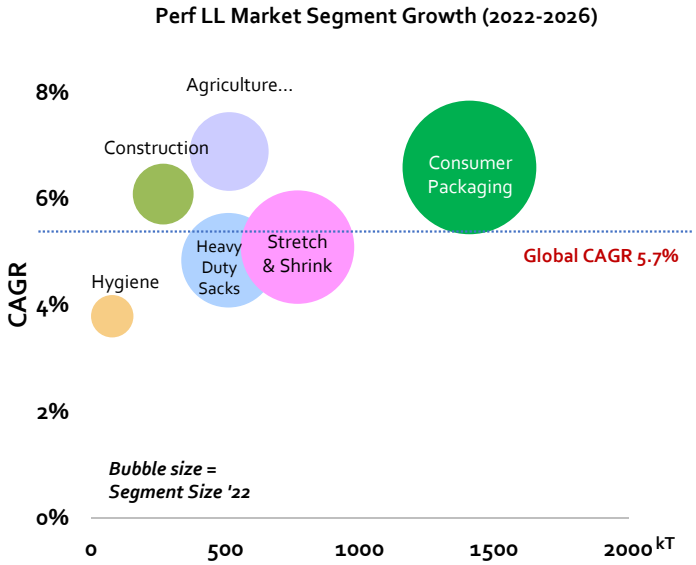
Performance polyethylene*: rapid growth





EM analysis and Chemical Market Analytics by OPIS, A Dow Jones Company

*Performance Polyethylene = C6 & C8 linear low density polyethylene

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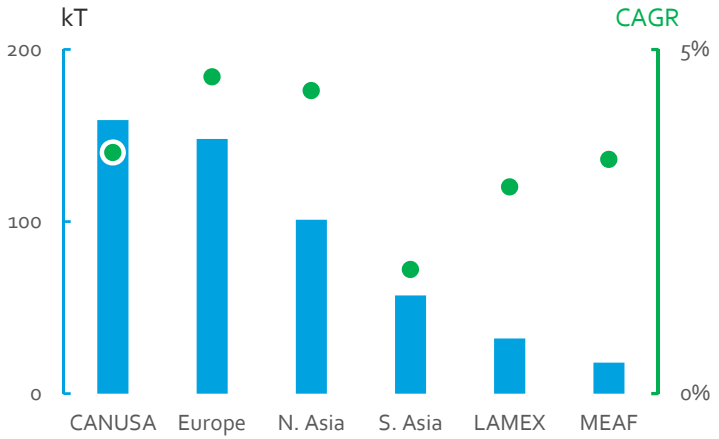
Plastomers – Market size and growth

Macro-economic trends are driving strong demand for

- ↳Growing middle class
- ↳Convenience & personalization
- ↳Increase in snacking & e-commerce
- ↳Growing demand for mono-material packaging

- ↳Low sealing and hot-tack temperatures - fast packaging speeds
- ↳Excellent toughness, flex-crack and hermeticity performance - food safety
- ↳Mono-material packaging design: lower sealing temperatures and overall better heat seal integrity

~516 kt film* grade plastomer demand in 2022



Sources: 2022 TOWNSEND and EM estimates; excludes wide-spec and ZN catalyzed
**blown, cast, and extrusion-coating film conversion processes*

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Sealant Portfolio

- Premium Performance Sealants:
  - Generally density range: 0.900-0.910 g/cm^3
  - Low seal initiation temperature (SIT)
  - Hermetic sealing and good hot tack strength
  - Good caulkability, Seal through contamination
  - Ex. Meat & cheese, produce, etc.

Sealant Portfolio

- High Performance Sealants:
  - Generally density range: 0.910-0.916 g/cm^3
  - High hot tack strength in laminated structures
  - High heat seal strength and hermetic sealing
  - Broad hot tack and heat seal window
  - Ex. Liquids, Frozen poultry, large packages for candy, etc.

