

**PEBAX<sup>®</sup>**  
BY ARKEMA

A POLYMER IN MOTION™

# Pebax<sup>®</sup> elastomers





## WHAT ARE PEBAX® ELASTOMERS?

Pebax® elastomers are block copolymers that offer the best combination of performance (mechanical, chemical, processing) among thermoplastic elastomers (TPE).

### A WINNING COMBINATION

- Versatile processing
- The lightest TPE's
- Wide range of flexibility
- Outstanding physical and chemical properties

The name Pebax® is derived from its own chemistry, polyether block amide. These elastomers are plasticizer free and are available in a wide range of hardness values.

Pebax® resins can be reinforced with various fillers like glass and carbon fiber.





Pebax® resins can also be used pure, as additives, or in blends with other polymers or rubbers.



Optionally bio-based – Select grades marketed under the Pebax® Rnew® brand are partially bio-based.

## PEBAX® ELASTOMERS BRING:

### PHYSICAL PROPERTIES

-  • Lightweight
  - Typically 20% lighter than traditional polymers
  - Low density enables weight reduction without compromise
-  • Energy return
  - Extremely low energy loss compared to TPU
  - High energy transfer and minimal heat build-up
-  • Mechanical strength
  - High impact resistance
  - Fatigue resistance
  - Enduring elasticity
  - Good dimensional stability
-  • Consistent performance at low temperature
  - Maintains impact strength, energy return, and flexibility
- Soft touch/Good haptics
- Electrical conductivity (select grades)
  - Bring instantaneous and permanent antistatic properties to other thermoplastic matrices

- Selective molecule diffusion (select grades)
  - Allow a controlled release of active molecules over time (e.g. perfumes, insecticide)
  - Non-porous breathable membranes offer adjustable permeation to water vapor and gas

### CHEMICAL PROPERTIES:

Pebax® elastomers provide good chemical resistance for industrial and recreational applications

### REGULATORY COMPLIANCES:

Select Pebax® grades comply with USP Class VI and FDA/ECC regulations

### VERSATILE PROCESSING:

- Compatible with standard equipment with simple settings
  - Injection, overmolding, extrusion, rotomolding, foaming, fiber and melt spinning, more...
- Good adhesion when overmolded
- Thermoforming, coloration, welding, and decoration is possible
- Recyclable

## APPLICATIONS

<b>SPORTS</b>	Extreme lightweight performance and outstanding energy return for sports equipment including footwear components, outsoles, ski boots, and more
<b>MEDICAL</b>	Specific grades with USP Class VI compliance provide flexibility, good touch and feel, excellent processing, breathable features, kink resistance, and sterilization resistance for medical device applications
<b>INDUSTRIAL APPLICATIONS</b>	Long-life durability, cold impact performance, chemical resistance, puncture resistance (film), and unique touch and feel benefit industrial applications such as belting and gears
<b>FIBER AND NON-WOVEN</b>	Elastic stretch, chemical resistance, and good processability for fibers and non-woven fabrics
<b>PERMANENT ANTISTATIC ADDITIVE</b>	Certain grades intrinsically disperse electrostatic charges and can be added to wide variety of thermoplastic matrices to impart immediate permanent antistatic properties regardless of the relative humidity
<b>BREATHABLE MEMBRANES</b>	Hydrophilic breathable grades offer a wide range of permeation levels according to specific market requirements



# PRODUCT RANGE OVERVIEW

## STANDARD GRADES

7233, 7033, 6333, 5533, 4533, 4033, 3533, 2533

## BREATHABLE GRADES

MV 1041, MV 1074, MV 3000, MH 1657

## STABILIZATION

SA Grades: no additives  
SP Grades: UV stabilized

## BIO-BASED GRADES

Rnew® Grades: 35R53, 40R53, 55R53, 63R53, 70R53, 72R53, 80R53

## ANTISTATIC GRADES

MH Grades: 1657, 2030  
MV Grades: 1074, 2080

## General Characteristics

CHARACTERISTICS	CONDITIONS	STANDARD	UNITS	7233	7033	6333	5533	4533	4033	3533	2533
SHORE HARDNESS	Instantaneous	ISO 868/ ASTM D 2240	Shore D	69	69	64	54	46	42	33	27
			Shore A	—	—	—	—	92	90	82	77
	After 15 Seconds	ISO 868/ ASTM D 2240	Shore D	61	61	58	50	41	35	25	22
			Shore A	—	—	—	—	90	89	80	74
DENSITY		ISO 1183	g/cm <sup>3</sup>	1.01	1.01	1.01	1.01	1.01	1.00	1.00	1.00
MELTING POINT		ISO 11357/ ASTM D 3418	°C	174	172	169	159	147	160	144	134
VICAT SOFTENING POINT	Under 10 N	ISO 306/ ASTM D 1525	°C	164	164	157	142	111	131	77	58
WATER ABSORPTION AT EQUILIBRIUM	At 23°C and 50% RH	ISO 62/ ASTM D 570	%	0.7	0.7	0.7	0.7	0.4	0.5	0.4	0.4
WATER ABSORPTION SATURATION	24h in Water at 23°C	ISO 62/ ASTM D 570	%	0.9	0.9	1.1	1.2	1.2	1.2	1.2	1.2
MELT INDEX	235°C / 1kg	ISO 1133/ ASTM D 1238	g/10 mn	4	6	5	7	9	9	8	10
LINEAR COEFFICIENT OF THERMAL EXPANSION	From -40°C to +140°C	ASTM D 696	10 <sup>-5</sup> /°C	12	16	14	17	20	20	21	16
SURFACE RESISTIVITY		IEC 60093/ ASTM D 257	Ohm/sq	>10 <sup>12</sup>							
VOLUMIC RESISTIVITY			Ohm.cm								



## Rubber Materials Tests

CHARACTERISTICS	CONDITIONS	STANDARD	EQUIVALENT	UNITS	7233	7033	6333	5533	4533	4033	3533	2533	
TENSION SET TO OBTAIN EXTENSION OF	10%	v = 500 mm/min	ASTM D 638	MPa	28.7	21.6	14.2	10.0	5.5	5.1	1.6	1.1	
	50%				25.0	21.8	16.6	13.2	9.1	8.9	4.6	3.2	
	100%				24.8	21.1	16.9	13.6	9.1	10.5	5.8	4.2	
TENSION SET UNDER	5%	v = 500 mm/min	ISO 2285	ASTM D 412 (method A)	kN/m	194	177	147	135	115	116	78	66
	10%					2.4	1.9	1.5	1.5	1.2	1.2	0.7	0.5
	15%					4.2	3.8	3.3	2.9	2.3	2.1	0.9	0.8
	20%					6.6	5.8	5.1	4.6	3.3	3.1	1.4	0.9
TEAR RESISTANCE	Unnotched	ISO 34-1	ASTM D 624		194	177	147	135	115	116	78	66	
	Notched				166	149	127	106	77	85	50	44	
TABER ABRASION RESISTANCE	H18 / load 1kg / 1000 rotations	ISO 9352		mm	54	59	60	62	60	62	77	99	
ABRASION RESISTANCE	10 N / 40 m	ISO 4649	DIN 53516	mm <sup>3</sup>	—	—	55	47	40	48	64	130	
RESILIENCE		ISO 4662	DIN 53512	%	—	—	53	57	58	66	69	70	
COMPRESSION SET UNDER DEFORMATION OF 25%	70h at 23°C	ISO 815		%	—	—	47	43	37	32	22	19	
COMPRESSION SET UNDER LOAD OF 9.3 MPA	22h at 70°C			%	—	—	5	10	—	21	54	62	
RESISTANCE TO CRACKING BY REPEATED FLEXURE	20°C – 100000 flex	ISO 133	ISO 133	mm	—	—	5	3	—	2	2	2	
	-20°C – 50000 flex				—	—	14	9	—	4.5	2.5	2.5	

