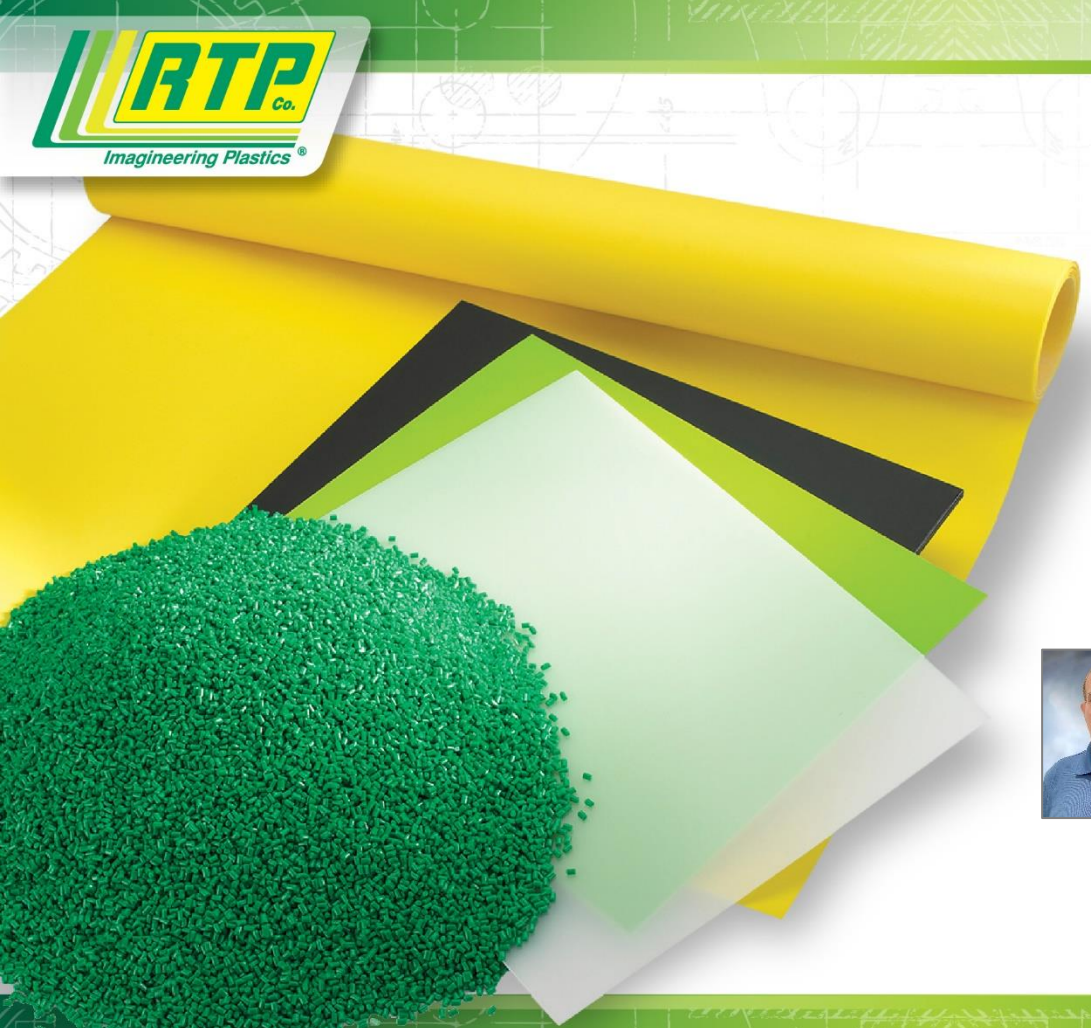
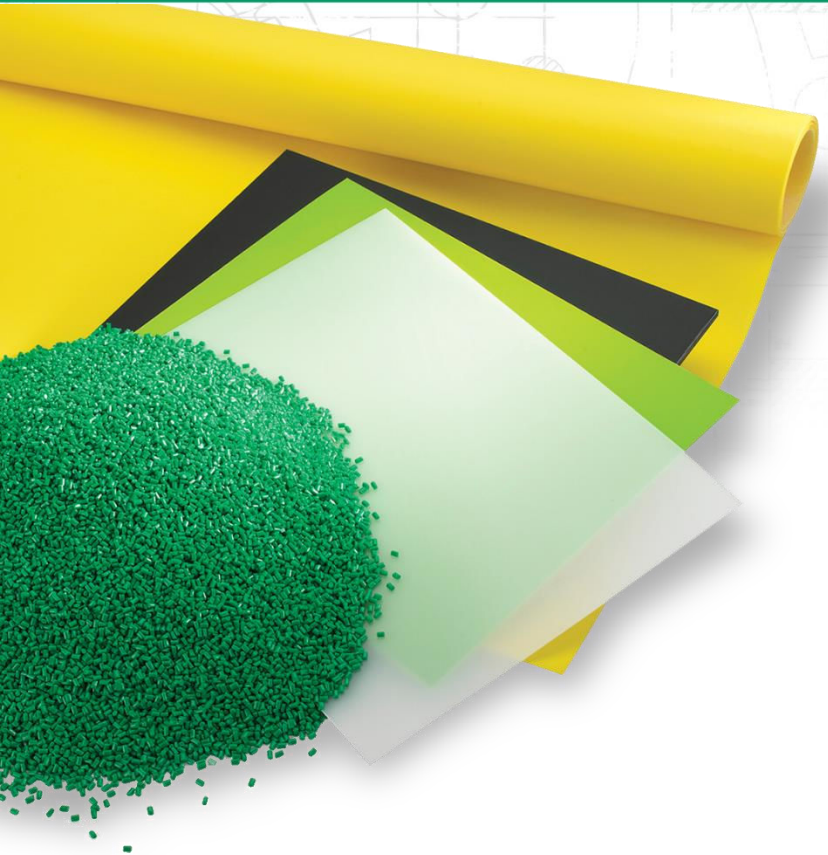


