Advances in LDPE Resins for Extrusion Coating Applications

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Agenda

- Introduction to the extrusion coating market and performance needs
- Technical preference for autoclave like LDPE
- Availability of LDPE
- What new tubular grades of LDPE offer in performance
- Conclusions & Future

Introduction

Extrusion coating provides for the enhancement of substrates wherein autoclave LDPE is the most commonly applied material

Convertor

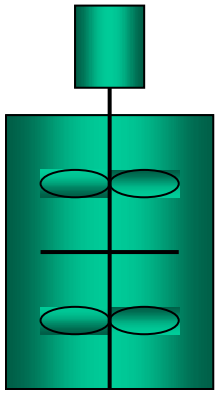
- Processability
- ★ Melt Strength
- Availability
- Cost Effectiveness

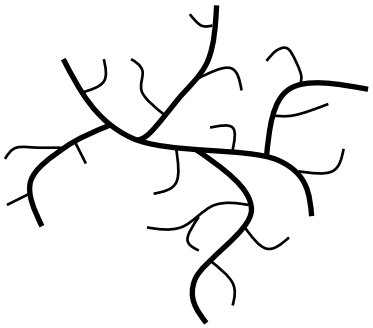
End Use

- Barrier (WVTR)
- Strength, tear resistance
- Bond
- Inertness
- Sealability

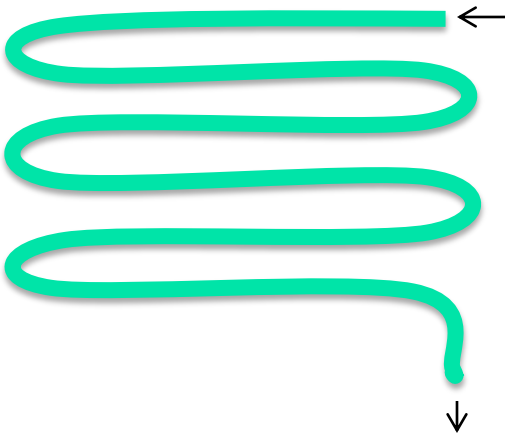
Autoclave vs Tubular LDPE

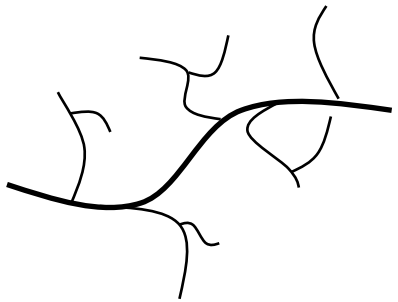
Autoclave Reactor





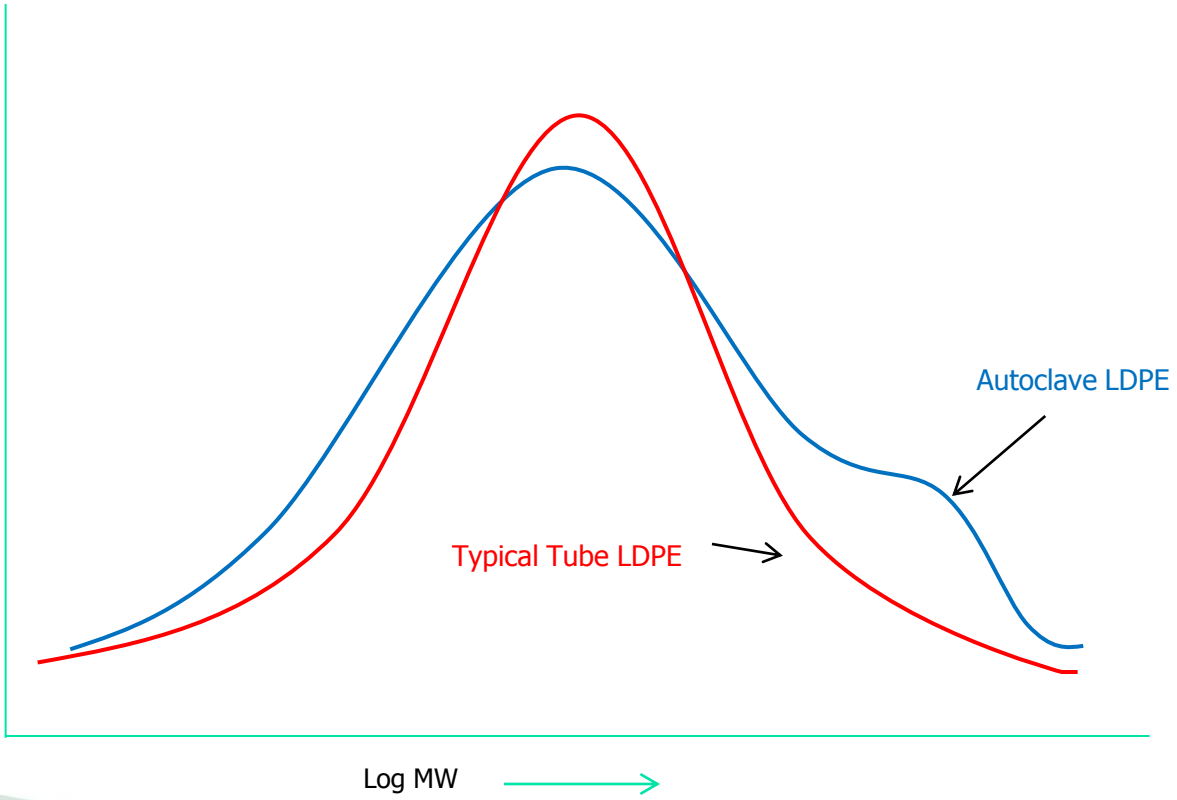
Tubular Reactor





Autoclave vs Tubular LDPE

Molecular weight distribution of an autoclave produced LDPE vs one produced on a conventional tubular asset.



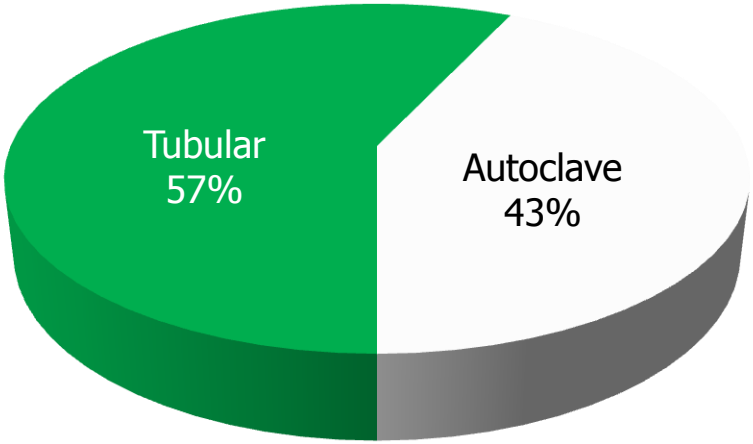
LDPE Availability in North America

North American autoclave start up year

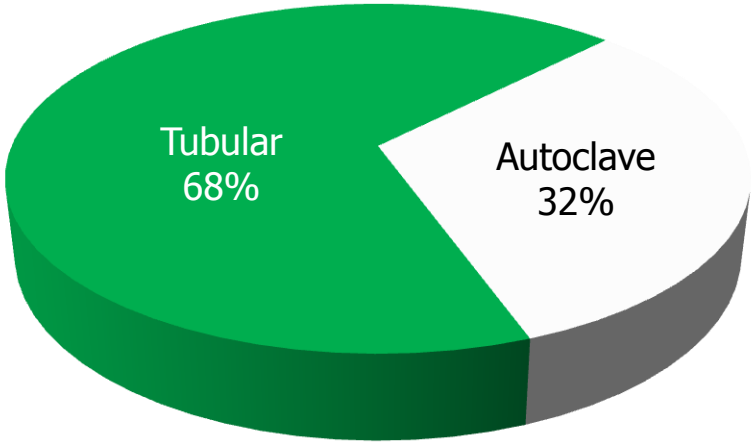
1954
1960
1965
1966
1968

NA LDPE Balances ('14 to '19)

