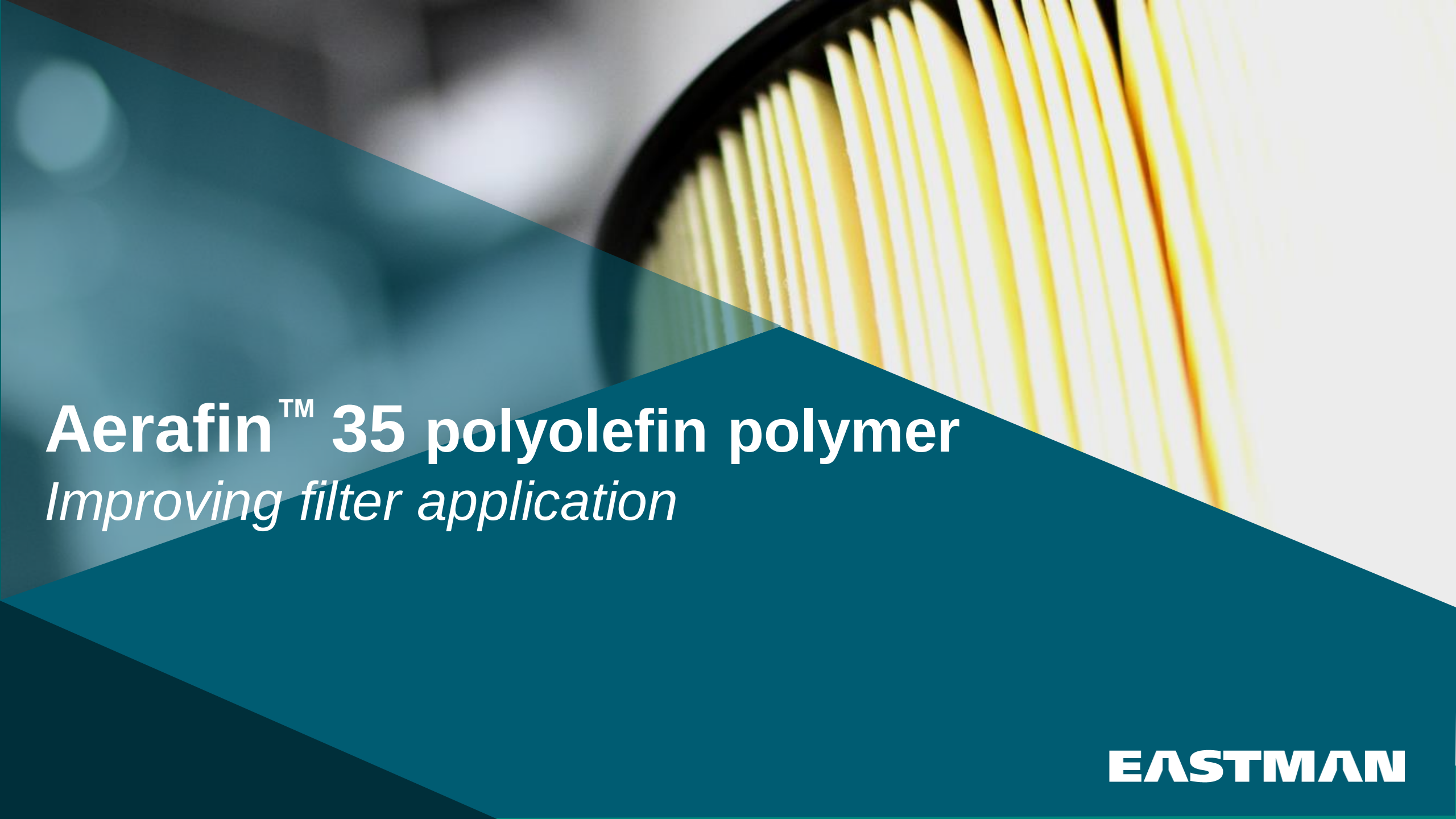


Aerafin™ 35 polyolefin polymer

Improving filter application

EASTMAN

TRENDS

Impacting filtration

GLOBAL AND ENVIRONMENTAL

- Growing population/urbanization
- Climate change and natural resource scarcity
- Healthcare transformation
- Growth in filtration demand across all end-use markets