## Plastic Materials Tests

CHARACTERISTICS	CONDITIONS	STANDARD	UNITS	7233	7033	6333	5533	4533	4033	3533	2533
FLEXURAL MODULUS		ISO 178	MPa	513	390	285	170	86	77	21	12
		ASTM D 790	MPa	518	379	278	164	93	81	20	14
TENSILE MODULUS		ISO 527	MPa	522	384	280	161	81	71	18	10
		ASTM D 638	MPa	521	383	287	160	79	74	20	10
TENSILE – STRESS AT YIELD	= 50 mm/min	ASTM D 638 type IV	MPa	26	22	18	12	—	—	—	—
TENSILE – STRAIN AT YIELD			%	18	20	22	25	—	—	—	—
TENSILE – STRESS AT BREAK			MPa	56	54	53	52	42	40	39	32
TENSILE – STRAIN AT BREAK			MPa	>300	>350	>350	>450	>550	>450	>600	>750
IMPACT STRENGTH* (IZOD) AT + 23°C	unnotched	ASTM D 256	J/m	1380 <sup>p</sup>	969 <sup>p</sup>	607 <sup>p</sup>	N	N	N	N	N
	notched		192 <sup>c</sup>	847 <sup>p</sup>	554 <sup>p</sup>	N	N	N	N	N	
IMPACT STRENGTH* (IZOD) AT - 40°C	unnotched	ASTM D 256	J/m	2460 <sup>p</sup>	2345 <sup>p</sup>	1589 <sup>p</sup>	1589 <sup>p</sup>	N	N	N	N
	notched		50 <sup>c</sup>	50 <sup>c</sup>	11 <sup>c</sup>	1038 <sup>p</sup>	N	N	N	N	
IMPACT STRENGTH* (CHARPY) AT + 23°C	unnotched	ISO 179	kJ/m <sup>2</sup>	N	N	N	N	N	N	N	N
	notched		15 <sup>c</sup>	120 <sup>p</sup>	N	N	N	N	N	N	
IMPACT STRENGTH* (CHARPY) AT - 30°C	unnotched	ISO 179	kJ/m <sup>2</sup>	N	N	N	N	N	N	N	N
	notched		10 <sup>c</sup>	10 <sup>c</sup>	20 <sup>c</sup>	N	N	N	N	N	

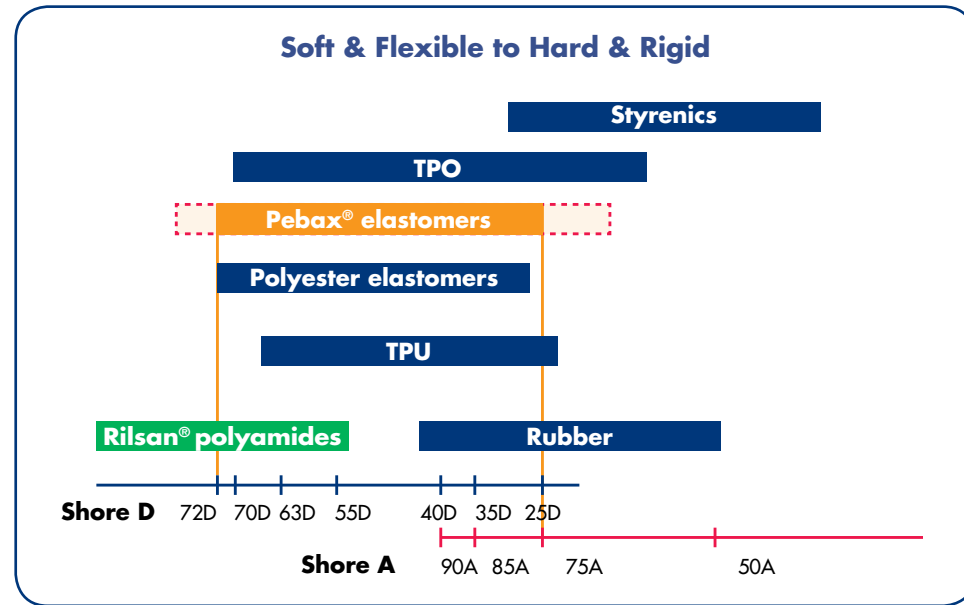
\* = conditioned sample; C = complete break; P = partial break; N = no break

# MEDICAL APPLICATIONS



Select Pebax® MED grades are used in medical applications like catheters, PVC-free tubing and medical gowns.

- Most balanced PEBA range
  - The Pebax® MED range has a wide variety of rigid, semi-rigid, and flexible grades for medical applications. Pebax® MED grades have undergone testing in accordance with certain portions of the USP class VI and/or ISO 10993 standards. Contact us for more details.
- See Arkema's medical device policy at [ark.ma/medPolicy](http://ark.ma/medPolicy)



## Pebax® MED Range

GRADES	DENSITY (G/CM <sup>3</sup> ) ISO 1183	MELTING POINT (°C)	SHORE D HARDNESS ISO 868		FLEXURAL MODULUS (MPa) ISO 178
			INSTANTANEOUS	AFTER 15 SEC	15 DAYS @ 23°C, 50% RH
PEBAX® 2533 SA 01 MED	1.00	134	27	22	12
PEBAX® 3533 SA 01 MED	1.00	144	33	25	21
PEBAX® 4033 SA 01 MED	1.00	160	42	35	77
PEBAX® 4533 SA 01 MED	1.01	147	46	41	86
PEBAX® 5533 SA 01 MED	1.01	159	54	50	170
PEBAX® 6333 SA 01 MED	1.01	169	64	58	285
PEBAX® 7033 SA 01 MED	1.01	172	69	61	390
PEBAX® 7233 SA 01 MED	1.01	174	69	61	513
			SURFACE RESISTIVITY (OHM/SQ) IEC 60093		VOLUME RESISTIVITY (OHM.CM) IEC 60093
					REFRACTIVE INDEX
PEBAX® MV 1074 SA 01 MED*	1.07	158	3 109	12.5 109	1.502

\*Main Applications: Permanent antistatic additive/Breathable membranes

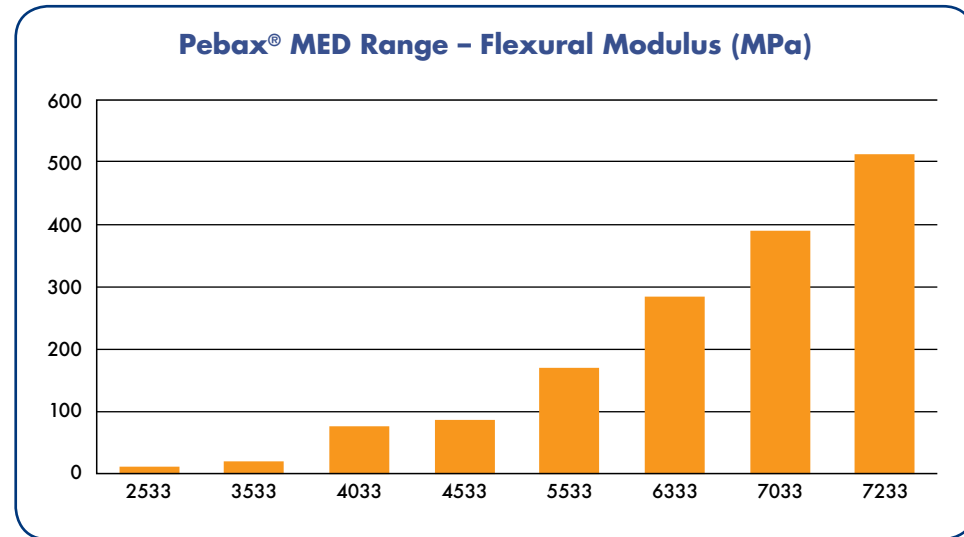
## SOLUTIONS

### APPLICATIONS

- Catheter
- PVC-free tubing
- Films
- Monofilament

### KEY BENEFITS

- Softness and flexibility
- Elastic/shape memory
- Kinking resistance
- Torque transfer
- Low coefficient of friction
- Resistance to pressure
- Can be compounded with radiopaque fillers
- Can be used in co-extrusion with TPU
- Breathable and antistatic properties (MV 1074 SA 01 MED)
- Good compromise between strength and softness
- Relatively consistent modulus vs. temperature
- Sterilization feasibility
- Bondable by adhesives or RF welding