Stretching the Limits of Possibility with TPEs

Chris Patnaude
Application Development Engineer



AGENDA

- What is a TPE? Definitions
- How they work? Unique chemistry
- Why TPE? Elastomers vs. TPE
- How TPEs are made
- Common TPE types
- Which TPE for your application?
- RTP Company product offerings

GOALS

- Basic understanding of various TPEs
- RTP Company TPE solutions

WHAT IS A TPE? WORD-FOR-WORD

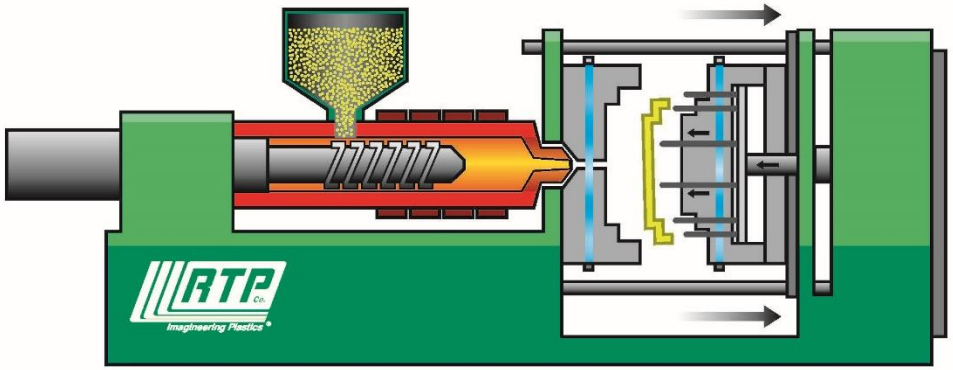
THERMOPLASTIC ELASTOMER

"…Having the property of softening or fusing when heated and of hardening again when cooled…"

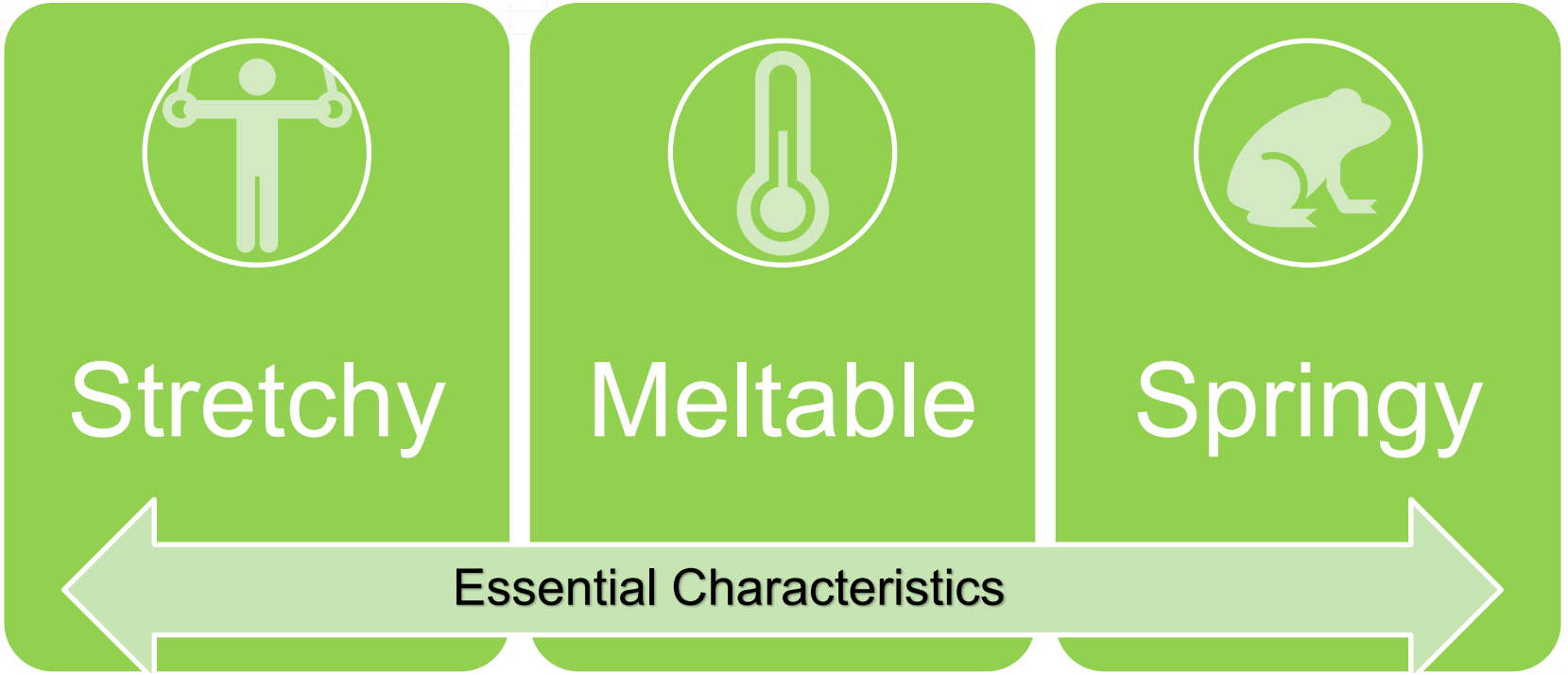
"…Any of various elastic substances resembling rubber…"