https://www.afssociety.org/assets/docs/AFS-POV-Final-High-Res.pdf

MANUFACTURING AND SUPPLY

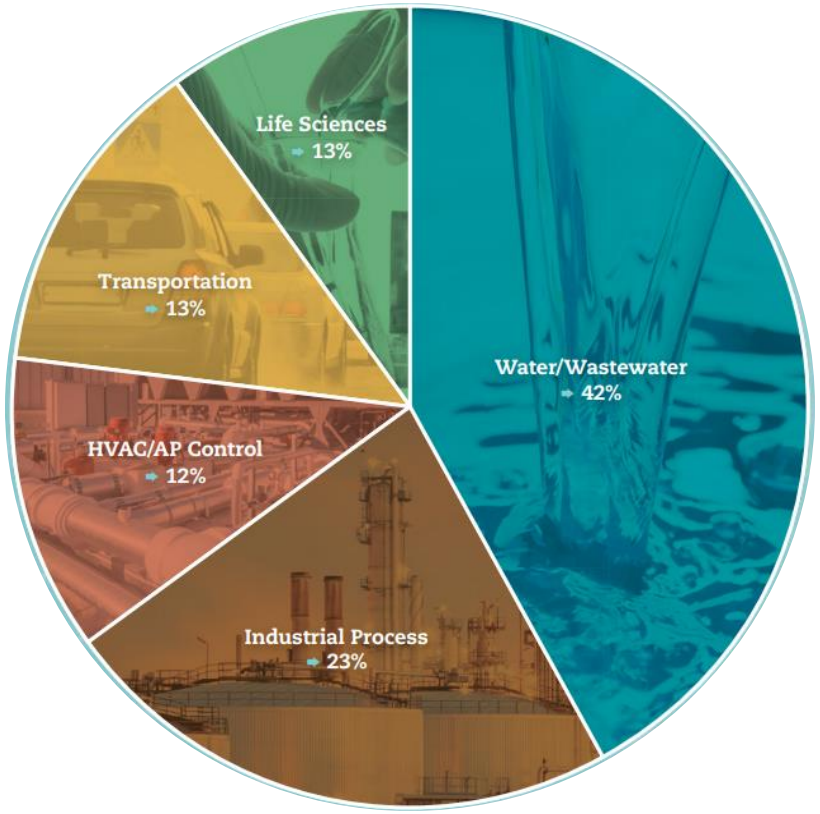
- Customers want newest technology and latest filtration media
- Creates consolidation of global suppliers in filtration and separation technology segment

REGULATION AND LEGISLATION

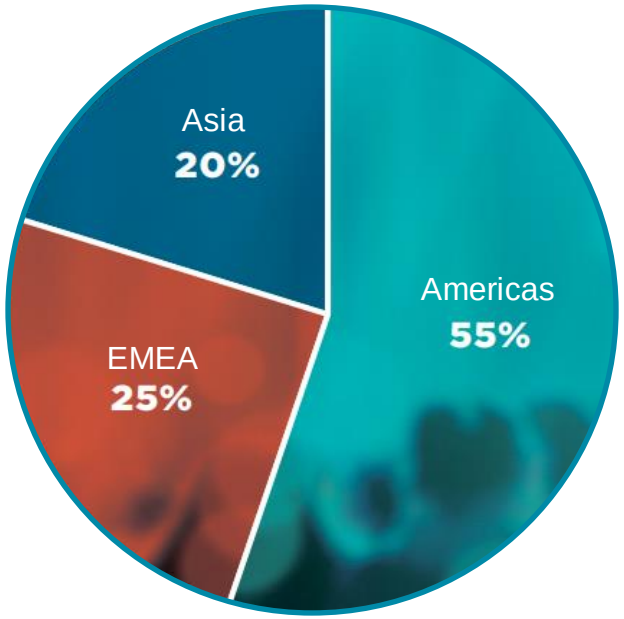
- Drives the need for filtration and separation technology
- Demand for reduced waste
- Zero discharge for emissions
- Need for improved product quality processes
- Demand for cleanable/reusable filtration