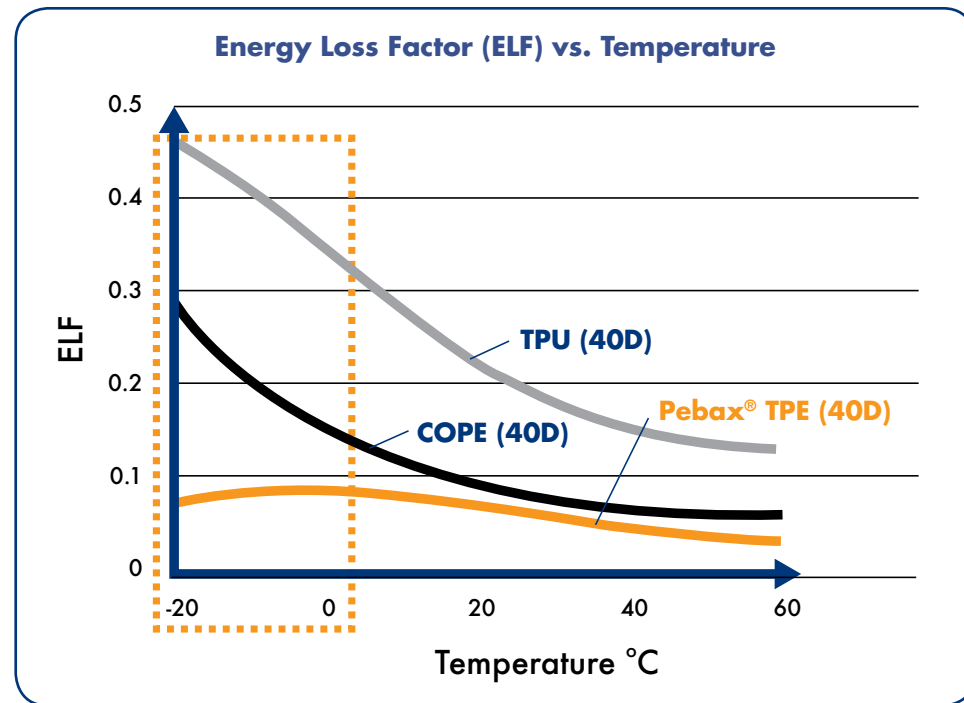
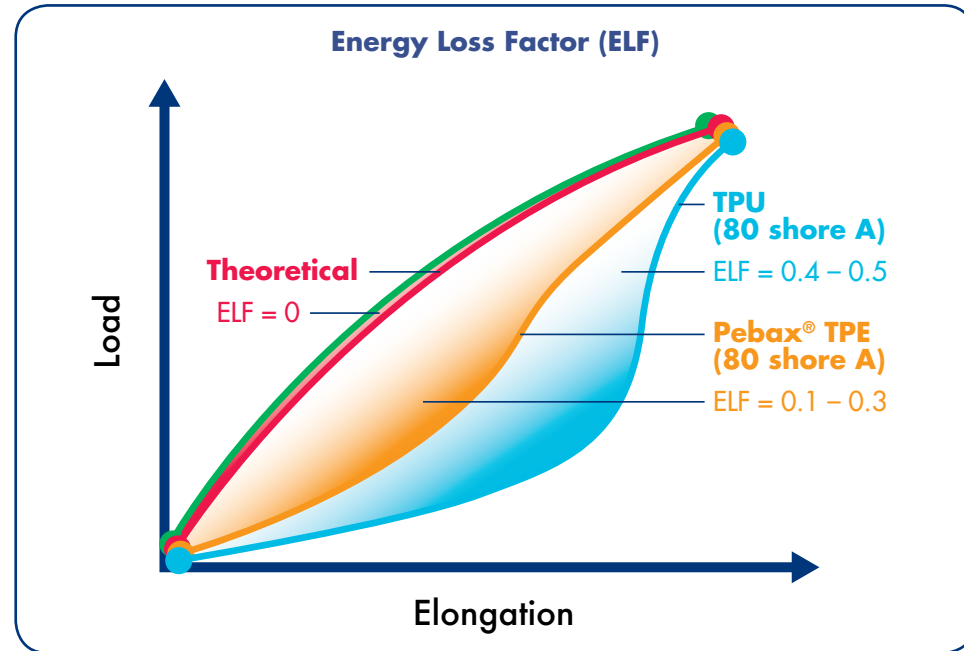
# INDUSTRIAL THERMOPLASTIC ELASTOMERS



Industrial grade Pebax® elastomers exhibit enduring elasticity, fatigue resistance, and cold temperature performance among other benefits. Some common industrial applications include films, belting, silent gears, wires, and cables.

## FOCUS: ENERGY RETURN

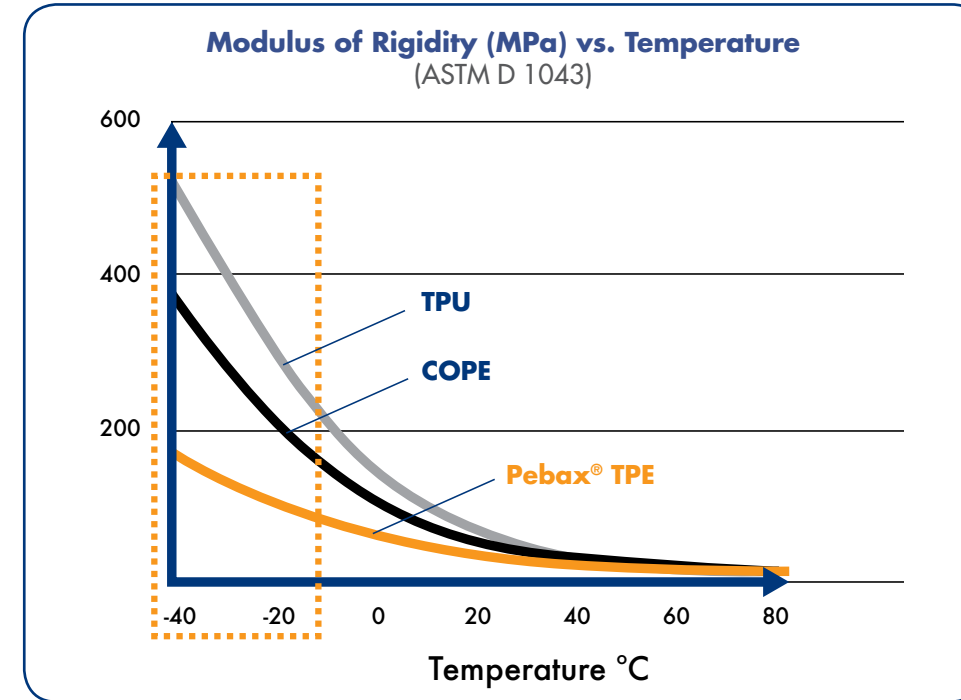
Generally, energy is lost during a cyclic mechanical stress of a material. This energy loss is a function of the material's modulus and what we call its energy loss factor (ELF). The microstructure of Pebax® resins contributes to its very low ELF when compared to other thermoplastic elastomers like TPU, as shown in the graphs below.



For industrial belts and silent gears the lower hysteresis (higher energy return) of Pebax® resins can translate into higher speed and frequencies of use and even subsequent energy savings through better power transmission and low heat buildup.

## FOCUS: CONSISTENT PERFORMANCE AT LOW TEMPERATURE

Thanks to the low glass transition temperature of its polyether phase, the energy loss factor of Pebax® resins remain low even in sub-zero environments. This allows Pebax® elastomers to maintain flexibility and display almost no increase of elastic modulus compared to other materials at sub-zero temperatures that experience cold stiffening.