2014 LDPE Balances
6.8 B lbs



Projected 2019 LDPE Balances
9 B lbs

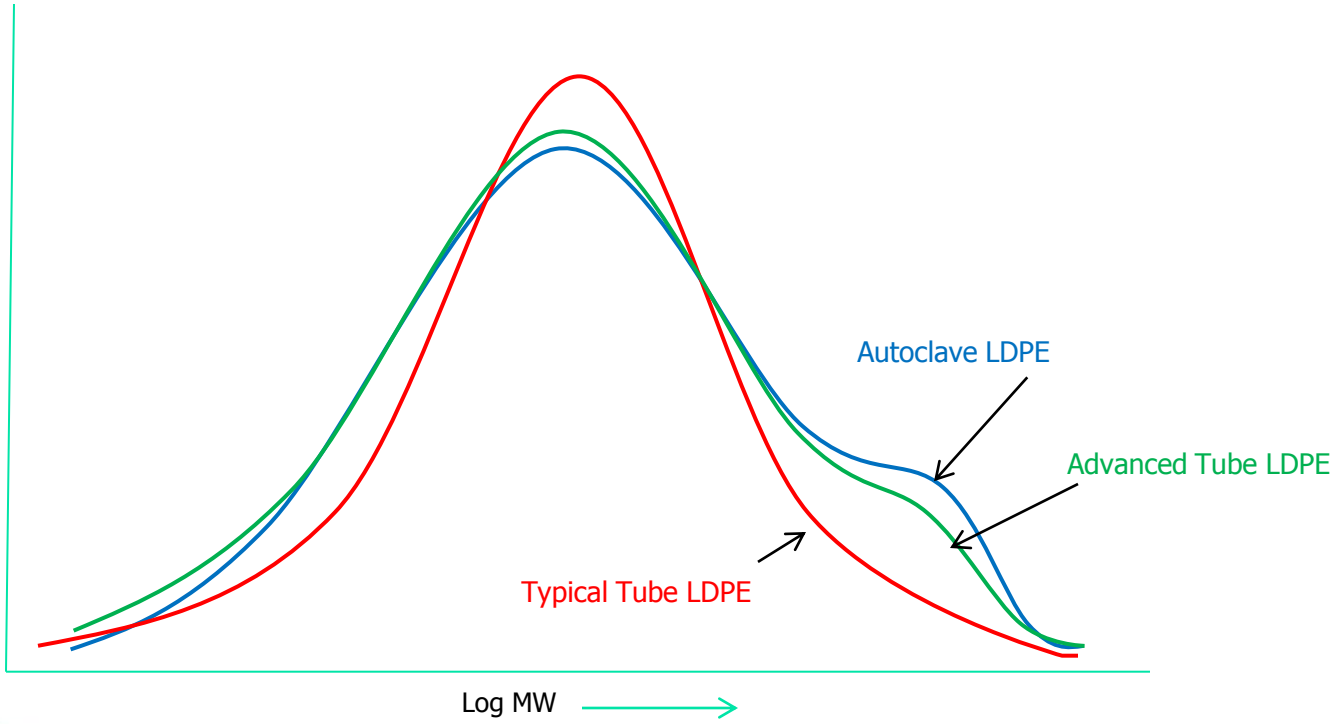


Data source: Townsend Solutions, Global PE Demand 2014

LDPE: Advanced Tubular vs Traditional Autoclave Performance

Autoclave vs Tubular LDPE

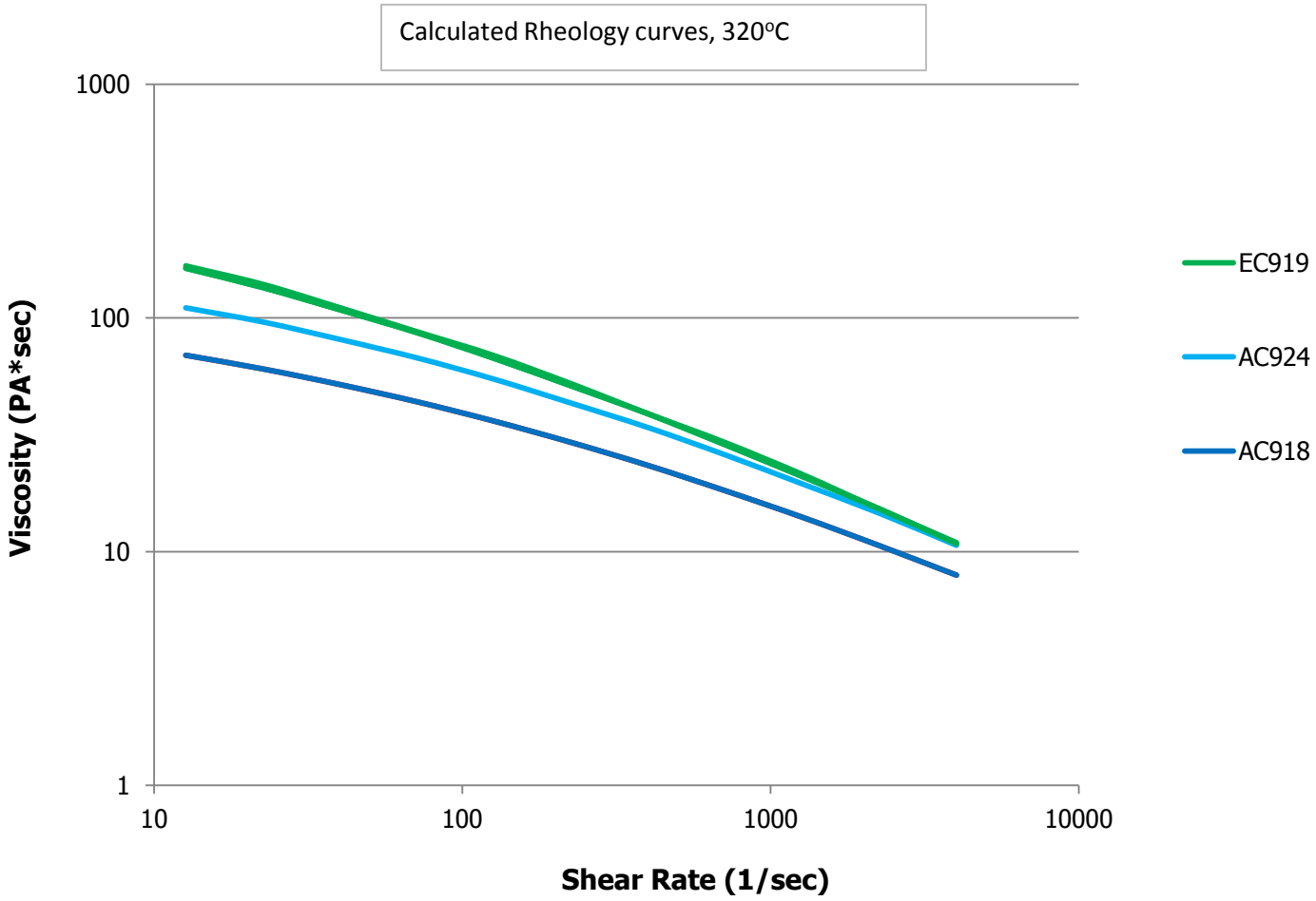
Molecular weight distribution of autoclave produced LDPE vs one produced on a conventional tubular asset and one on an advanced tubular asset.