INDUSTRY OVERVIEW

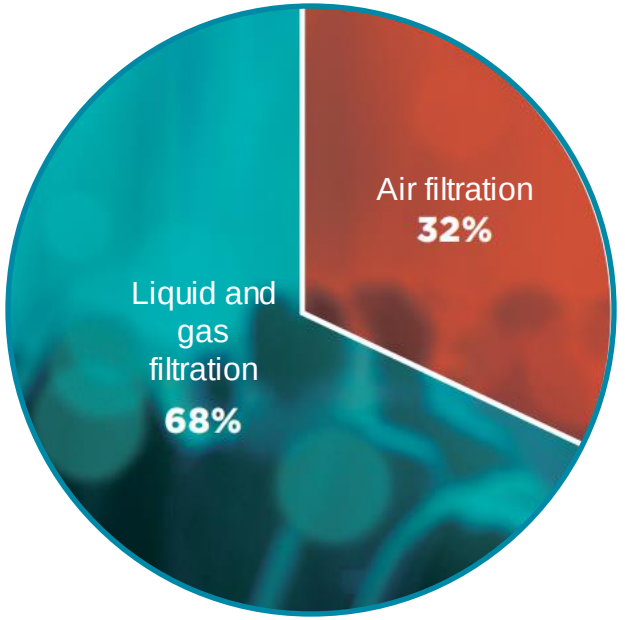
Filtration and separation markets



Filter use by region



Filter use by product category



https://www.afssociety.org/assets/docs/AFS-POV-Final-High-Res.pdf

ADHESIVE TECHNOLOGY COMPARISON

For filter industry

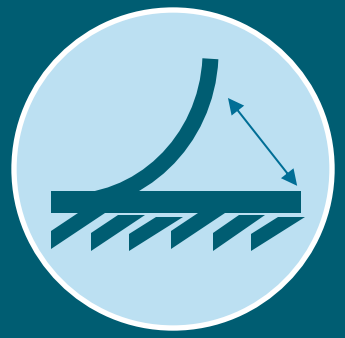
	Ethylene-vinyl acetate	Metallocene	Polyamide	Polyester	Polyolefin	Polyurethane	Pressure sensitive
Filter type	Air	Air	Air	Air	Air	Air	Air
			Oil	Oil		Oil	
					Water	Water	
Application	• Filter to frame • Pleat separator • First to last pleat	• Filter to frame • Pleat separator • First to last pleat	• Pleat separator • Potting • End-cap bonding	• Pleat separator • Media lamination • End-cap bonding	• Foam spiral bead • Potting • Frame assembly	• Pleat separator • Frame assembly • End-cap bonding	• Filter to frame • Gasketing
Application method	Bead	Bead	Bead	Bead	Bead	Bead	Bead
	Spray						
			Melt blown	Melt blown	Melt blown		
					Swirl spray		Swirl spray
			Web	Web			
Temperature resistance	–30°C to 65°C	0°C to 70°C	–20°C to 175°C	< 175°C	–10°C to 155°C	–10°C to 200°C	0°C to 120°C

FORMULATOR ADVANTAGES

Why APO hot melts in filters?

Formulation flexibility

Through improved balance of tensile strength, elongation, and lower viscosity



Adhesion performance

Good adhesion to various base materials such as paper and plastic

Low odor

Does not contribute to unpleasant odors in final adhesive formulation

Light color

Due to the light color, there is no obvious adhesive on the finished filter.