WHAT IS A TPE?

TPEs are a diverse family of **rubber-like materials** that, unlike conventional vulcanized rubbers, **can be processed and recycled like thermoplastic materials**



WHAT IS TPE? FAMILY TRAITS

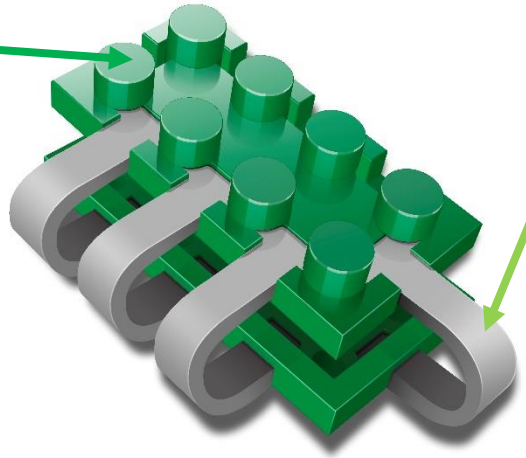


HOW TPEs WORK: UNIQUE CHEMISTRY

TPEs are composed of **hard** and **soft** regions;
they are **multi-phase** materials in their solid state.

Hard block regions
(Plastic properties)

- High-temperature performance
- Thermoplastic process-ability
- Tensile strength
- Tear strength



Soft block regions
(Elastic properties)

- Low-temperature performance
- Hardness
- Flexibility
- Compression and tension set

ADVANTAGES: SIMILAR, BUT DIFFERENT

Thermosets

- Heat resistance
- Chemical resistance
- Long-term elasticity
- Material cost

Application Requirements

- Design
- Process
- Physicals
- Environment
- Cost
- Aesthetics

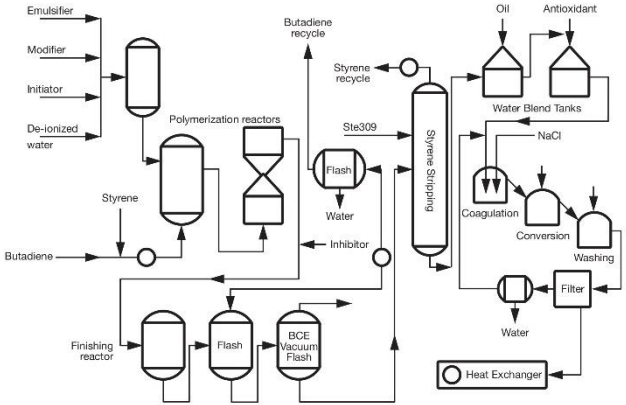
TPEs

- Recyclable
- Mass reduction
- Ease of manufacturing
- Design flexibility

HOW ARE TPEs MADE:

