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Santoprene™ TPV Proven sealing performance in building applications

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Energy lives here

ExxonMobil

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- Introduction
- Typical sealing applications
- Main challenge on quality
- Material options for glazing gaskets
- Standard
- Product & value
- Reference buildings

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ExxonMobil Chemical: one of the largest chemical companies in the world

$3.4B
in earnings

11%
return on average capital employed

27M
tonnes prime product sales

Source: ExxonMobil 2018 Annual Report

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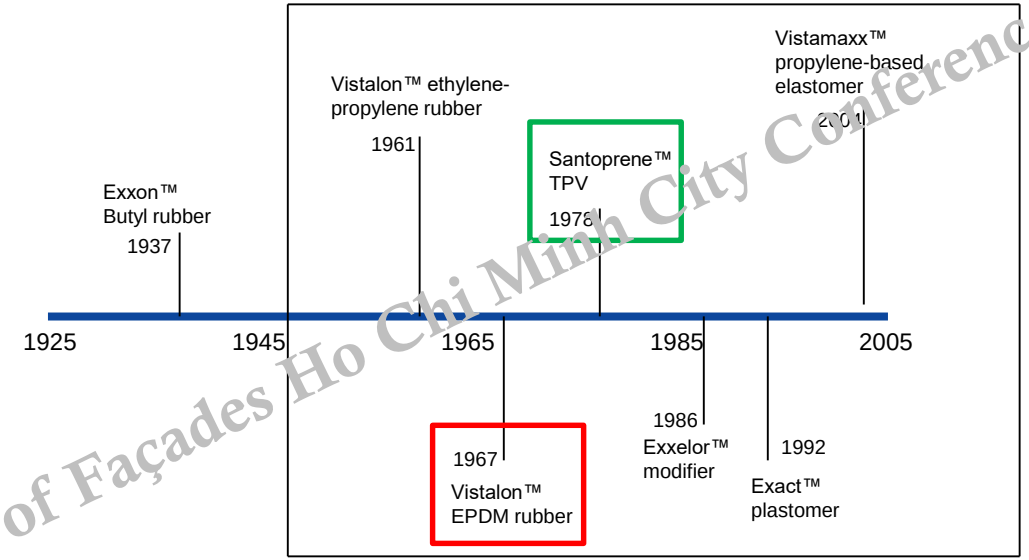
Specialty elastomer brands

Our roots run deep in synthetic elastomers

…



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… where we've been meeting customer needs with innovative elastomeric solutions for over 50 years

Our pipeline of customer-focused technologies is supported through ongoing investment

Santoprene™ TPV introduction

Rubber performance with thermoplastic processing

- Chemically cross-linked (vulcanized) rubber encapsulated in thermoplastic matrix
- Properties like thermoset rubber but melt-processable like a thermoplastic
- Homogeneous dispersion of small particle-size rubber provides good tensile strength
- Locked-in morphology provides stable physical properties