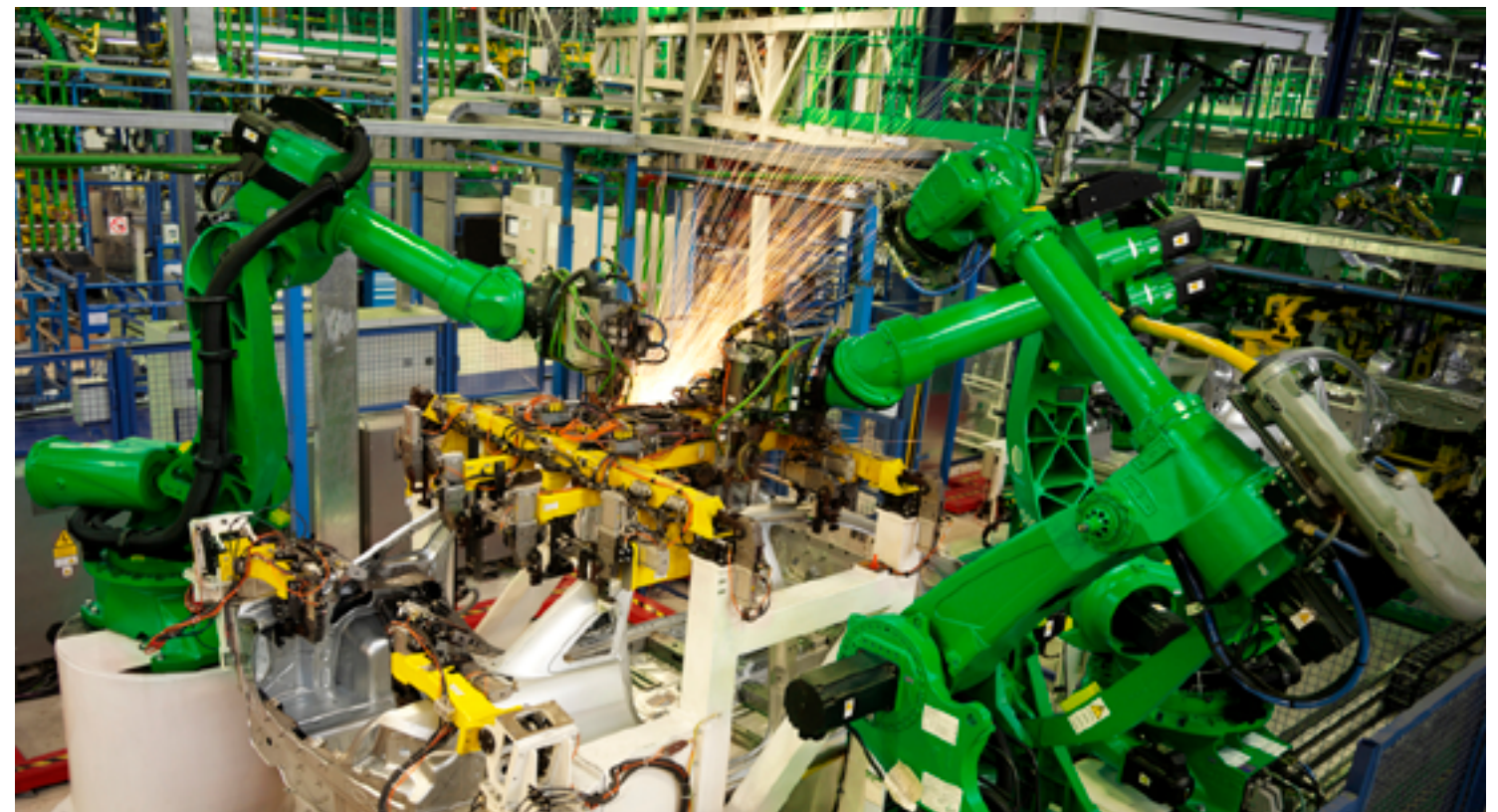


## ADVANTAGES OF USING PEBAX® ELASTOMERS

The PolyEther Block Amide (PEBA) structure of Pebax® elastomers include a rigid polyamide block and soft polyether block that enable outstanding dynamic properties like flexural fatigue resistance and high energy return (low hysteresis). Even at low temperatures, Pebax® resins maintain flexibility and energy return while also maintaining strong mechanical properties like impact strength, making these resins an excellent choice for applications requiring durability after cyclic motions at varying temperatures.

## KEY BENEFITS

- Lightweight
- High energy return (low hysteresis)
- Maintains high performance at very cold temperatures
- Flex fatigue resistance
- Low vibration and noise
- Dimensional stability
- Wear resistance
- Easy processing





# ELASTOMERS FOR SPORTS EQUIPMENT



## EXTREME PERFORMANCE SOLUTIONS FOR EXTREME ATHLETES

Pebax® elastomers have a wide range of flexibilities, from rigid polyamide-like to soft rubber-like grades. This allows Pebax® resins to be utilized in a wide variety of applications like running shoes, ski boots, and protective gear.

### KEY BENEFITS

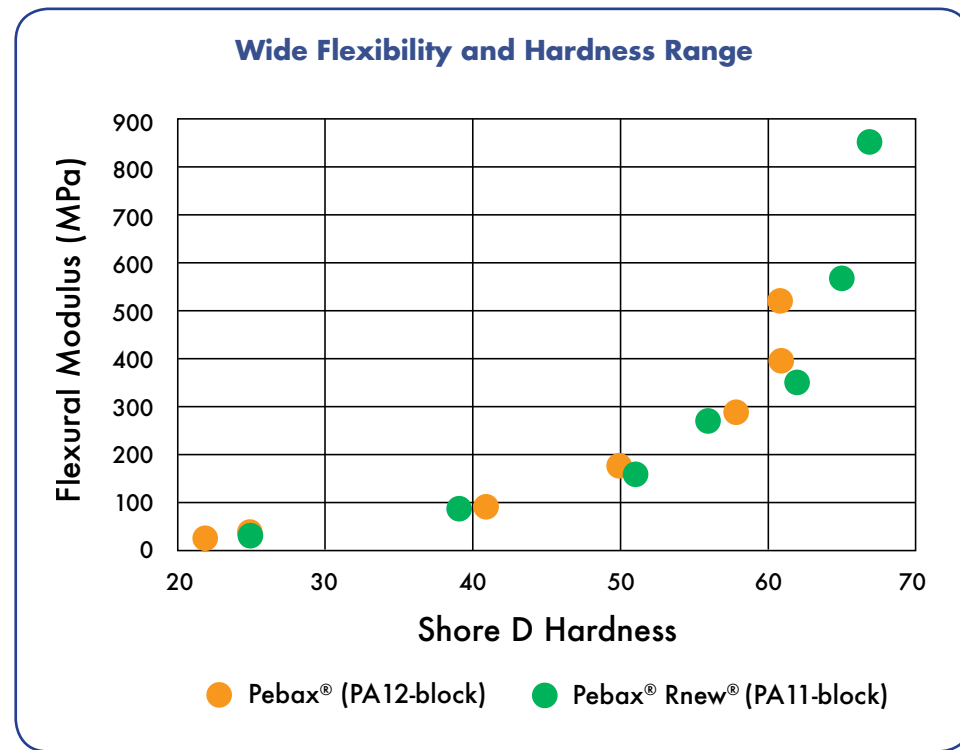
- Lightweight
- High energy return
- Flex fatigue resistance
- Cold temperature performance
- Shock/Impact resistance
- Easy processing and overmolding

### APPLICATIONS

- Athletic shoes and cleats
- Golf balls and putter face
- Ski boots, skis, other winter sports equipment
- Bicycle parts
- Protective gear (e.g. helmet, shin guards)
- Wearable devices