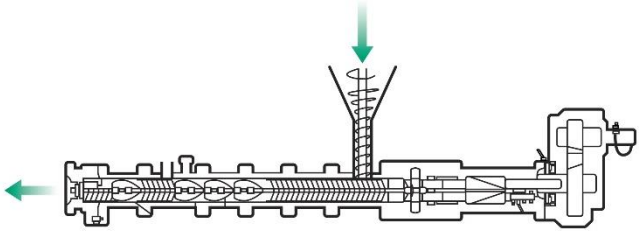
POLYMERIZATION

Created in a reactor, polymerizing thermoplastics chemically from feedstock

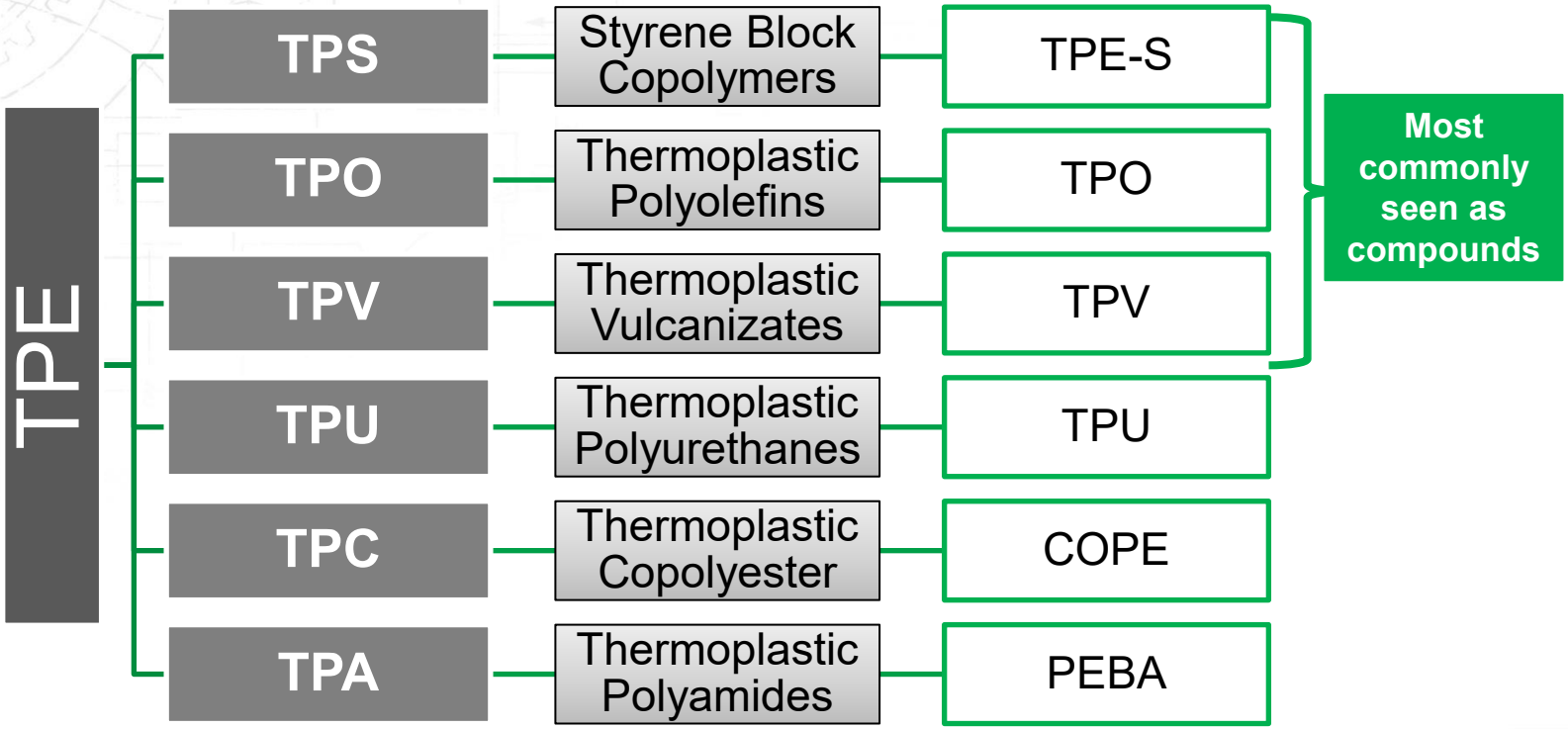


COMPOUNDING

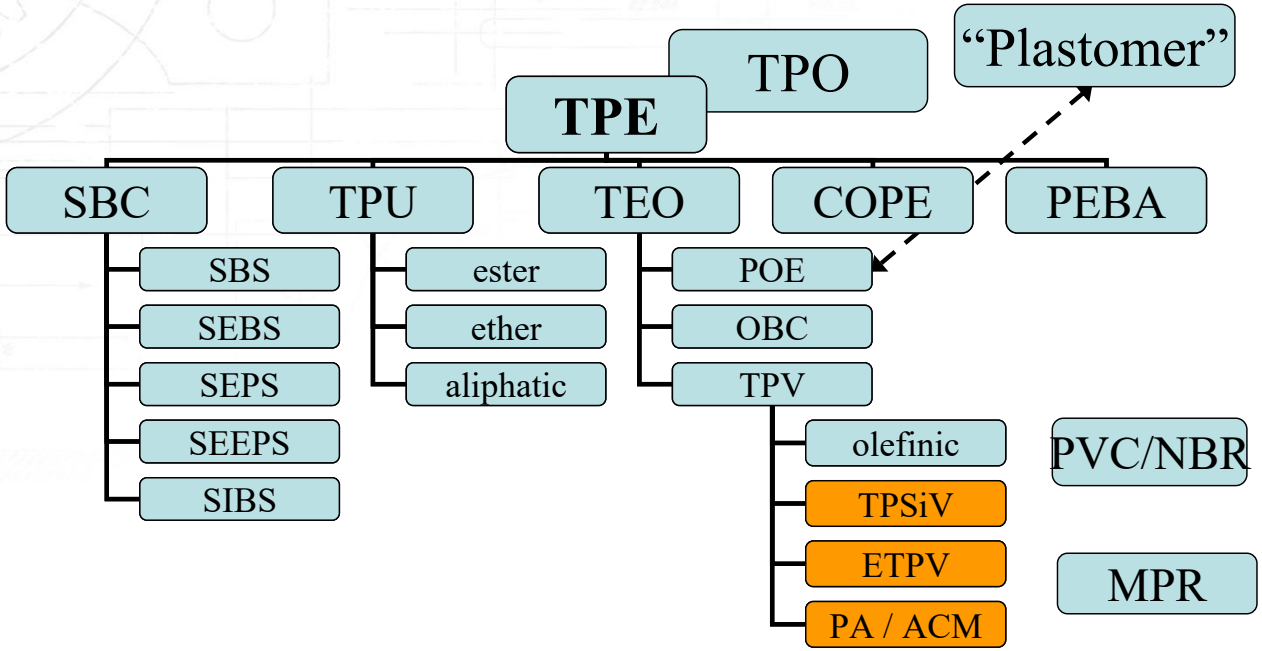
Using a mechanical mixing or reactive process to improve one or more neat polymers