- General Purpose Sealants:
  - Generally density range: 0.918-0.922 g/cm^3
  - Good heat seal strength
  - Adequate hot tack strength
  - Ex. Dry foods, crackers, granola, etc.

Materials

Code Name	Product Name	MI – I2 (g/10 min.)	Density (g/cc)
New Plastomer	**Exact™ 3236 plastomer**	**2.0**	**0.908**
Plastomer A	Exact™ 3132 plastomer	1.2	0.900
Plastomer B	Competitive	1.0	0.902
Plastomer C	Competitive	0.85	0.908
mLLDPE-1	Exceed™ 1018 performance polymer	1.0	0.918
mLLDPE-2	Enable™ 2005 performance polymer	0.5	0.920
mLLDPE-3	Exceed™ 1012 performance polymer	1.0	0.912
mLLDPE-4	Exceed™ 1015 performance polymer	1.0	0.915
HDPE	ExxonMobil™ HDPE HTA108	0.7	0.961
LDPE	ExxonMobil™ LDPE LD071.LR	0.7	0.924

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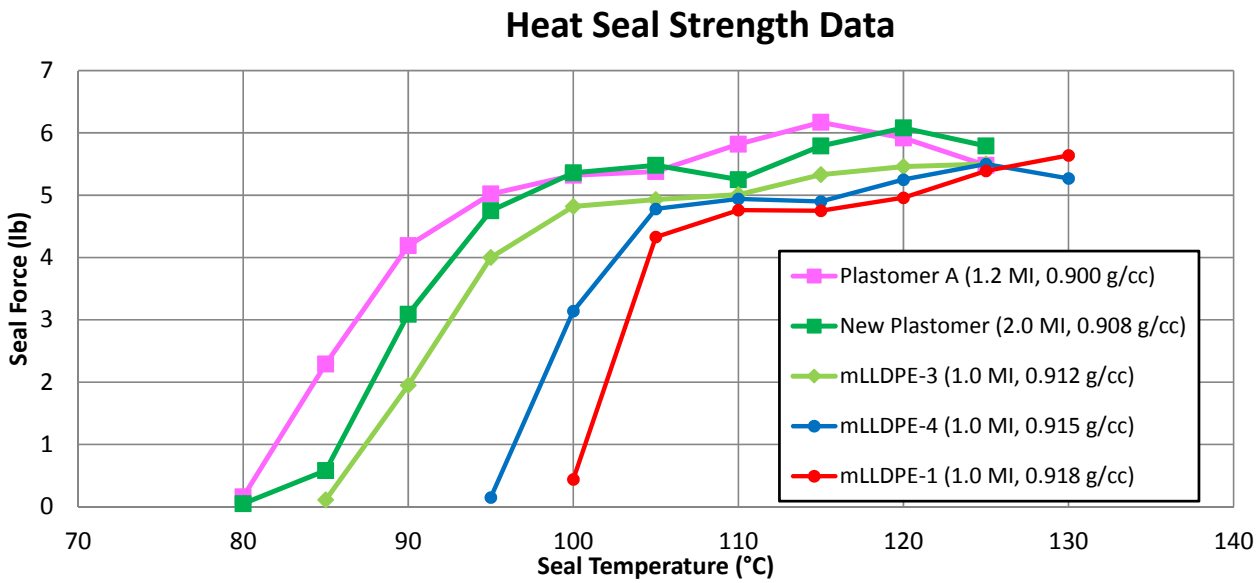
Sealant Portfolio: Heat Seal Data

Seal curves shift to the right with increasing sealant layer density



	Sealant coex structure, 50 µm, 1/3/1
Other skin	80% mLLDPE-1 + 20% LDPE
Core	80% mLLDPE-1 + 20% LDPE
Sealant skin	100% or 80% sealant with remainder mLLDPE-1