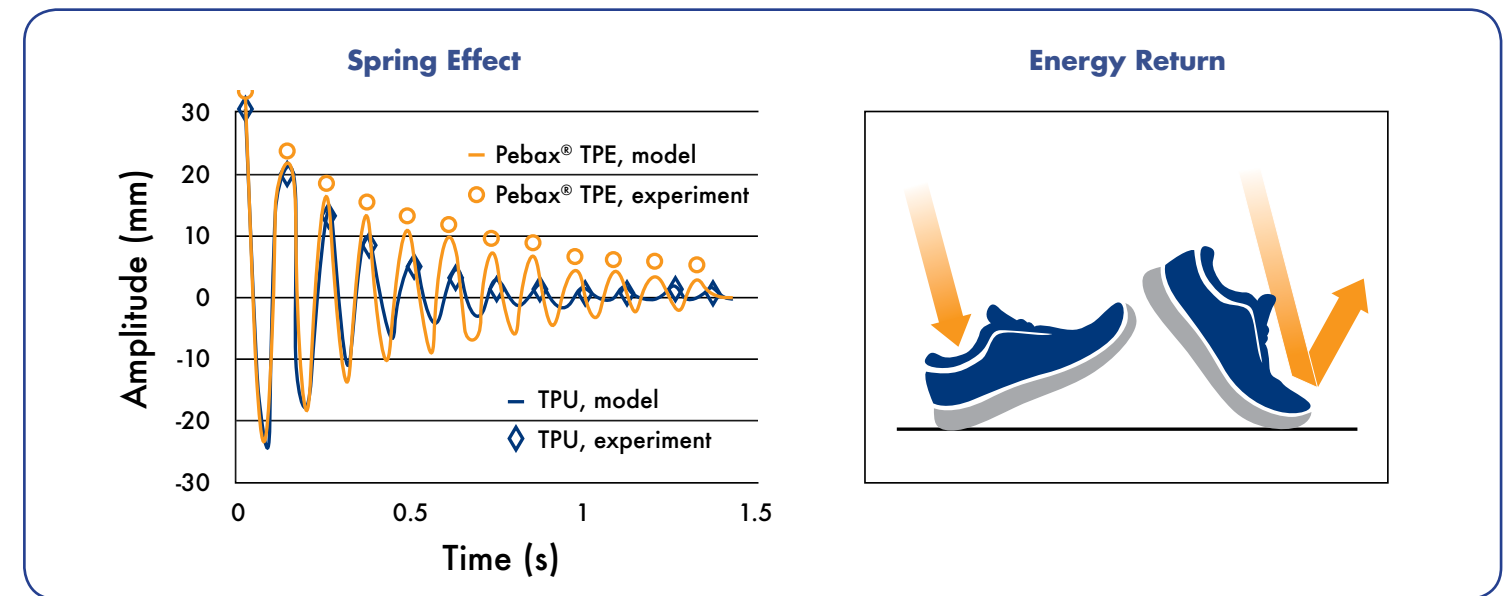
## SOFT AND FLEXIBLE TO HARD AND RIGID

Maximum strength where you need support, flexibility where you need movement. Pebax® grades can also be combined within a single component to provide stiffness at one end and flexibility at the other.



## EXCEPTIONAL ENERGY RETURN

Pebax® resins have the lowest energy loss factor of all thermoplastic elastomers, with the best energy return and an unbeatable flex fatigue resistance. In fact, the shoes worn by all medalists in the marathon event in Rio De Janeiro contained Pebax® elastomers.



## LIGHTWEIGHT MATERIALS THAT PACK A PUNCH

Pebax® resins have a very low density that enable the design of lighter parts. This benefit is ideal for outsoles, offering resilience to repeated stress, along with resistance to distortion and deformation. Using Pebax® resin can reduce the plastic component weight by 20%, and even more with Pebax® Foam.

POLYMER TYPE/DENSITY (g/cm³)	PEBAX® ELASTOMERS	POLYESTER ELASTOMERS (COPE)	THERMOPLASTIC URETHANES (TPU)
SOFT GRADES	1.01	1.18 - 1.20	1.21 - 1.25
RIGID GRADES	1.02	1.22 - 1.26	1.25 - 1.26

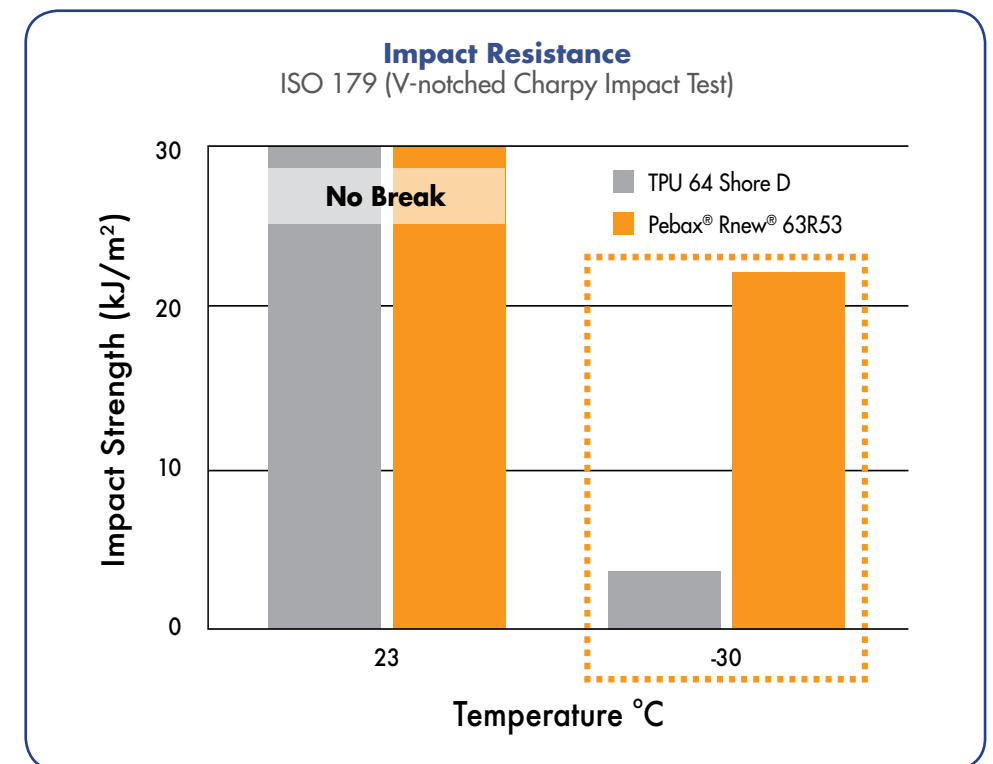
Many sports applications like cleated footwear demand materials with very high strength and increased rigidity. Glass Fiber and Carbon Fiber filled grades are available to improve strength, rigidity, and in the case of Carbon Fiber, maintain lightness.

FILLED GRADES	FILLER	FLEXURAL MODULUS (MPA)
BZM7 0 TL	Glass Fiber	1500
BZM8 0 T3L	Glass Fiber	2200
ASR13	Carbon Fiber	7200
BSR30	Carbon Fiber	11000
BZM30	Glass Fiber	56000



## WINTER SPORTS – LOW TEMPERATURE PERFORMANCE

Unlike fingers and toes, Pebax® resins do not stiffen in cold weather. Applications like ski boots designed with Pebax® elastomers retain their mechanical properties (strength and impact resistance) and resilience in frigid conditions (-40°C). The Ross Flex machine proves it too: all Pebax® grades can withstand more than 280,000 cycles down to -20°C and some grades more than 50,000 cycles at -40°C.



# PERMANENT ANTISTATIC ADDITIVES



## SOLVING STATIC CHARGE PROBLEMS WITH ANTISTATIC PEBAX® RESINS

Very fast charge decay can damage sensitive electronic components while very slow charge decay can create dust attraction forces and uncontrolled Electrostatic Discharge (ESD events). Select Pebax® grades may be used as permanent (non-fugitive) antistatic additives, producing an excellent compromise.

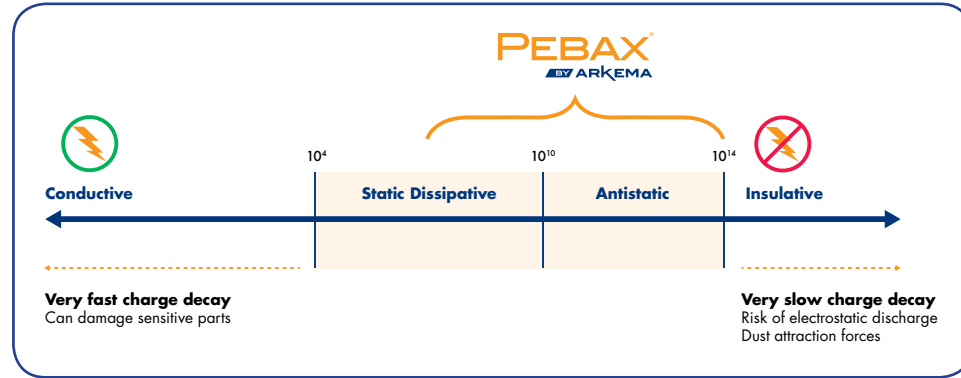
### KEY BENEFITS

As an additive, Pebax® resins can impart permanent antistatic properties in polymer matrices. The antistatic properties are effective immediately and can withstand a broad range of environmental conditions.