COMMON TPE TYPES



COMMON TPE TYPES



WHICH TPE? PRACTICAL ADVICE

PITFALLS TO AVOID

- Focusing on hardness
- Using TDS in lieu of specification
- Assuming performance standards are uniform across industries
- Trying to do too much with one material

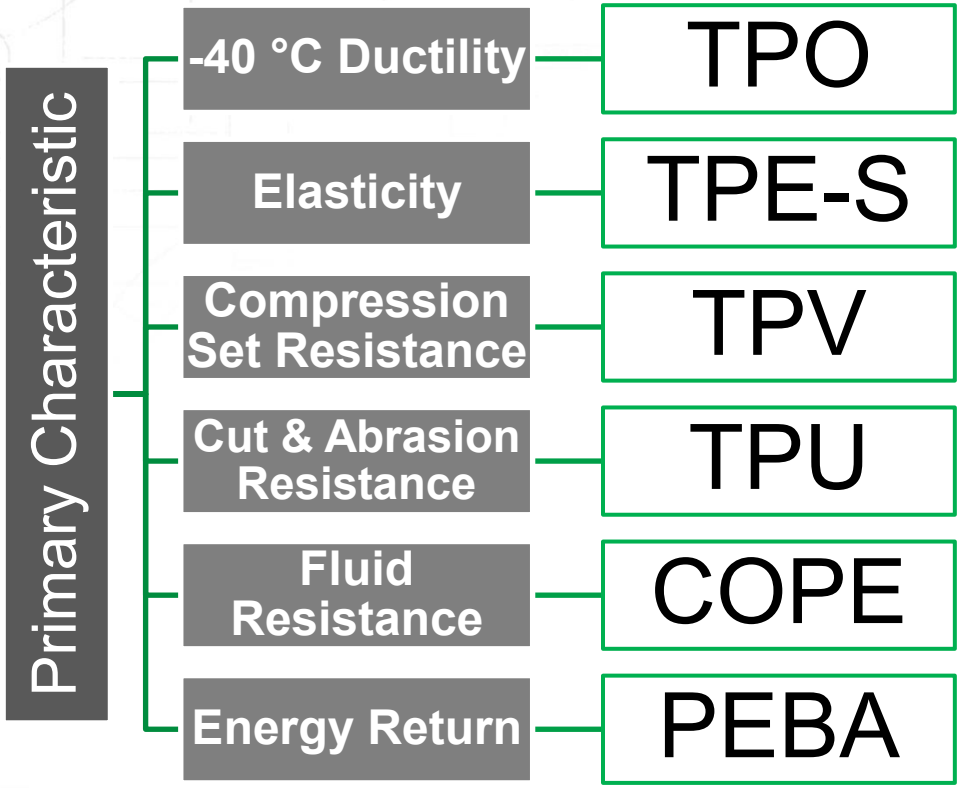
QUESTIONS TO ASK

- Operating temperature range
- Chemical and environmental exposures
- Key physical performance properties
- Preferred manufacturing process
- Cost restraints

WHICH TPE? UNIQUE VERNACULAR

Terminology	Description	Special Note
Durometer	Measure of **hardness** of a material	Not the same as stiffness
Compression Set	Permanent deformation **remaining** after removal of compressive stress	Not the measure of return; lower % = better performance
Tear Strength	Measure of how well a material resists the growth of any cuts when under tension	Deviates from Tensile Strength in that specimen has tear initiated prior to tension