Comparative Examples

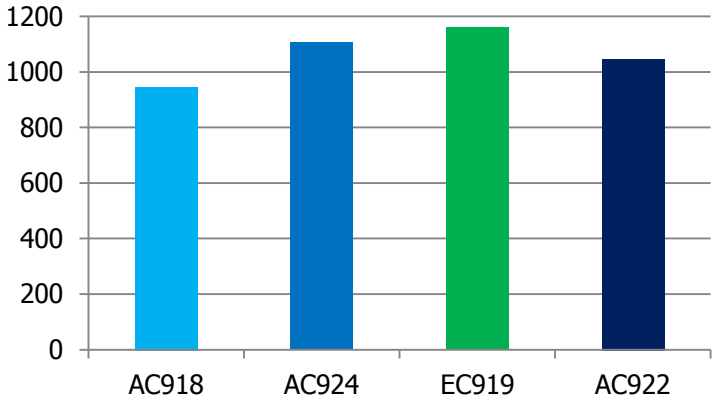
LDPE	Type	MI (g/10min)	Density (g/cc)	Notation
Dow LDPE 722	Autoclave	8.0	0.918	AC918
Dow LDPE 5004I	Autoclave	4.2	0.924	AC924
Dow LDPE 5005	Autoclave	5.7	0.922	AC922
AGILITY ™ EC 7000	Tubular	3.9	0.919	EC919
Competitive 1	Tubular	5.0	0.918	CT918
Competitive 2	Tubular	5.0	0.919	CT919
Dow LDPE PG 7008	Autoclave	7.7	0.918	EU918