- Immediate and permanent antistatic
- Humidity independent
- Maintain colorability of the matrix
- Maintain the physical properties of the matrix
- No sloughing, offgassing or blooming

### APPLICATIONS

- Electronics packaging and components
- Storage containers
- Copy machines, printers
- Clean-room and anti-dust applications
- Fibers



## RANGE OVERVIEW AND COMPATIBLE MATRICES

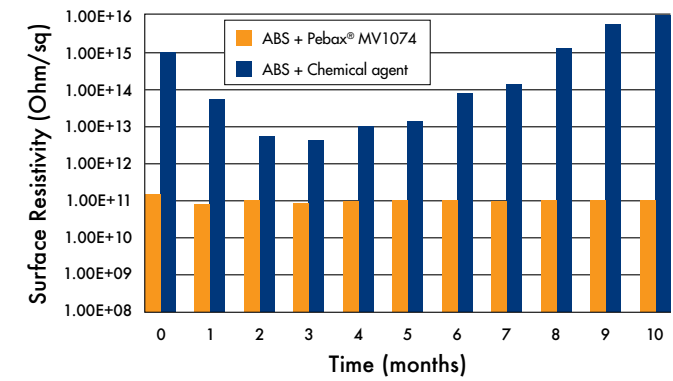
Pebax® antistatic additives are delivered in pellet form and can be added to a wide range of polymer matrices either by dry blending or compounding. A compatibilizer may be required depending on the host matrix.

	PE	PP	ABS, PS, HIPS	PMMA	PA
MV 1074 MV 2080	Injection Molding 10 - 20%	Injection Molding 10 - 20%			Injection Molding 10 - 20%
MH 1657 MH 2030	Injection Molding 10 - 20%	Injection Molding 10 - 20%	Injection Molding Sheet Extrusion 10 - 25%		Injection Molding 10 - 20%
30R51				Injection Molding Sheet Extrusion 10 - 20%	

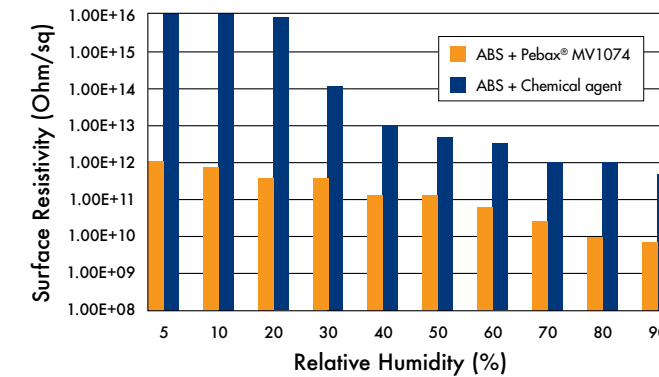
## PERMANENT ANTISTATIC ADDITIVES (PEBAX® RESIN) VS TEMPORARY CHEMICAL ANTISTATIC AGENTS

The graphs illustrated below show the evolution of surface resistivity in ABS matrix with Pebax® polymer additives compared to chemical antistatic agents. The addition of Pebax® resin results in immediate and permanent antistatic properties nearly independent of atmospheric relative humidity.

### Surface Resistivity vs. Time (ASTM D257)



### Surface Resistivity vs. Relative Humidity in the air (ASTM D257)



## General Properties

CHARACTERISTICS	CONDITIONS	STANDARD	UNITS	PEBAX® MV 1074	PEBAX® MV 2080	PEBAX® MH 1657	PEBAX® MH 2030	PEBAX® RNEW® 30R51
SHORE D HARDNESS	Instantaneous	ISO 7619-1	—	40	40	40	40	30
DENSITY		ISO 1183	g/cm <sup>3</sup>	1.07	1.07	1.10	1.14	1.10
MELTING POINT	10°C/min	ISO 11357-1/-3	°C	158	160	204	200	150
REFRACTION INDEX	23°C	ISO 489	—	1.502	1.502	1.508	1.508	1.490
SURFACE RESISTIVITY		IEC 60093	Ω/m <sup>2</sup>	3.10 <sup>9</sup>	10 <sup>7</sup>	1.10 <sup>9</sup>	10 <sup>7</sup>	1.10
RECOMMENDATIONS				For Matrices With T <sub>m</sub> <180°C Ex: HDPE, LDPE, PP, PMMA, POM, PC/ABS		For Matrices With T <sub>m</sub> >180°C Ex: PA6, ABS, PS, HIPS, PC/ABS		For Transparent PMMA / Indoor Applications



# BREATHABLE FILMS

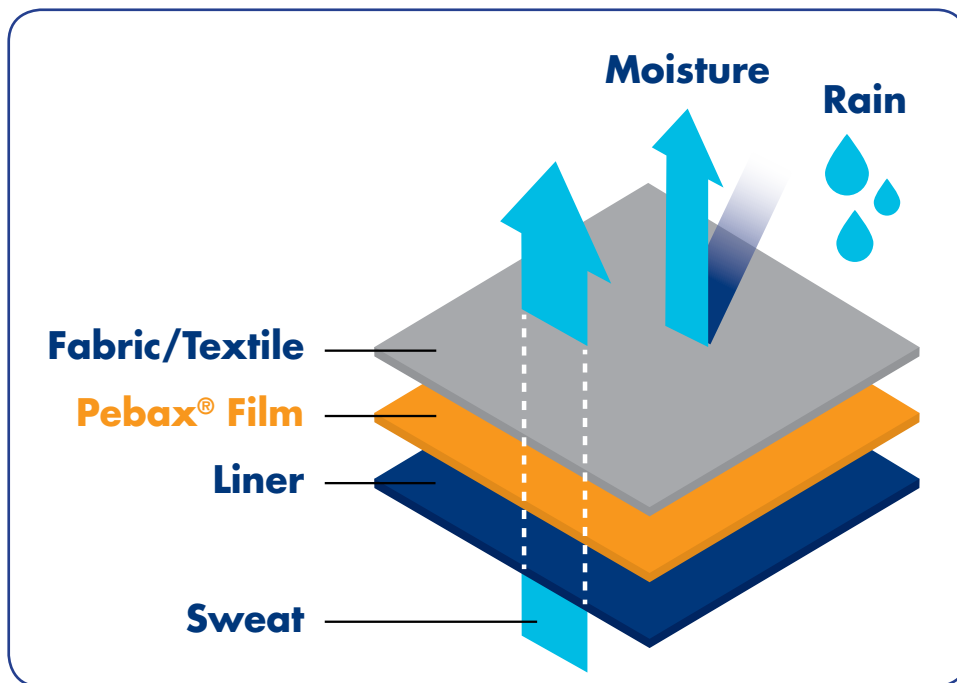
## BREATHABLE, WATERPROOF FILMS

When extruded into a thin film or laminated onto a substrate, select hydrophilic Pebax® grades offer excellent permeability to moisture vapor while remaining waterproof and creating an excellent barrier layer to molds and mildews. These Pebax® resins can be laminated onto synthetic nonwovens, wovens, or textiles with the help of functional polyolefins, and may not require any additional adhesives or bonding agents to adhere to these substrates.

## KEY BENEFITS

Through their unique copolymer structure, hydrophilic Pebax® grades offer a combination of mechanical strength, breathability, and ease of processing. Unlike microporous products, the monolithic structure of these Pebax® films are a barrier to water and bacteria and exhibit a high level of MVTR (Moisture Vapor Transmission Rate). Each of these advantages make breathable Pebax® resins the material of choice in many applications such as construction house-wrap films, breathable textiles for sports, packaging, and selective membranes.

- Waterproof barrier
- Breathability
- High and adjustable MVTR
- Lightweight
- Excellent toughness and tear resistance
- Flexibility



## PROCESSING BREATHABLE GRADES

Breathable Pebax® grades can be extruded into a very thin monolithic film (down to 1.5 microns) or laminated onto a wide variety of substrates (e.g. wovens, non wovens, textiles) offering excellent adhesion for structural integrity. These grades can also be used with compatibilizing resins (functional polyolefins) to adjust their breathability to different levels suitable for a wide range of applications and environments. This design flexibility allows laminators and builders to design a wide range of breathable products.