HOW TO CHOOSE: TYPE-CAST



WHICH TPE? PRIMARY CONCERNS

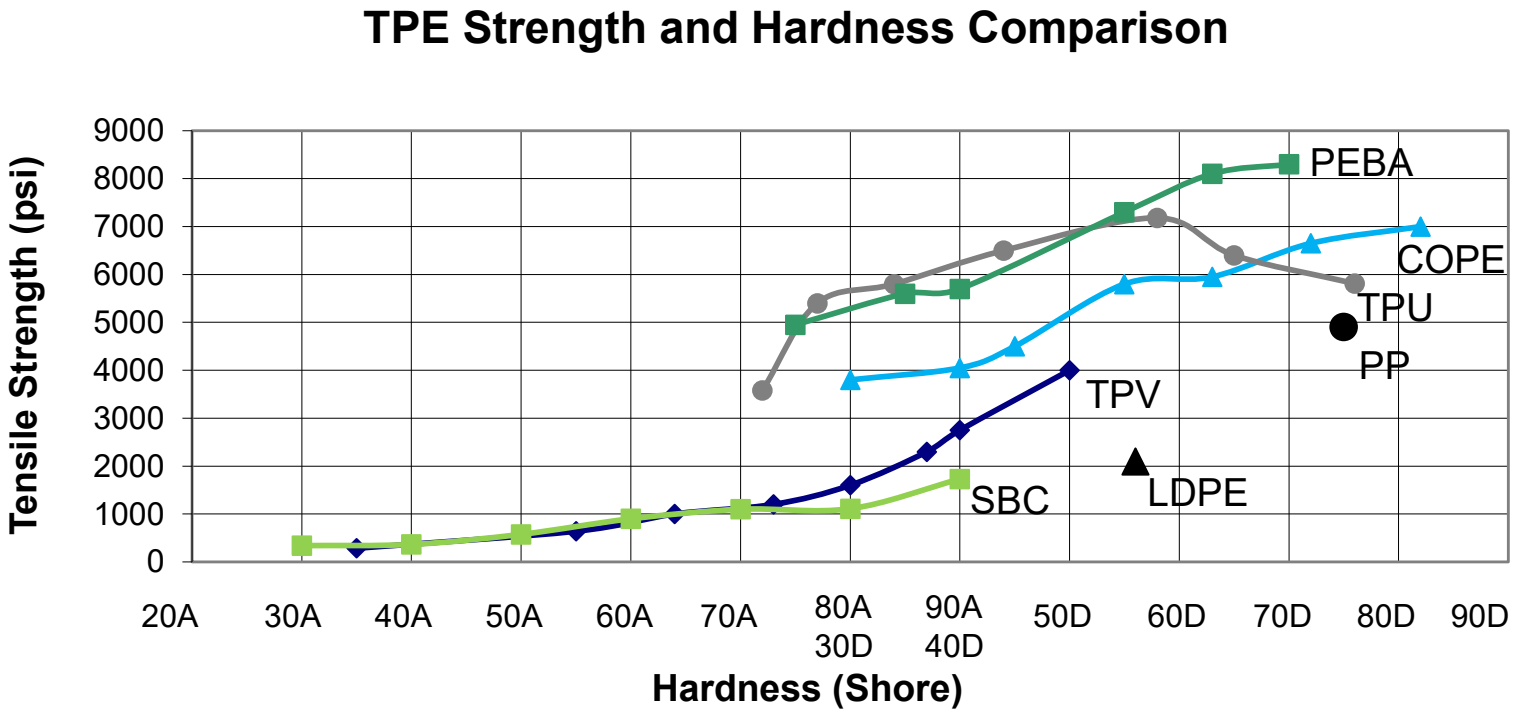
	TPS	TPO	TPV	TPU	TPC	TPA
Lower Cost	X	X				
Low Modulus	X					
Comp Set Resistance	X		X			X
Cut & Abrasion				X		
Creep Resistance				X	X	X
High-Heat			X*			X
Automotive Fluid Resistance		X	X*		X	