Rheology Comparison



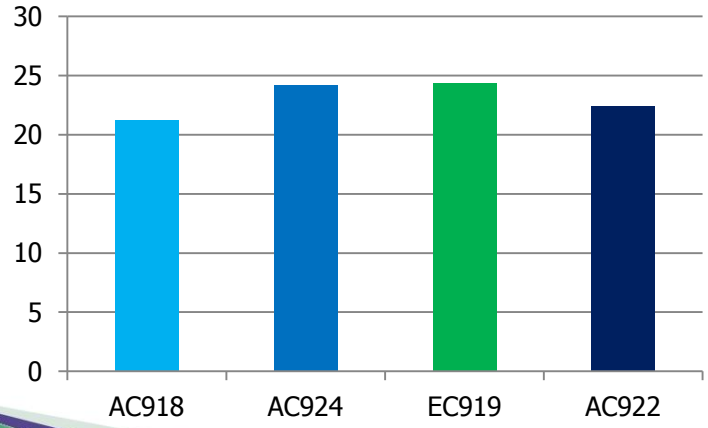
Processability Comparison

Back Pressure (psi)

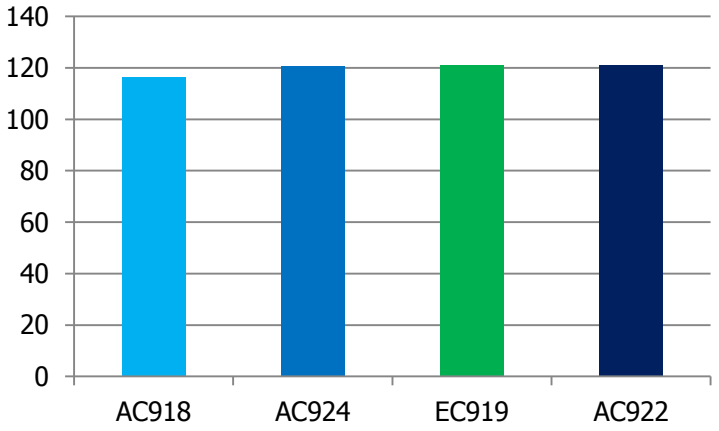


Advanced tubular LDPE will process similarly to autoclave grades

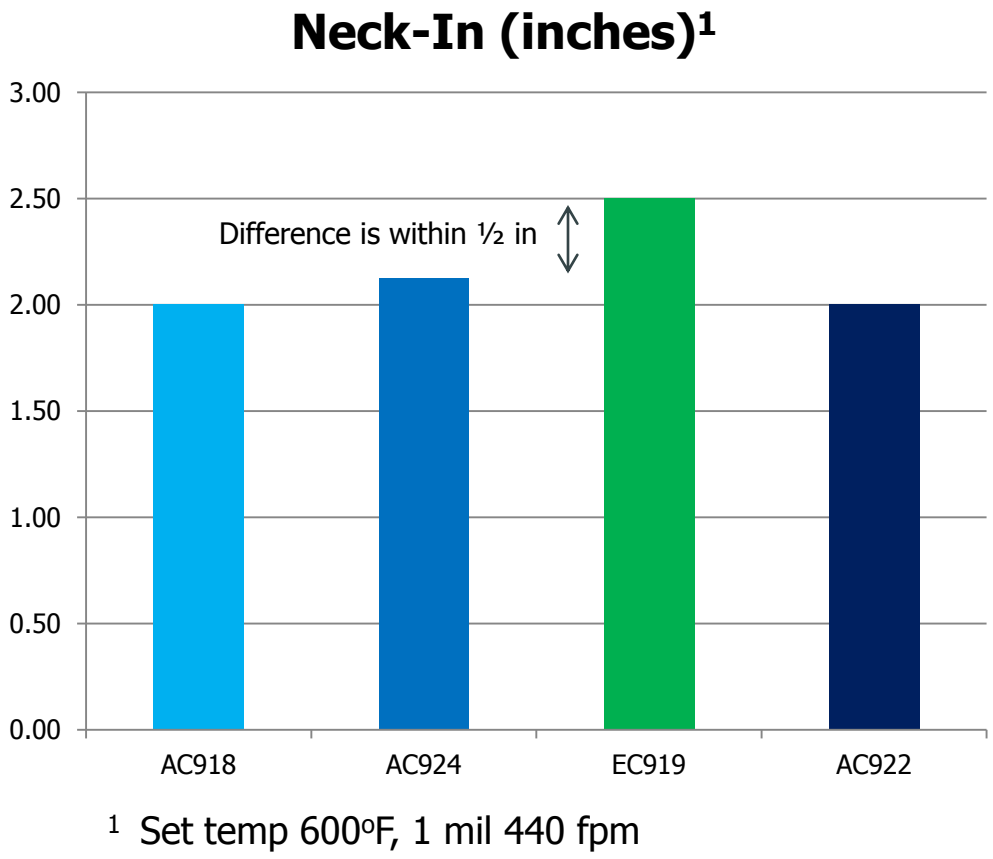
Horsepower