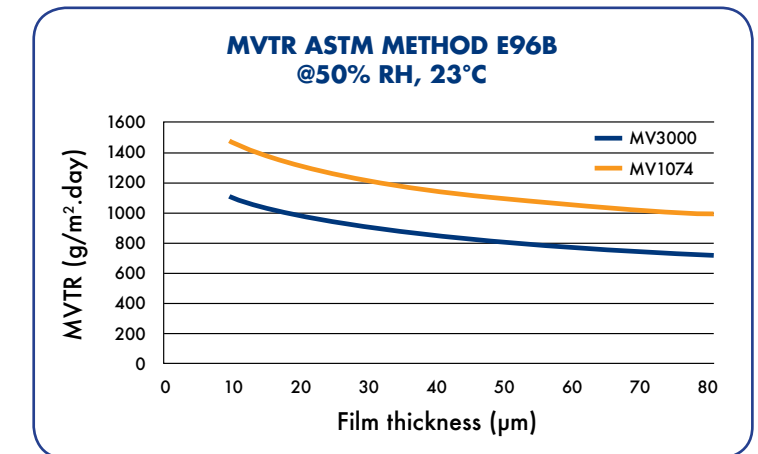
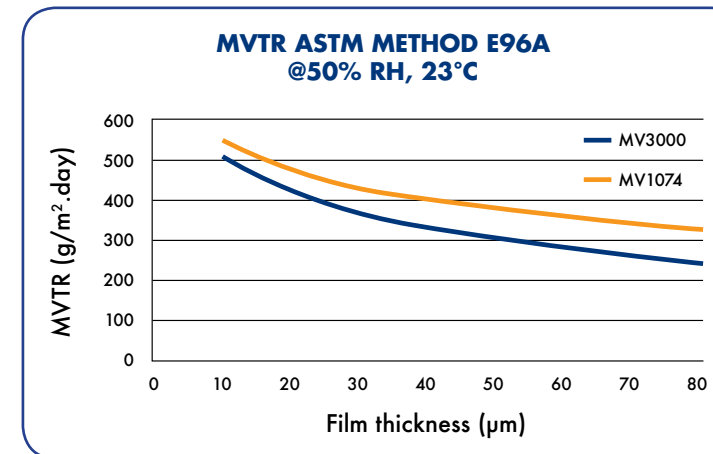
## APPLICATION FOCUS: MONOLITHIC HOUSEWRAP

High MVTR allows monolithic house-wrap to breathe easily so the moisture vapor behind it does not turn into condensation that potentially leads to molds and mildews in the walls. The water resistance of hydrophilic Pebax® grades enable the housewrap to protect the housing structures from water-related failures. Tear resistance is also key as during installation, house-wrap is prone to tearing damages at the jobsite. A very durable and tear resistant film can make it easier for the construction workers to wrap the house more efficiently and safely.



## BREATHABILITY – MVTR DATA

Breathability can be described as the Moisture Vapor Transmission Rate (MVTR) and it represents the amount of water vapor that passes through a film or structure over a period of 24 hours. It is measured per ASTM E96 A/B/BW/E methods in g/m<sup>2</sup>/day at 50% or 90% RH and at 23°C or 38°C. Depicted in the graphs below, select Pebax® grades offer high levels of MVTR under different conditions.



## General Characteristics: Breathable Grades

CHARACTERISTICS	CONDITIONS	STANDARD	UNITS	PEBAX® MH 1657	PEBAX® MV 1074	PEBAX® MV 1041	PEBAX® MV 3000
SHORE D HARDNESS	Instantaneous	ISO 7619-1	—	40	40	30	35
DENSITY		ISO 1183	g/cm <sup>3</sup>	1.10	1.07	1.10	1.02
MELTING POINT	10°C/min	ISO 11357-1/-3	°C	204	158	150	158
WATER ABSORPTION AT EQUILIBRIUM	(23°C, 50% HR)		%	4.5	1.4	0.9	1
MVTR	23°C, 501% HR, 15µm Film	Method A	g/m <sup>2</sup> · 24h	570	530	320	460





# ACTIVE MOLECULES, FRAGRANCE CARRIER



## SELECTIVE DIFFUSION

A common challenge in the active molecule and fragrance carrier industry is uniform distribution of fragrance and controlling the rate of release of the scent. The block amide-ether structure of Pebax® polymers can enable the absorption and controlled release of volatile molecules like fragrances, oils, and even insecticides at just the right rate over extended periods of time.

## APPLICATIONS

- Air fresheners
- Aroma candles
- Fire-less candles
- Toilet cleaners
- Dishwasher tables
- Scented/flavored dental floss
- Insect repellants
  - Wearable, non-wearable, livestock tags, pet collars

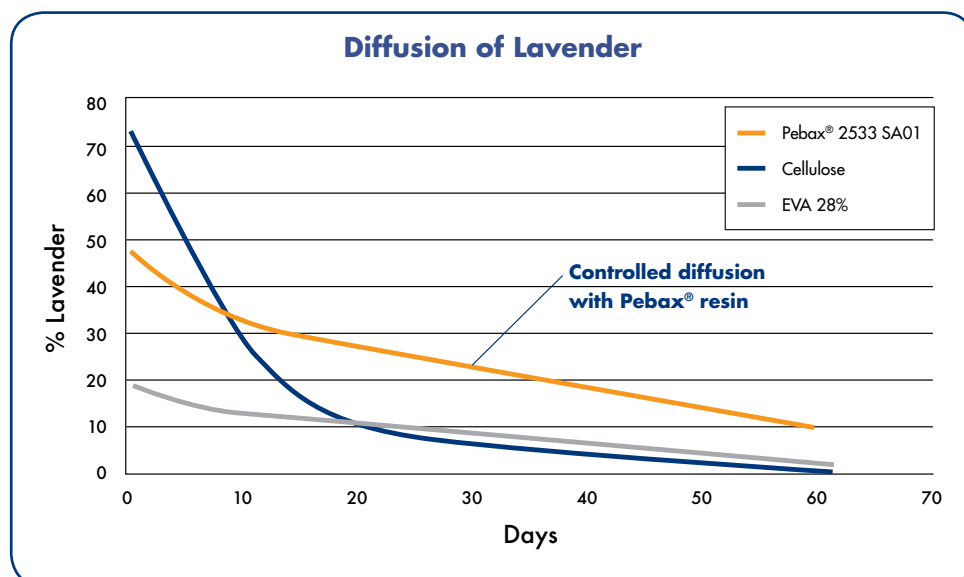
## KEY BENEFITS

- Selective absorption
  - Polyether phase accepts many volatile molecules
  - Good absorption up to 50%
- Controlled release
  - Manipulate diffusion with wall thickness and temperature
  - Very good retention of fragrance properties
- Strong mechanical structure
  - Preserved by the polyamide block
  - Maintain the integrity of the finished part
- Low melting point
  - Molding and extrusion without degrading the fragrance substances
- Easy processing
  - Save time and money with more efficient processing