Sealing Conditions: Seal jaw pressure = 73 psi, Dwell time = 1 s

Slip and AB added to sealant skin; Slip added to core layer

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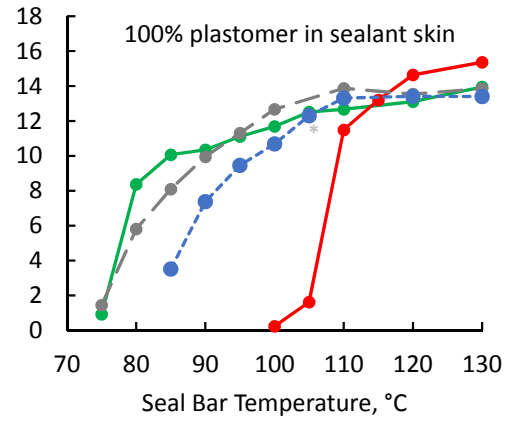
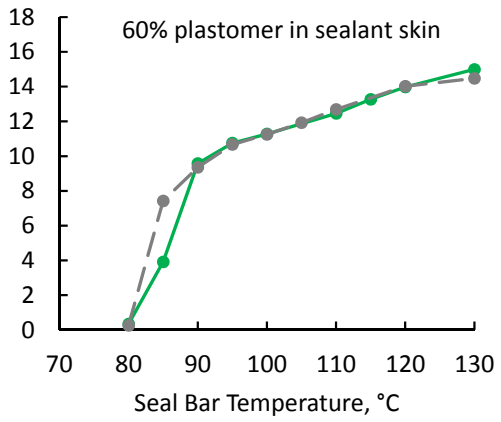
Data from tests performed by or on behalf of ExxonMobil

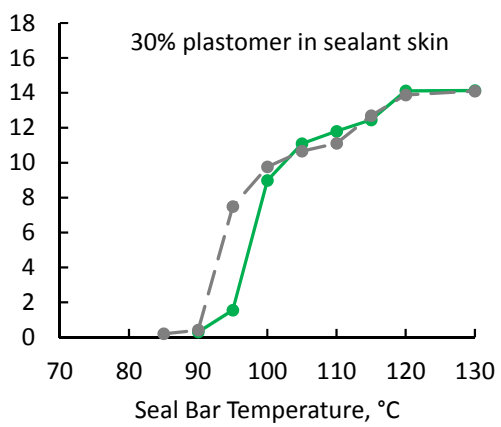
Coextruded non-laminated films

New Plastomer offers excellent sealing equivalent to a conventional 0.902 d plastomer

Seal force (N) (on 15 mm width)







New Plastomer (0.908 g/cm^3)
Plastomer B (0.902 g/cm^3)
Plastomer C (0.908 g/cm^3)
mLLDPE-1 (0.918 g/cm^3)

	Plastomer coex structure, 50 µm, 1/2/1
Other skin	75% mLLDPE-1 + 25% mLLDPE-2
Core	83% mLLDPE-2 + 17% HDPE
Sealant skin	100%, 60% or 30% plastomer with remainder mLLDPE-1

Sealing Conditions: Seal jaw pressure = 0.5 MPa, Dwell time = 0.5 s
Slip and AB added to sealant skin; Slip added to core layer