*Special TPV Technology from RTP Company

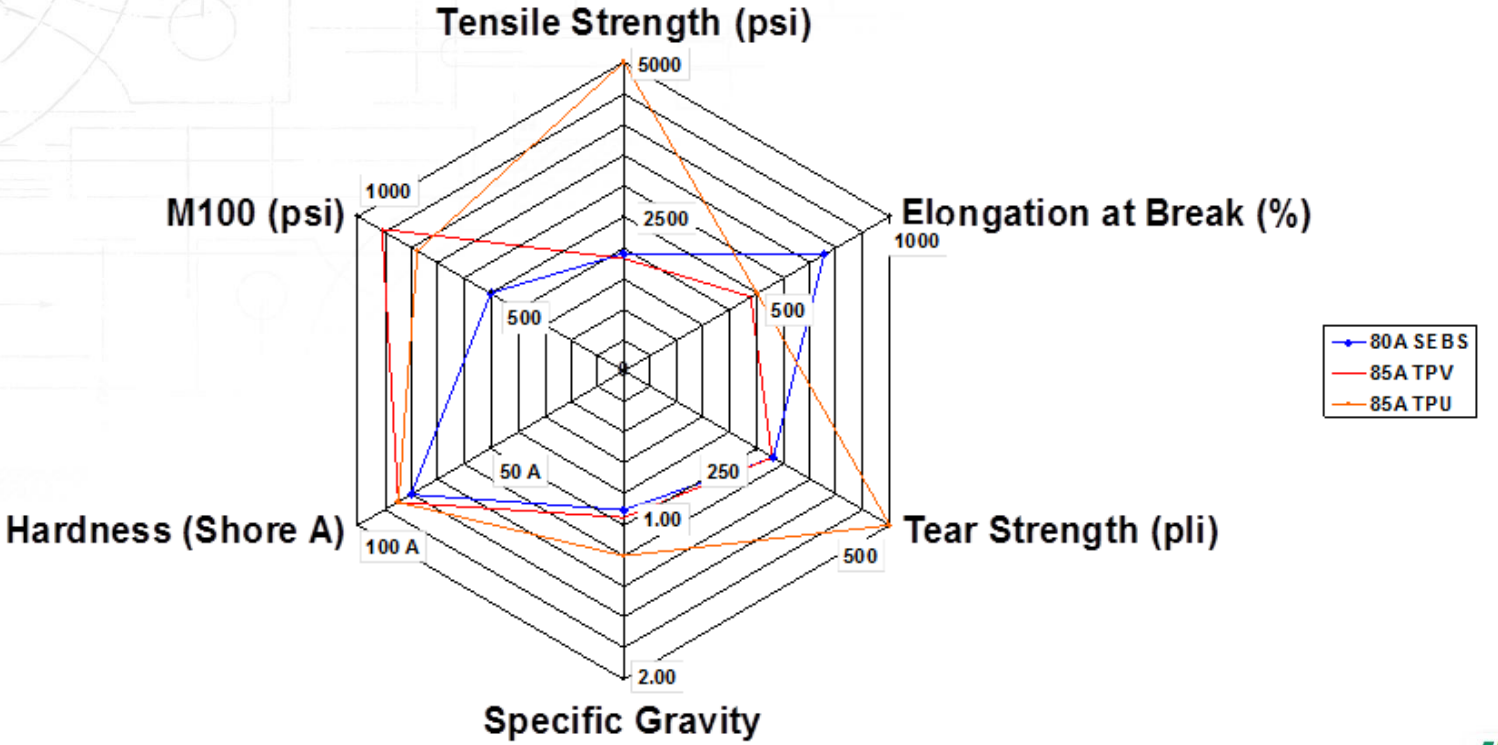
TPE PROPERTY COMPARISION

	TPO	TPS	TPV	TPU	TPC	TPA
Density (g/cm^3)	0.9-1.15	0.9-1.3	0.9-1.1	1.1-1.3	1.05-1.40	1.0-1.2
Shore Hardness	80A-70D	5A – 30D	35A – 55D	70A – 70D	35D – 70D	65A – 70D
Low Temp Limit (°C)	-60	-70	-60	-50	-65	-40
High Temp Limit (°C)	110	110	130	135	150	170
Compression Set (@ 100 °C)	Poor	Good – Excellent	Good – Excellent	Fair – Good	Fair	Good
Hydrocarbon Fluid Resistance	Poor	Poor	Fair – Good	Fair	Good – Excellent	Good – Excellent
Aqueous Fluid Resistance	Good – Excellent	Good – Excellent	Good – Excellent	Fair – Good	Poor – Fair	Fair - Good

THE PROBLEM WITH HARDNESS



THE PROBLEM WITH HARDNESS



RTP COMPANY TPE PORTFOLIO

RTP 2700	• TPS based series
RTPrene®	• TPV Series
Permaprene®	• Custom TPV Series
Nylabond®	• TPV Polyamide-bondable series
Polabond®	• Polar-bondable series
RTP 4999	• TPO based series
Specialty	• Customized Additive Technology Series

RTP 2700 SERIES – TPS

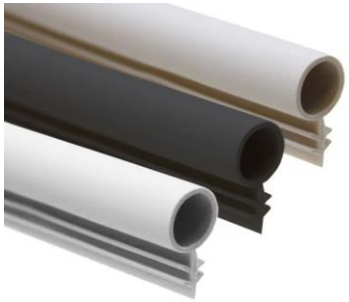
- **RTP 2700 S- HF Series: 30A To 80A unfilled**
  - Translucent to clear, low gravity, excellent elasticity
  - Medical (MD) and FDA compliant grades available
- **RTP 2740 S- HF Series: 30A To 90A filled**
  - Opaque, higher gravity
  - FDA compliant grades available
- **2799 SX Customization**
  - Water clear
  - Increased elasticity
  - Low hardness + strength
  - Food contact compliant
  - Processing tweaks
  - Haptics (touchy-feely)

Attributes

- *Highly elastic*
- *Highly customizable*
- *Design flexibility*
- *Broad cost spectrum*
- *Great RT compression set*

RTPRENE® SERIES - TPV

G SERIES General Purpose Non-UV Stable Natural & Black	M SERIES Extrusion UV Stable Black Only	K SERIES General Purpose UV Stable Black Only
RTPrene® G 35	RTPrene® M 35	RTPrene® K 55
RTPrene® G 45	RTPrene® M 45	RTPrene® K 64
RTPrene® G 55	RTPrene® M 55	RTPrene® K 73
RTPrene® G 64	RTPrene® M 64	RTPrene® K 80
RTPrene® G 73	RTPrene® M 73	RTPrene® K 87
RTPrene® G 80	RTPrene® M 50D	RTPrene® K 40D
RTPrene® G 87		RTPrene® K 50D
RTPrene® G 40D		
RTPrene® G 50D		



"Kerf Style Weatherstrip with 1/4 Inch Hollow Bulb." Photograph. All About Doors & Windows. All About Doors & Windows, 2022. https://www.allaboutdoors.com/Kerf-Style-Weatherstrip-with-1-4-Inch-Hollow-Bulb , 10/4/2024