Amps

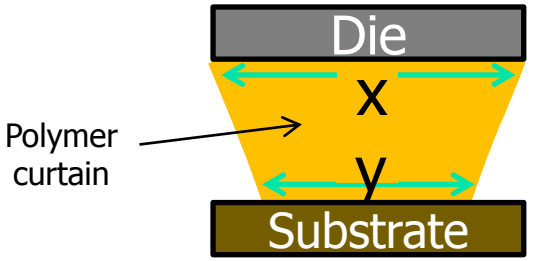


Neck-In Comparison



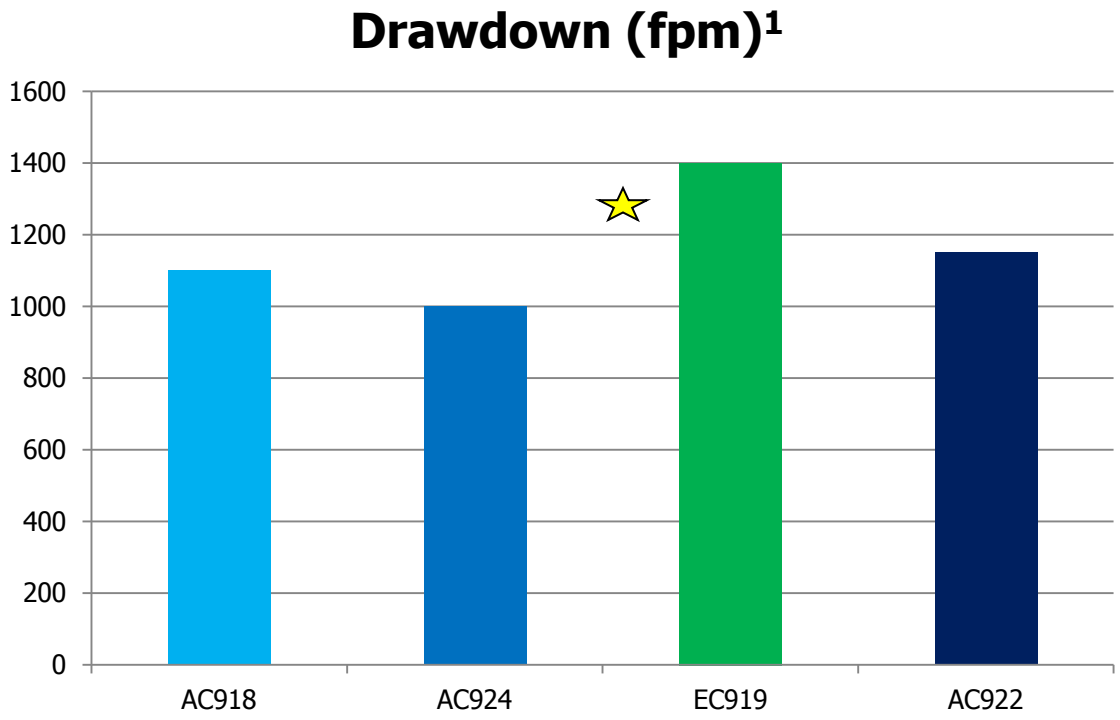
[1] Set temp 600°F, 1 mil 440 fpm

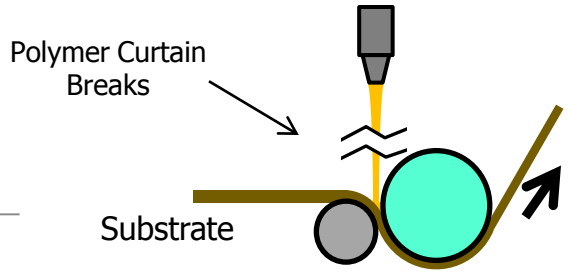
Similar Neck-In performance of advanced tubular LDPE to traditional autoclave resins