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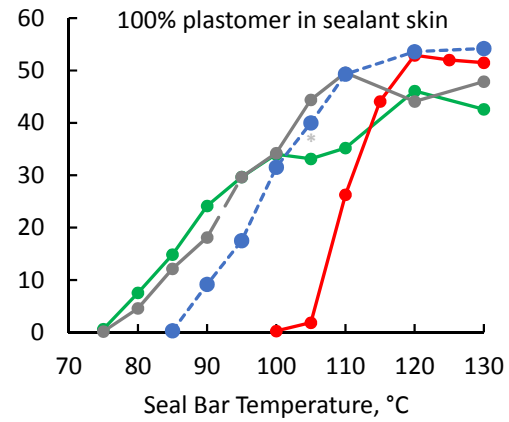
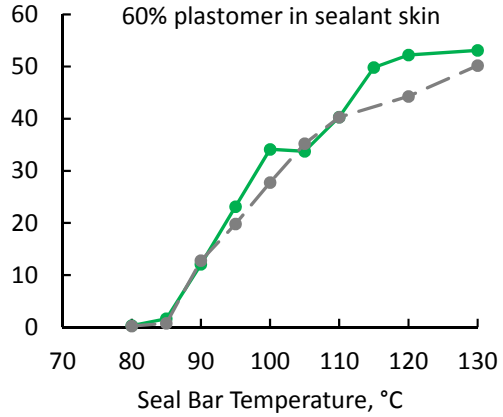
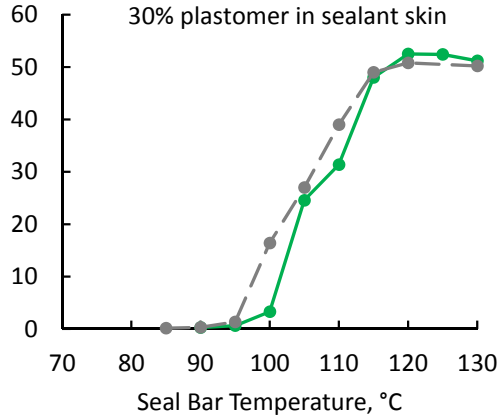
Coextruded and laminated films

New Plastomer offers excellent sealing equivalent to a conventional 0.902 d plastomer

Seal force (N) (on 15 mm width)







New Plastomer (0.908 g/cm³)
Plastomer B (0.902 g/cm³)
Plastomer C (0.908 g/cm³)
mLLDPE-1 (0.918 g/cm³)

Laminated with 12 µm PET

	Plastomer coex structure, 50 µm, 1/2/1
Other skin	75% mLLDPE-1 + 25% mLLDPE-2
Core	83% mLLDPE-2 + 17% HDPE
Sealant skin	100%, 60% or 30% plastomer with remainder mLLDPE-1

Sealing Conditions: Seal jaw pressure = 0.5 MPa, Dwell time = 0.5 s
Slip and AB added to sealant skin; Slip added to core layer

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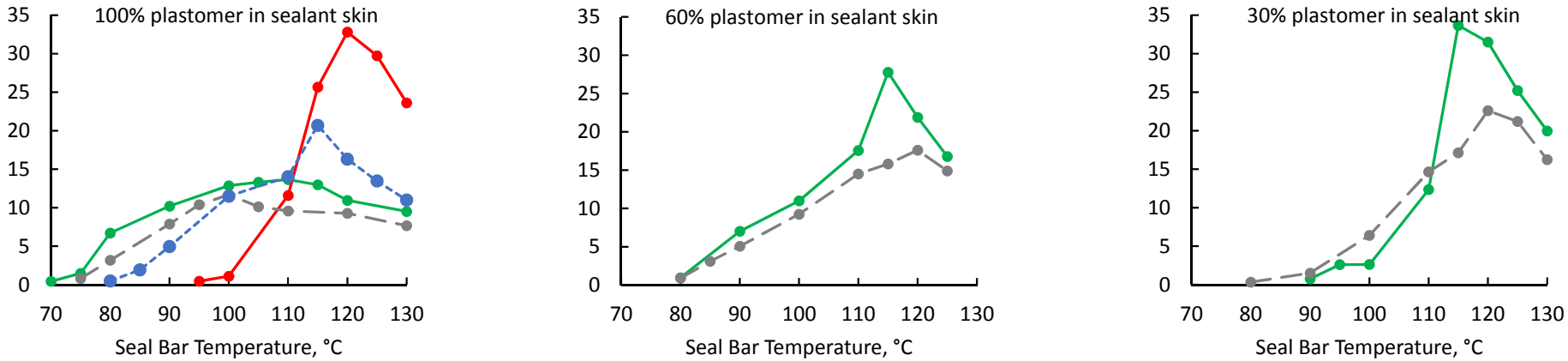
Coextruded and laminated films