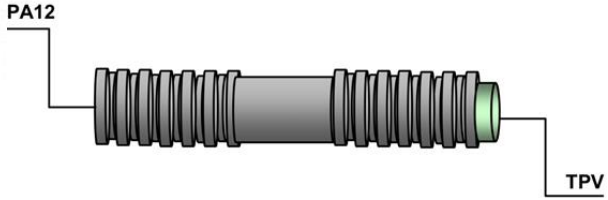
NYLABOND® SERIES - TPV

Nylabond® 6091 Series: Nylon Bondable TPVs

- Durometers from 55A to 85A
- Market-leading technology, unequalled property set
- Market-proven PA12 bondable extrusion applications
- Nylabond C Series – customization

Nylabond® 7091: High-Heat and Fluid Resistance

- CUT at 150 °C with spikes to 175 °C
- Durometers from 70A to 40D
- Superior resistance to hot oil and grease
- Outperforms copolyester in LTHA
- Injection molding - blow molding – extrusion
- Global automotive OEM approved



POLABOND® SERIES

Polabond® 6042 Series

- Durometers from 40A - 70A
- Excellent bonding and durability
  - ABS, PC, PC/ABS, PBT/PC, PET/PC, PC/PMMA
- Great haptics
- ISO 10993 compliant tested-grades
- Customization available

Polabond® 6041 Series

- 55A and 70A TPV-based
- Excellent bonding to PC, ABS, PMMA, RTPU
- Premium polar ponding product
- Excellent chemical resistance at high temperatures
- Superior weatherability

RTP 4999 SERIES – TPO

- Unfilled or filled
- High impact, high stiffness
- Low-temperature ductility
- Scratch and mar resistance
- Paintable or molded-in color
- Interior and exterior grades
- Sustainable options

ADDITIVE INCORPORATION: LEVEL UP

Color FR Structural Wear Conductive

Color

Flame Retardant

Structural

Wear Resistant

Conductive

RTP Company's expertise applied to TPE

- Strong market leadership
- Leverage expertise and resources
- Deliver unique solutions and functionality

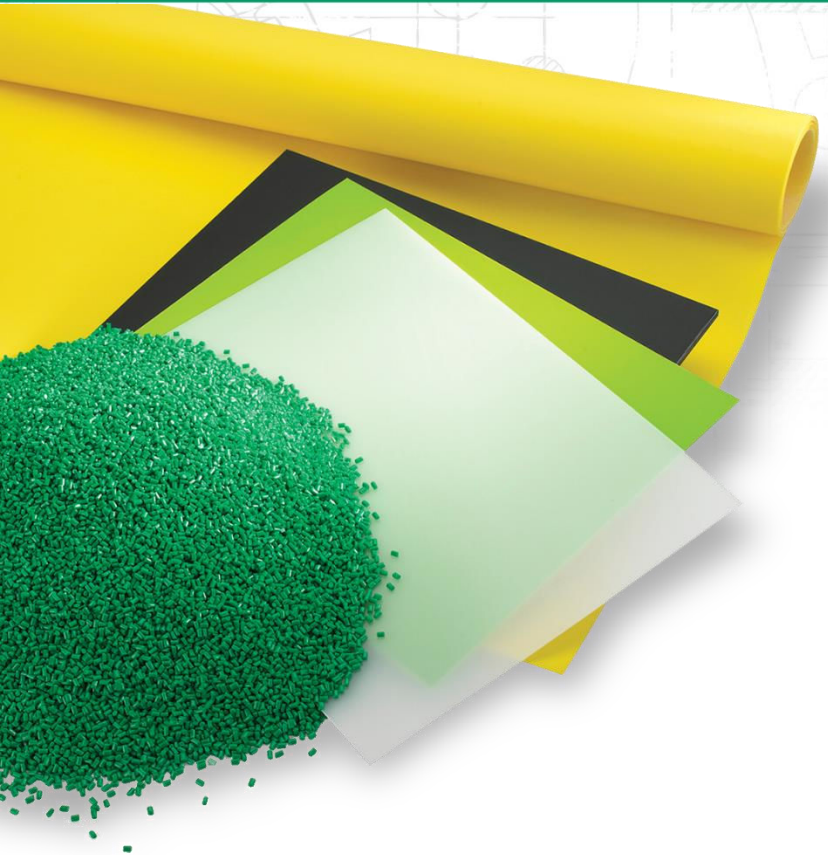
Precolor anything	CoF-modified TPEs
Conductive anything	FR TPEs
Glass RTPU	ATEX bondables
Wear TPU / COPE	Density modified

Uniquely experienced with all TPE chemistries

- Technical acumen to create custom formulations and alloys
- Culture of customer co-development – create what you NEED

GLOBAL TPE PRODUCTION & SUPPORT

- 5 Primary Production Locations
  - Fort Worth, Texas
  - Portage, Wisconsin
  - Gahanna, Ohio
  - Suzhou, China
  - Wroclaw, Poland
- Multiple support production locations globally
- Committed R&D Support Team
- Committed Commercial Team
- Committed Production Team



THANK YOU!

Questions?

Chris Patnaude
cpatnaude@rtpcompany.com