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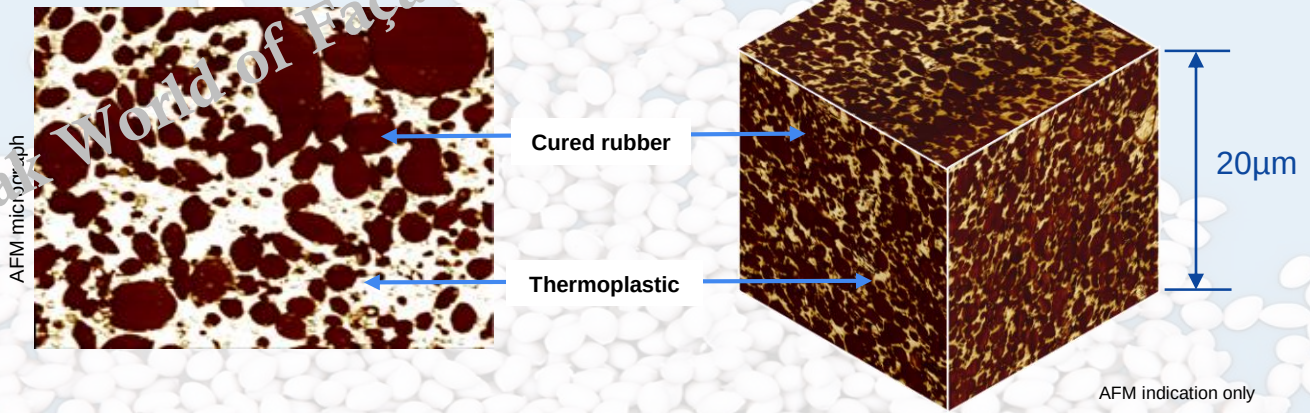
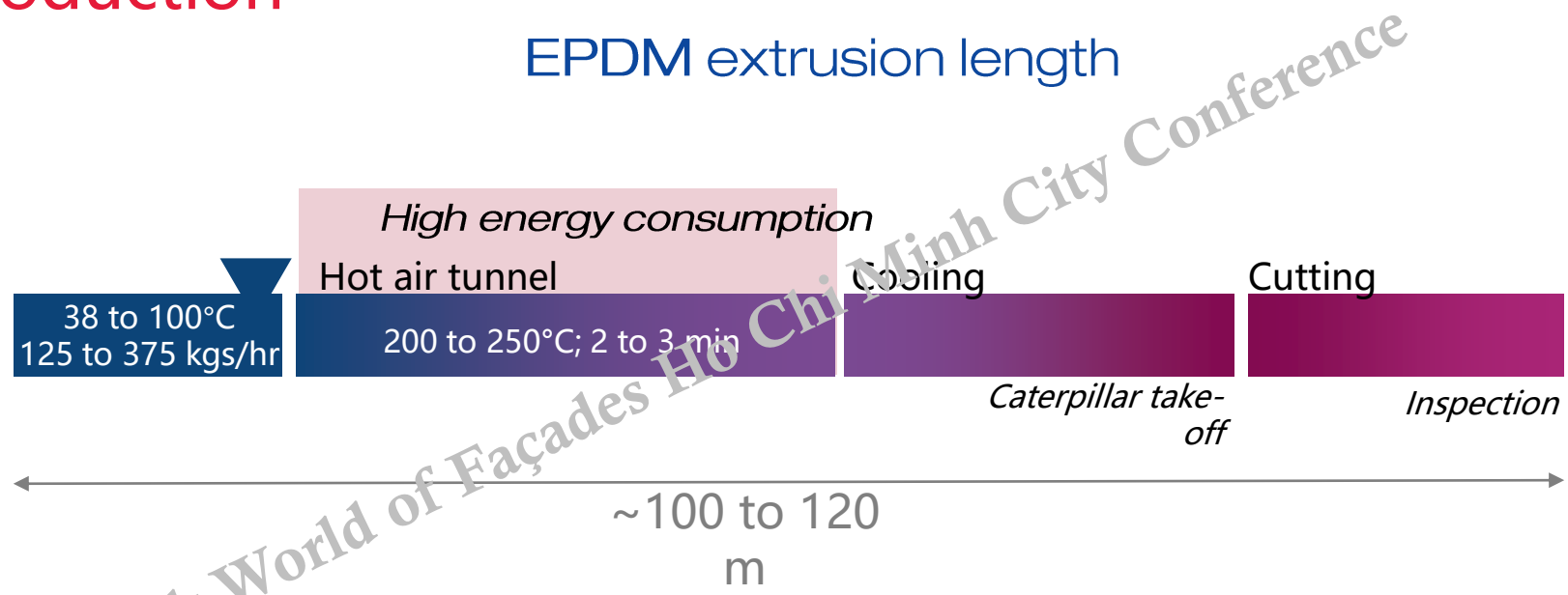


