

# ExxonMobil

## PERFORMANCE POLYMERS FOR NEW VALUE-ADDED EXTRUSION COATING AND LAMINATION SOLUTIONS

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### Introduction

Extrusion coating and lamination on various substrates such as board, paper, flexible films and HDPE woven fabrics, impart properties that prove beneficial for diverse end use applications. Extrusion coating and lamination also contribute towards decreasing the permeability of liquids, improved adhesion strength, sealing and toughness. Traditionally, LDPE and butene based LLDPE copolymers have been used as the material of choice. However, with advancement in material science and technology, ExxonMobil Exceed™ 0015XC and Exceed™ 0019XC performance polymers were developed, that deliver enhanced toughness and sealing performance. ExxonMobil's robust supply chain ensures consistent supply of these resins in various regions globally.

### LDPE supply shortfall

As per Townsend's 2020 PE report, the global LDPE supply will increase by 1% while demand is expected to be robust, with a 3% CAGR by 2025, resulting in a potential supply-demand gap.

In 2021, according to Townsend 2020 PE report LDPE demand in India for extrusion coating applications is expected to be 140kT and is forecast to grow by 3.6% CAGR (Compound Annual Growth Rate) for the next 5 years. With domestic manufacturing capacity currently slated at 90kT, India continues to be a net importer of LDPE. It is no surprise that in 2020, 75kT of LDPE was imported for extrusion coating applications.

Shortages in supply lead to uncertain markets, making it an ideal time for the industry to seek alternative solutions that can help negate these issues. Exceed™ performance polymers not only do that, but they also allow customers to advance their business with innovative, value-added extrusion and coating lamination solutions.

### Exceed™ performance polymers

Exceed™ performance polymers are ethylene 1-hexene copolymers designed to deliver superior mechanical and sealing performance for highly demanding end-use applications, compared to conventional LDPE & LLDPE resins. Two resins in the

portfolio, Exceed™ 0015XC and Exceed™ 0019XC, are new to the Indian market. They are tailor-made for extrusion coating and lamination on different substrates like board, paper, flexible films and HDPE woven fabrics. They offer the following benefits:

- Outstanding sealing properties, especially lower sealing temperature
- Broad hot tack window
- Improved adhesion strength at lower melt temperature
- Opportunities to downgauge the coating thickness
- Easy processability with minimum blending of LDPE
- Good organoleptics
- Global availability

Compared to conventional LDPE & LLDPE, Exceed™ performance polymers provide superior performance for better product integrity and less failure-in-use, while helping ease the pressure caused by LDPE shortages and price variations.



Pond liner



Truck cover



Grain cover



Rain shelter



Paper cup coating

### Technical performance

Exceed™ 0015XC and Exceed™ 0019XC are dedicated for extrusion coating and lamination processes. ExxonMobil PE polymers commonly used in the extrusion coating and lamination process are listed below in Table 1.

RESIN	MI (g/10 min)*	Density (g/cc)*
Exceed™ 0015XC	15	0.918
Exceed™ 0019XC	19	0.918
LDPE LD258	8.2	0.919
LDPE LD259	12	0.915

\*Data from tests performed by or on behalf of ExxonMobil

Table 1: MI & Density of ExxonMobil PE polymers for extrusion coating and lamination

The rheological behavior (see Figure 1) of Exceed™ 0015XC and Exceed™ 0019XC performance polymers helps make them easy to process. Offering increased draw down, these polymers allow line speeds to be increased, while maintaining product quality and consistency. These polymers also offer coating possibilities for weights as low as 5 gsm with line speeds varying from 50 m/min to 300 m/min. Exceed™ 0019XC is the preferred resin for lower coating thickness at higher line speeds. Exceed™ 0015XC and Exceed™ 0019XC can create opportunities for downgauging which translates into potential cost savings, while delivering superior performance. It is recommended that these resins are used with a blend of up to 30% LDPE LD258 or LDPE LD259 or equivalent to control the neck-in.

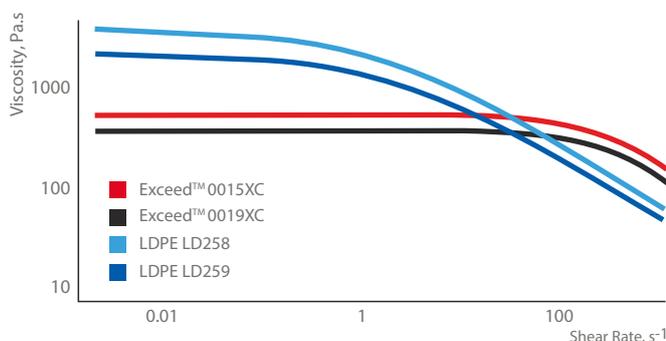
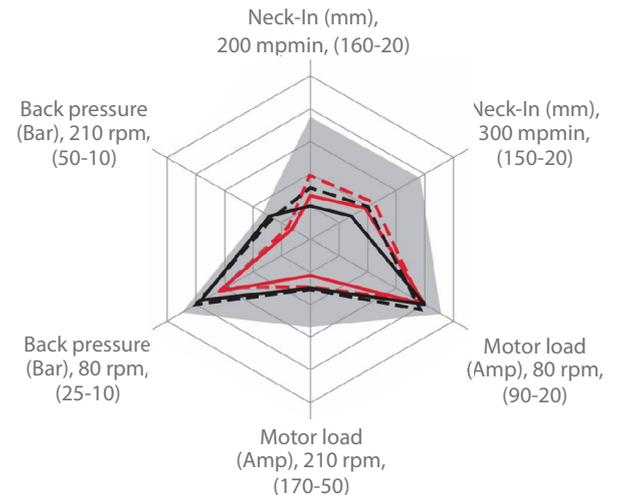