## FOCUS – ABSORPTION AND DIFFUSION PROPERTIES

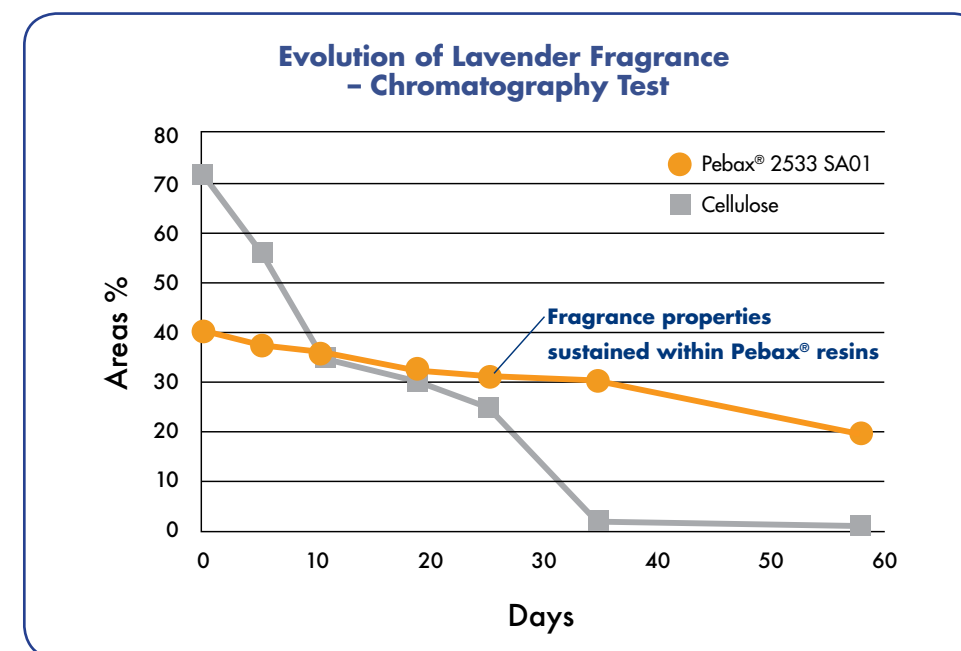
While materials like cellulose might absorb much more fragrance than Pebax® polymers at first, the scent is quickly diffused leaving the consumer with a potent wakeup call in the first days, but also the responsibility to replace their air freshener much more frequently. Pebax® 2533 SA01 exhibits a controlled release curve, providing a much better user experience.

REFERENCE	PEBAX® 2533 SA01	CELLULOSE	EVA 28%
% LAVENDER ABSORPTION	50	70	20
% LAVENDER AFTER 60 DAYS	11	3	2



## FOCUS – CONSISTENT SUBSTANCE RELEASE

Using chromatography methods, the evolution of a particular fragrance can be measured (answering the question, does the fragrance smell the same as it did 50 days ago?). The graph below illustrates how a cellulose carrier can affect the olfactory notes of perfumes like lavender. Contrary to a cellulose support, Pebax® 2533 SA01 allows for a consistent diffusion at a consistent rate, while maintaining the integrity of the scent.



## PROCESSABILITY

Pebax® 2533 SA01 pellets can be impregnated before melt processing through dry-blending with the volatile substances. The low melting point (134°C) allows for injection molding and extrusion of the polymer without degradation of volatile substances. Standard conditions of processing and coloration may also be used, although lower processing temperatures are recommended to avoid modification of the volatile substances.



# PROCESSING AND HANDLING



## MANY PROCESSING OPTIONS

Pebax® resins have excellent processability in each of the major thermoplastic processing technologies:

- Injection molding
- Extrusion (e.g. cast film, blown film, sheet, tube)
- Assembly process: overmolding and coextrusion

## HANDLING AND STORAGE RECOMMENDATIONS

- For unopened bags, resins are ready-to-use without re-drying
- Storage temperature should be less than 40 - 50°C and avoid high humidity
- Heated hoppers are not necessary when processing Pebax® resin
- To avoid condensation, store bags in the workshop 24 hours prior to processing
- Avoid using pellets from bags that have been open for longer than 2 hours
- During trials, manually close the bags after feeding the hopper to avoid moisture uptake
- After a one-day trial, reseal the bag before re-using the next day
- Shelf life is 2 years from the date of delivery in properly sealed and stored conditions

## DRYING CONDITIONS

Pellets exposed to atmospheric conditions for more than 2 hours should be dried before processing (see table below). Place the granules onto a clean flat metallic tray for efficient drying. Arkema highly recommends using vacuum drying ovens because the absence of oxygen allows for higher temperatures, which saves time. Desiccant dryers are also efficient with regularly changed filters. Risk of oxidation is increased with forced-air circulation ovens.

GRADES		7233	7033	6333	5533	4033	3533	2533
HOT AIR OVEN OR VACUUM OVEN	TEMPERATURE (°C)	70 - 80	70 - 80	65 - 75	65 - 75	60 - 70	55 - 65	55 - 65
	DURATION (hr)	4 - 6	4 - 6	5 - 7	5 - 7	6 - 8	6 - 8	6 - 8

## INJECTION MOLDING

The rheological behavior of Pebax® resins allow for:

- A wide range of processing temperatures compared to other thermoplastic elastomers (especially TPU)
- Ability to inject extremely thin parts (down to 0.8 mm)
- Short cycle times
- High recyclability
- Accurate dimension control

## RECOMMENDATIONS

- Residence time: < 10 min
- Injection volume: 25 - 80% of total shot capacity
- Compression rate: 2.2 - 2.8
- L/D: 18 - 22
- Correct check-valve
- Shrinkage rate: 0.5 - 1.5%
  - Varies depending on the grade chosen and on the injection conditions

## MOLDING CONDITIONS

### Melt Temperature (°C)

GRADES	7233	7033	6333	5533	4033	3533	2533
MINIMUM	230	230	230	200	200	180	180
RECOMMENDED	260	260	260	240	240	210	210
MAXIMUM	290	290	290	270	270	240	240

### Mold Temperature (°C)

GRADES	FILLED GRADES	RIGID GRADES (5533→7233)	SOFT GRADES (2533→4033)
RECOMMENDED	40 - 60	25 - 60	10 - 30

## DRY-BLENDING COMPATIBILITY

With an extensive flexibility and hardness range, Pebax® polymers are suitable for a variety of applications. It is possible however, to mix various grades of Pebax® in order to achieve specific properties. Arkema technical experts will be pleased to assist you in selecting the Pebax® blend that will meet your specification criteria.

## OVERMOLDING

Insert molding offers a countless combination of possibilities with a variety of materials such as glass, metals, polymers, and textiles. The overmolding technique is widely used to manufacture soles of athletic footwear like football cleats. Pebax® resins possess a wide plasticizing range, which makes them highly suitable for overmolding. The adhesion of Pebax® elastomers onto inserts can be optimized by adjusting the process parameters. See the general overmolding materials on the next page and contact Arkema to further discuss your overmolding questions.

- Pebax® resins can overmold:
  - Other Pebax® grades, TPU (preferably Ether type), PVC, leather, and coated parts
- Pebax® resins can be overmolded by:
  - Rilsan® PA11, Rilsamid® PA12, Rilsan® Clear, and others

## EXTRUSION

Thanks to the rheological properties of Pebax® polymers, many extrusion and coextrusion techniques are possible:

- Films down to 10 µm in cast or blown processes
- Sheets
- Tubes

Pebax® resins can be extruded on conventional equipment. Arkema personnel will be pleased to provide specific processing parameters related to Pebax® resins in technologies such as tube sizing, blown film drawing, or the cooling conditions for sheet calendaring.

GRADES	RECOMMENDED TEMPERATURES
7033	220 - 250°C
6333	210 - 240°C
5533	210 - 240°C
4033	210 - 240°C
3533	190 - 220°C
2533	170 - 210°C

## COLORATION

- Masterbatches
  - Polyamide-based masterbatches are recommended (instead of polyolefins) with a similar viscosity to Rilsan® or Pebax® resins
  - Compounding is always better, sometimes necessary
  - The rate of incorporation is generally ~3% for thin parts and 0.3% for thick parts
- Pigment blends
  - Recommended: preliminary compounding with material to be colored
  - Careful choice of pigment (to avoid migration phenomena or processing issues due to presence of organic colorants)
- Liquid colorants
  - Colorant acts as a lubricant so the flow of material is affected

## WELDING

There are many techniques suitable for welding Pebax® resin:

- Ultrasonic welding technique: for soft grades only (2533, 3533)
- Induction technique
- High frequency technique (due to polarity)
- Mirror technique
- Radio frequency welding

## DECORATION

Deciding on which technique to use depends on application, geometry of part, and cost. Many techniques are suitable for decorating Pebax® resin.

- Laser printing
- Hot printing
- Ink printing
- Clear coat/lacquers
- In-mold decoration techniques (e.g. co-molding, insert-molding, in-mold labeling)

## THERMOFORMING AND SUBLIMATION

This technology has been primarily developed to meet requirements for ski applications and can be applied in other fields with minor changes. After decoration, Pebax® film can be thermoformed and stamped to meet the required shape and size. This produces an insert that can be overmolded by Pebax® resin for example, or it produces a film that can be thermobonded on a substrate, such as composites.







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