New Plastomer offers excellent hot tack strength equivalent to a conventional 0.902 d plastomer

Hot tack (N) (on 30 mm width)



Laminated with 12 µm PET

	Plastomer coex structure, 50 µm, 1/2/1
Other skin	75% mLLDPE-1 + 25% mLLDPE-2
Core	83% mLLDPE-2 + 17% HDPE
Sealant skin	100%, 60% or 30% plastomer with remainder mLLDPE-1

Sealing Conditions: Seal jaw pressure = 0.5 MPa, Dwell time = 0.5 s
Slip and AB added to sealant skin; Slip added to core layer

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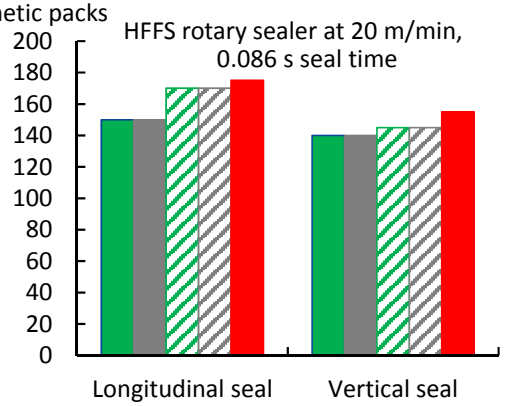
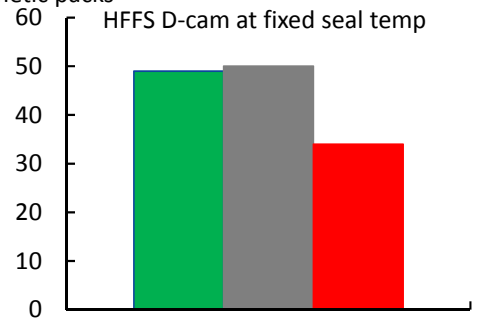
Packaging on an HFFS* line

New Plastomer shows excellent performance on a high speed packaging line

Seal temp (°C) needed at fixed line speed to obtain hermetic packs



Max line speed (m/min) at fixed seal temperature to obtain hermetic packs



- New Plastomer (0.908 g/cm^3)
- Plastomer B (0.902 g/cm^3)
- 30% New Plastomer
- 30% Plastomer B
- mLLDPE-1 (0.918 g/cm^3)

Laminated with 12 µm PET

	Plastomer coex structure, 50µm, 1/2/1
Other skin	75% mLLDPE-1 + 25% mLLDPE-2
Core	83% mLLDPE-2 + 17% HDPE
Sealant skin	100% or 30% plastomer with remainder mLLDPE-1

*HFFS = Horizontal form, fill and seal

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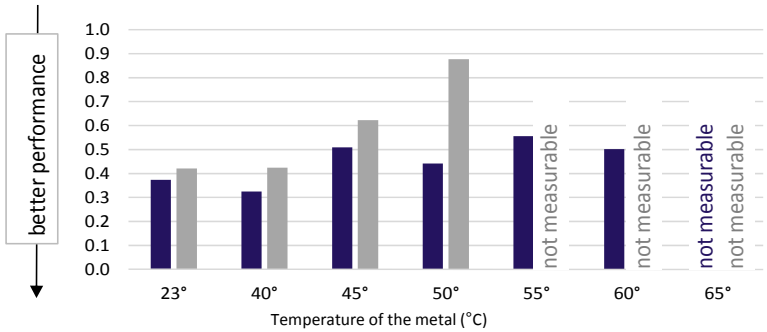
Data from tests performed by or on behalf of ExxonMobil