Figure 1: Viscosity curve at 190°C\*\*

\*\*Data from tests performed by or on behalf of ExxonMobil

Figure 2 shows that Exceed™ 0015XC blended with LDPE delivers lower neck-in. Exceed™ 0019XC blended with LDPE allows lower motor load and back pressure.



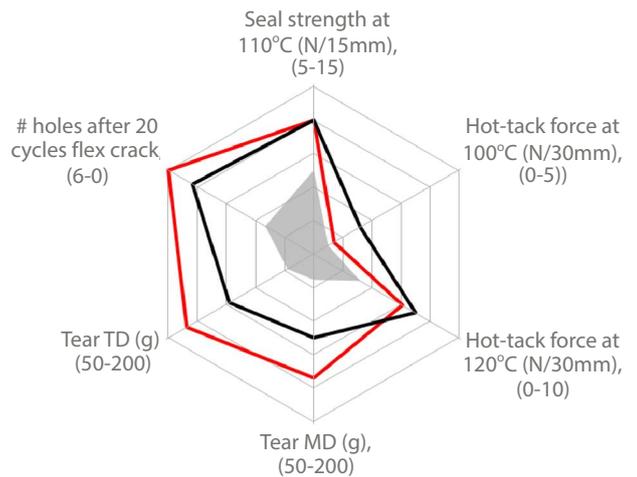
Polymers tested in mono extrusion coating, on a 3.5 inch extruder designed for the extrusion coating process, at 320°C set temperature

Reference	80% Exceed™ 0015XC ExxonMobil™ LDPE LD258	80% Exceed™ 0015XC performance polymer 20% ExxonMobil™ LDPE LD259	80% Exceed™ 0019XC performance polymer 20% ExxonMobil™ LDPE LD258	80% Exceed™ 0019XC performance polymer 20% ExxonMobil™ LDPE LD259
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Figure 2: Processability at 320°C\*\*\*

\*\*\* Data from tests performed by or on behalf of ExxonMobil

As can be seen in Figure 3, rich blends of Exceed™ performance polymer outperform LDPE in sealing and mechanical performance. The spider chart represents the properties of a mono extrusion coating on 70 gsm kraft paper under standard conditions, with a line speed of 100 m/min and a set temperature of 320°C (608°F). The reference polymer is LD258 or other equivalent LDPE resins commonly used in the market. With a higher seal strength and broad hot tack plateau contributing to a broad operating window, Exceed™ 0015XC and Exceed™ 0019XC are outstanding sealants. They also outperform the reference resins, in terms of tear and flex crack resistance.



Structures produced on EM pilot extrusion coating line 25 gsm polymer coated onto 70 gsm Kraft paper at 320°C set temp

Reference	Solution 1	Solution 2
100% ExxonMobil™ LDPE LD258	80% Exceed™ 0015XC performance polymer 20% ExxonMobil™ LDPE LD259	80% Exceed™ 0019XC performance polymer 20% ExxonMobil™ LDPE LD259

Figure 3: Sealing and mechanical performance\*\*\*

\*\*\* Data from tests performed by or on behalf of ExxonMobil

### Conclusion

While helping ease the pressure caused by any potential global LDPE shortages and price variations, Exceed™ performance polymers provide superior performance for better product integrity and less failure-in-use. These polymers also offer coating possibilities for weights as low as 5 gsm with line speeds varying from 50 m/min to 300 m/min. It is recommended that these resins are used with a blend of up to 30% LDPE LD258 or LDPE LD259 or equivalent.

For more information, kindly contact our regional representatives:

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TEST ITEM	TEST METHOD BASED ON
Elmendorf tear strength	ExxonMobil test method (MEZ 067) based on ASTM D-1922-09
Heat seal of coatings to Kraft paper	ExxonMobil test method (MEZ 047-04 & 143-04)
Seal sample preparation on Kopp, for coatings to Kraft paper	ExxonMobil test method (MEZ 360)
Hot-tack heat seal mode	ExxonMobil test method (MEZ 003)
Visual adhesion rating of coatings to cup board substrate	Non EM standard test method, see page notes
#holes after 20 cycles flex crack,	ExxonMobil test method (MEZ 232)
Draw-down/meck-in/extruder motor load / back pressure	ExxonMobil test method (: POTE 0011.000.00)

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