Neck-in = x – y
Lower is better

Drawdown Comparison



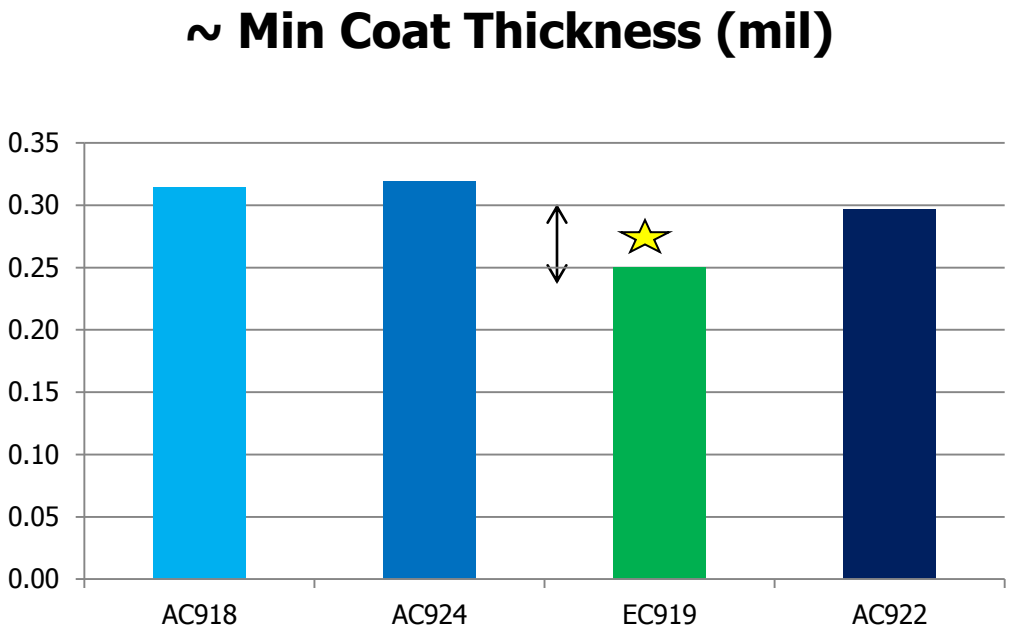


Draw down = tearing speed
Higher is better

[1] Ramping with frozen output until web breaks

Minimum coat weights

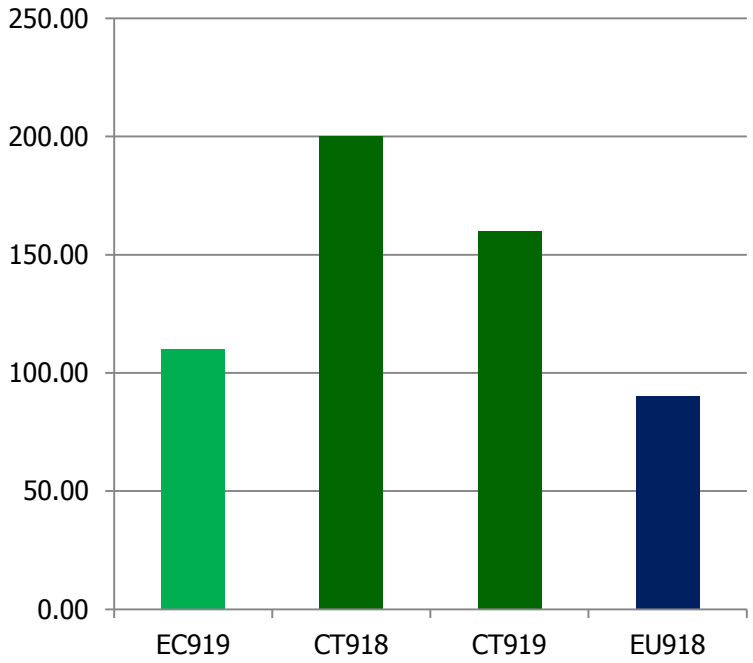
Improvement in drawdown ability of EC7000 over conventional autoclave grades, could allow for a wider process window and/or use less material.



Several more Advanced Tubular Grades vs Traditional Autoclave Performance

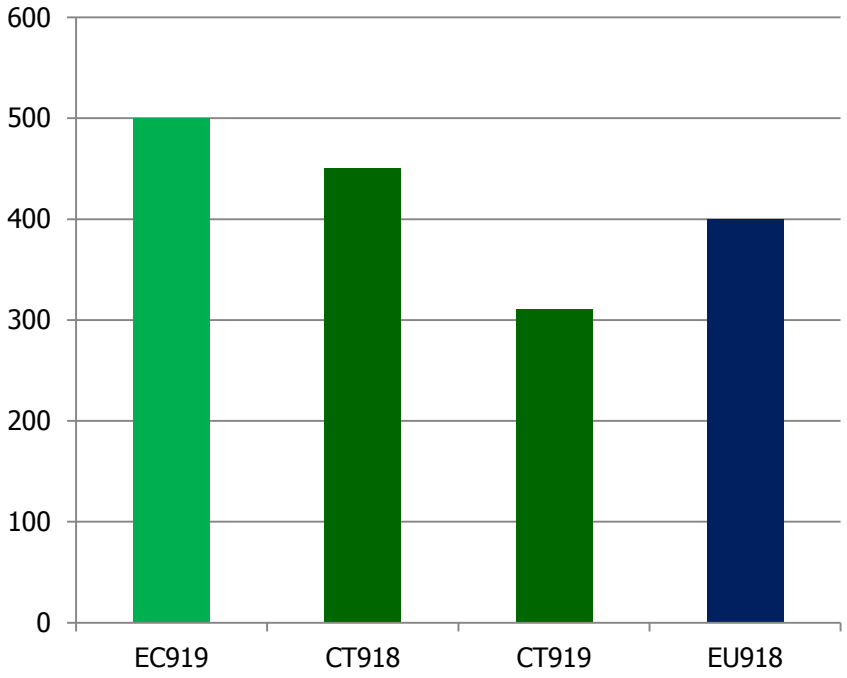
Comparison of Tubular Grades Available in Europe

Neck-In (mm)[1]



[1] **set temp 320°C with 15 g/m² & 100 m/min**

Drawdown (mpm)[2]



[2] **ramping until instability or break with frozen output at 15 g/m² and 100 m/min**

Data source: Dow Europe GmbH – Technical Center Horgen

Conclusions

- New tubular extrusion coating LDPEs are capable of meeting and exceeding the performance targets of conventional autoclave LDPEs
- Dow AGILITY™ technology delivers a sustainable solution to the aging autoclave LDPE asset base while enabling higher coating speeds at lighter coating weights

Acknowledgement

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Garrett Garcia - Technologist

Thank you

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