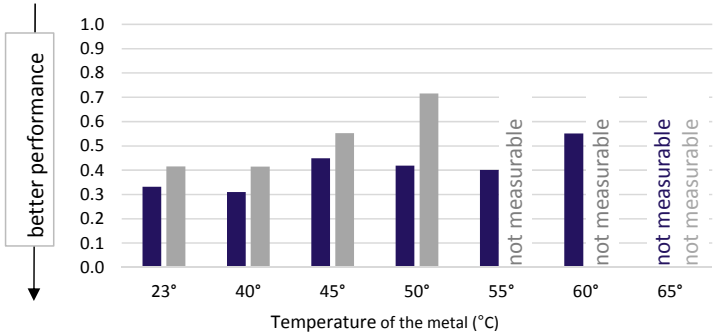
Coefficient of friction (COF) at high temperatures

New plastomer can deliver enhanced slip performance at room temp. & high temp. on the packaging line.

Static COF film - hot metal



Kinetic COF film - hot metal



	New Plastomer 50µm, 1/2/1	**Plastomer B 50µm, 1/2/1**
Other skin	75% mLLDPE-1 + 25% mLLDPE-2	
Core	81% mLLDPE-2 + 17% HDPE + 2% slip MB	
Sealant skin	New plastomer + 1% slip MB + 1.5% antiblock MB	Plastomer B + 1% slip MB + 1.5% antiblock MB

	New Plastomer	**Plastomer B**
Static COF film-film	0.20	0.29
Kinetic COF film-film	0.16	0.21

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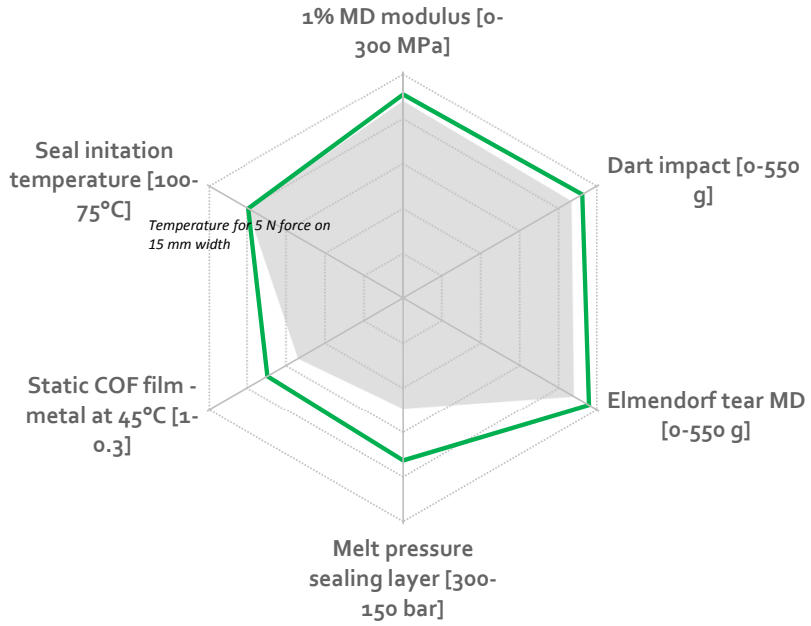
Data from tests performed by or on behalf of ExxonMobil

Mechanical properties: Coex non-laminated films

New plastomer shows certain enhanced attributes vs. conventional 0.902 d plastomer



New Plastomer (2.0 MI, 0.908 g/cm³)
vs. plastomer B ref. (0.902 d, 1.0 MI)

- Sealing and packaging behavior comparable
- Enhanced extrudability
- Enhanced stiffness and toughness characteristics
- Enhanced processibility on hot surfaces of the packaging line

	New Plastomer 50 µm	Plastomer B 50 µm
Ratio	1 / 2 / 1	1 / 2 / 1
Other	75% mLLDPE-1 + 25% mLLDPE-2	75% mLLDPE-1 + 25% mLLDPE-2
Core	83% mLLDPE-2 + 17% HDPE	83% mLLDPE-2 + 17% HDPE
Sealant	100% New Plastomer	100% Plastomer B

Slip and AB added to sealant skin; Slip added to core layer