Good thermal stability

Improves heat resistance and allows for clean running without charring during application

EXPANDED PRODUCT PORTFOLIO

For formulation flexibility

	T_g (°C)	Softening point (°C)	Viscosity @ 190°C (mPa·s)	Needle penetration (dmm)	Physical form	Tensile strength (MPa)/elongation (%)
Aerafin 180	–38	120	18,000	20	Pellets	1.9/263
Aerafin 17	–38	125	1,500	20	Pellets	2.3/18
Aerafin 35	–40	120	3,300	14	Pellets	2.7/40

Higher tensile strength

Good elongation at lower viscosity

MODEL FORMULATION SHOWS GOOD MECHANICAL PROPERTIES

Model formulation #1	
PE wax	10%~20%
Aerafin 35	45%~55%
Eastotac H130W	25%~35%
Antioxidant	0%~1%

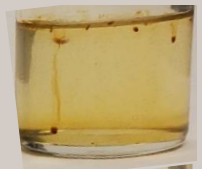
Adhesives with Aerafin 35 have good:

- Mechanical properties for filter application
- Open time/set time
- Viscosity profile

Physical properties of adhesive model formulation using Aerafin 35:

APO	Viscosity (mPa·s)				RBSP (°C)	Hardness (Shore A)	Set time (sec)	Open time (sec)	Tensile strength (MPa)	Elongation (%)
	120°C	140°C	160°C	180°C						
Aerafin 35	7375	3195	1700	1010	123.6	84	4	14	4.1	15

EXCELLENT THERMAL STABILITY OF AERAFIN 35 AT 180°C

	Aerafin 35	mPE	EVA	b-APO (propene-rich)	b-APO
Initial					
24 hr					
48 hr					
72 hr					
Comments	Slight char after 48 hours	Slight char after 24 hours	Slight char and cloudy after 24 hours	Cloudy and slight char after 48 hours	Slight char after 24 hours

IMPROVE ELONGATION

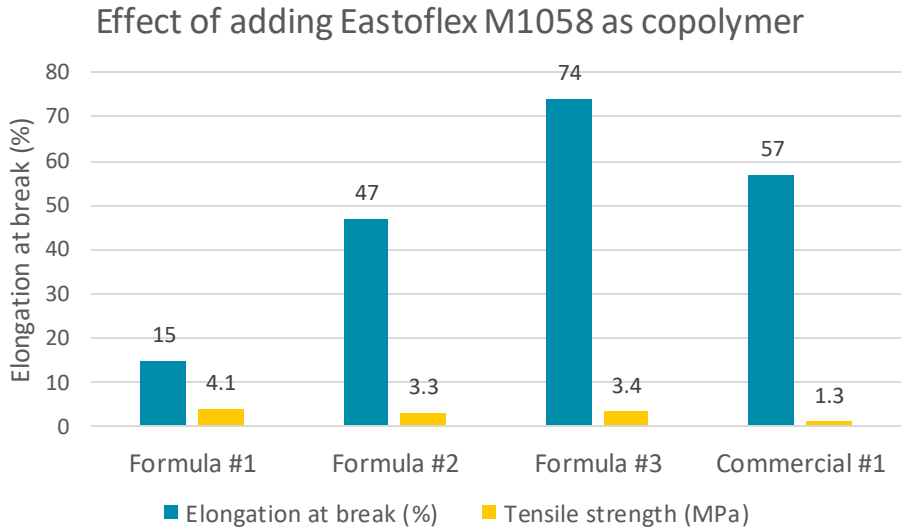
by using Eastoflex™ M1058 polyolefin polymer as copolymer

MODEL FORMULATIONS TO IMPROVE ELONGATION

by using Eastoflex M1058 as copolymer

Model formulations

FORMULA	#1	#2	#3	Commercial #1
Licocene® PE4201	10%~20%	10%~20%	10%~20%	—
Eastoflex M1058	—	25%~35%	35%~45%	—
Aerafin 35	45%~55%	15%~25%	5%~15%	—
Eastotac H130W	25%~35%	25%~35%	25%~35%	—
Antioxidant	0%~1%	0%~1%	0%~1%	—
TOTAL	100%	100%	100%	100%
Viscosity at 180°C (mPa·s)	1,010	1,230	1,305	5,600
RBSP, °C	124	139	143	140
Shore A hardness	84	88	83	70



Increasing the ratio of Eastoflex M1058 improved the elongation performance and increased the RBSP.

Benchmark with commercial adhesive:

- ✓ Lower viscosity
- ✓ Higher elongation
- ✓ Higher tensile strength

IMPROVE ELONGATION

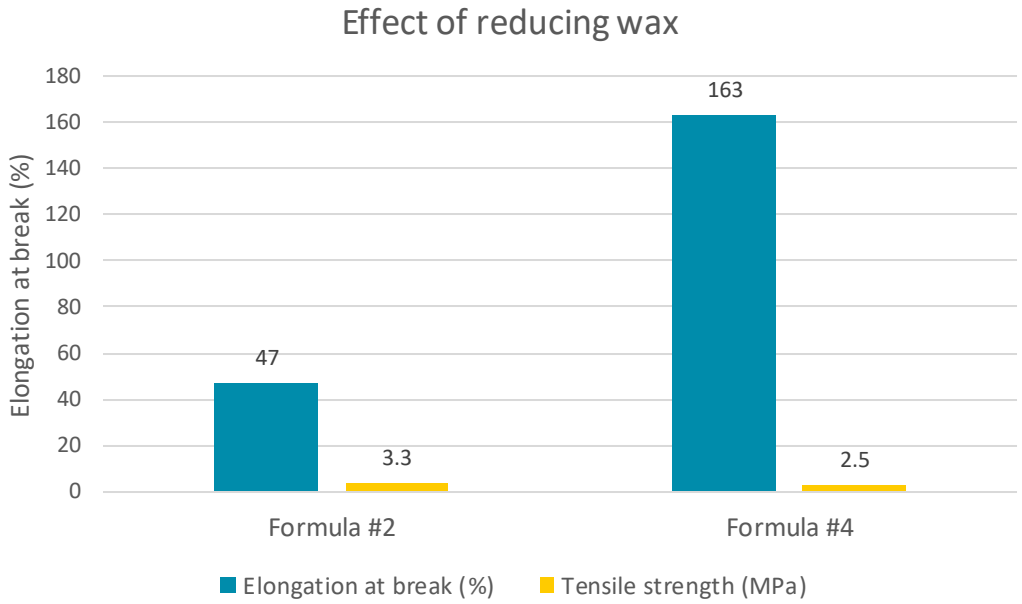
by reducing wax

MODEL FORMULATIONS TO IMPROVE ELONGATION

by reducing wax

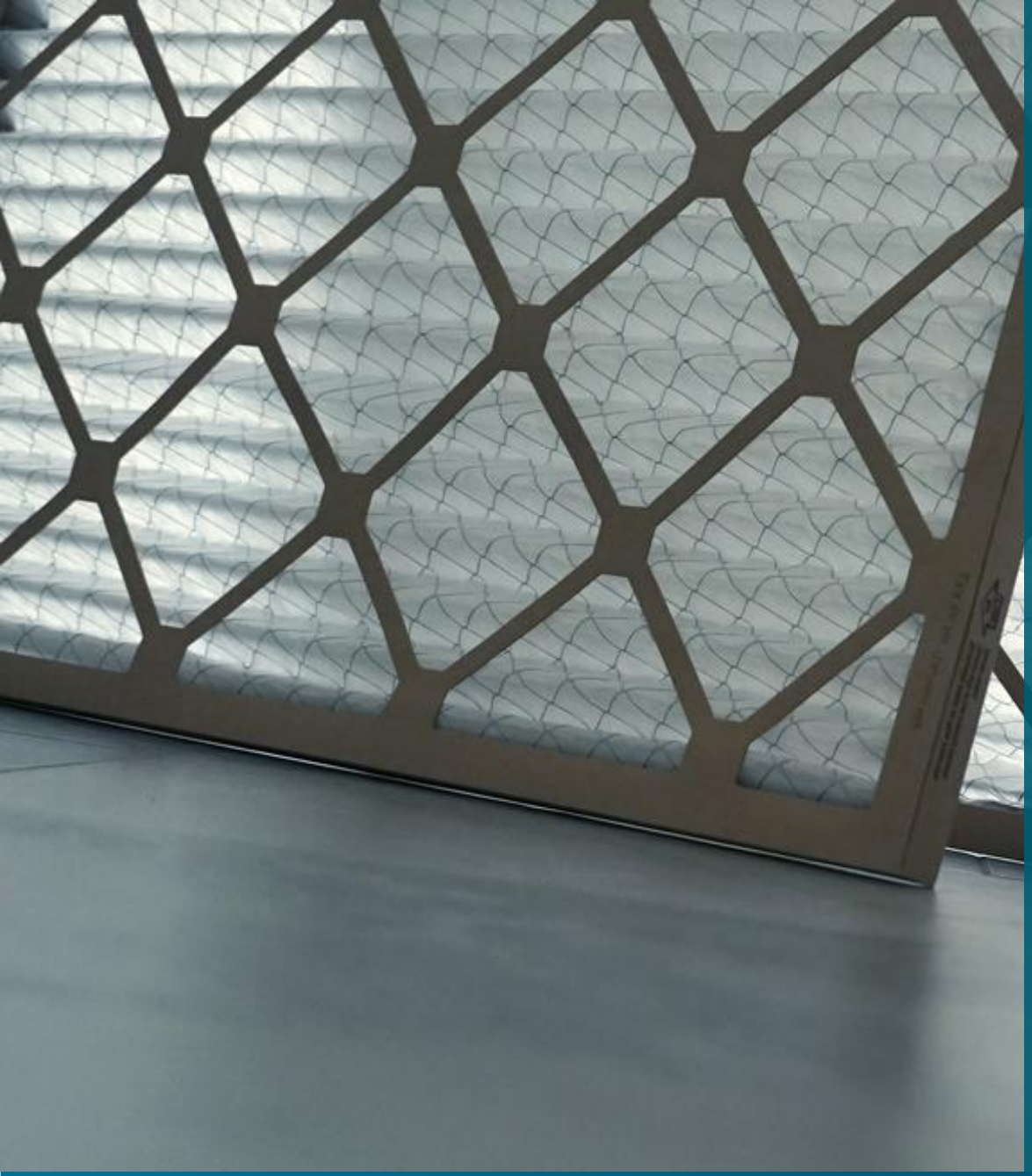
Model formulations

FORMULA	#2	#4
Licocene® PE4201	10%~20%	5%~15%
Eastoflex M1058	25%~35%	25%~35%
Aerafin 35	15%~25%	15%~25%
Eastotac H130W	25%~35%	30%~40%
Antioxidant	0%~1%	0%~1%
TOTAL	100%	100%
Tensile strength (MPa)	3.3	2.5
Elongation (%)	47	163
Open time (sec)	13	16
Set time (sec)	3	5



Reducing the wax:

- ✓ Improved the elongation performance but decreased the tensile strength
- ✓ Increased the open and set time but not significantly higher



BENEFITS FOR APO HOT MELT
for filter industry

- Reduce cost and minimize shelf-life issues
- Adhere to a variety of substrates, especially polypropylene media
- Easy to apply—roll coat, spray, bead
- Short, medium, and long open-time products to meet the application requirements
- High heat resistance—products can pass UL 94 V2.
- Excellent thermal stability
- Low odor, low VOC

Thank you!

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