Santoprene™ TPV vs EPDM – Part production



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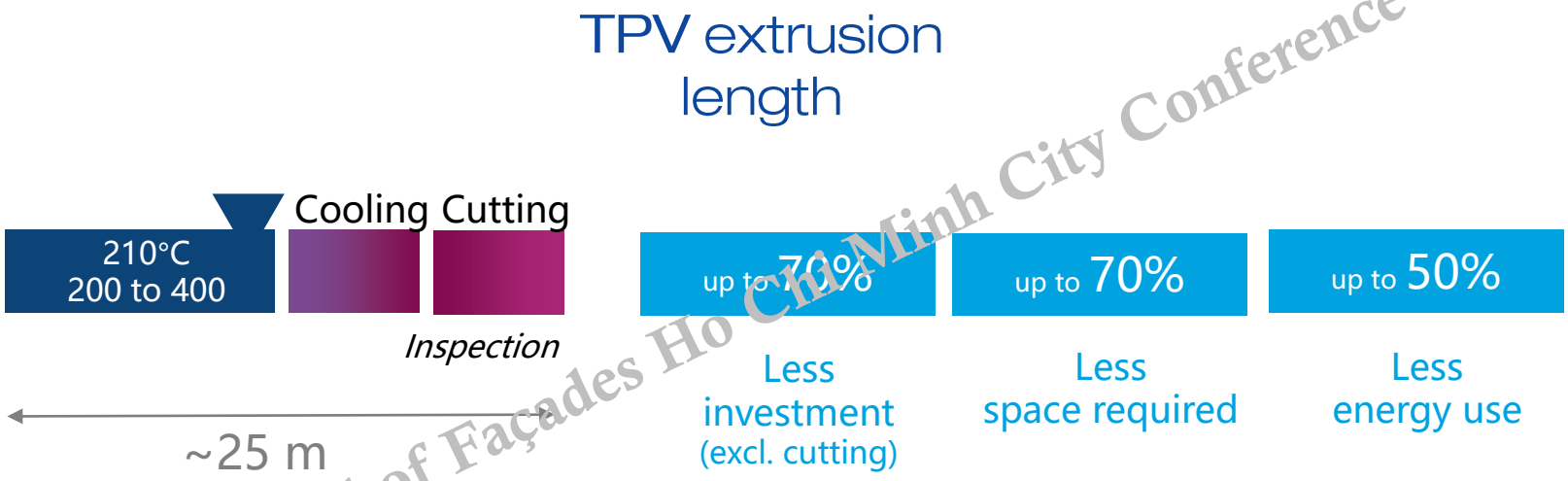
Source: ExxonMobil assessment based on GRC roof profile

Santoprene™ TPV vs EPDM – Part production



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TPV's **smaller footprint** reduces capital and energy use

Source: ExxonMobil assessment based on GRC roof profile

Santoprene™ TPV vs EPDM – Design flexibility

Key benefits on part design

- Colorability
- Easy heat-welding
- Hard & soft combination via co-extrusion

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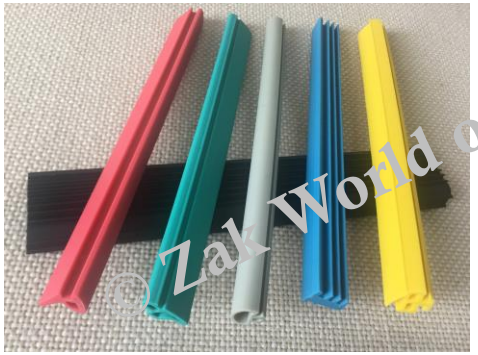

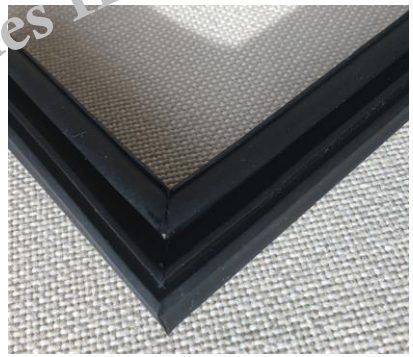

Typical sealing applications

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Commercial buildings

A static window seal

- Cohere frame and glazing
- Water infiltration
- Reduce noise and energy loss

Key requirements

- Excellent weathering properties
- Flexibility over wide temperature range

Applications

- Preset, wedge, setting block in curtain wall system, storefront, skylight

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Residential buildings

A dynamic seal

- Inside & around window / door system
- Water infiltration
- Reduce noise and energy loss

Key requirements

- Excellent weathering properties
- Design flexibility

Applications

- Glazing seals, weather seals in all types of systems, e.g. wooden, PVC, aluminium etc.

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Expansion joints

A dynamic application

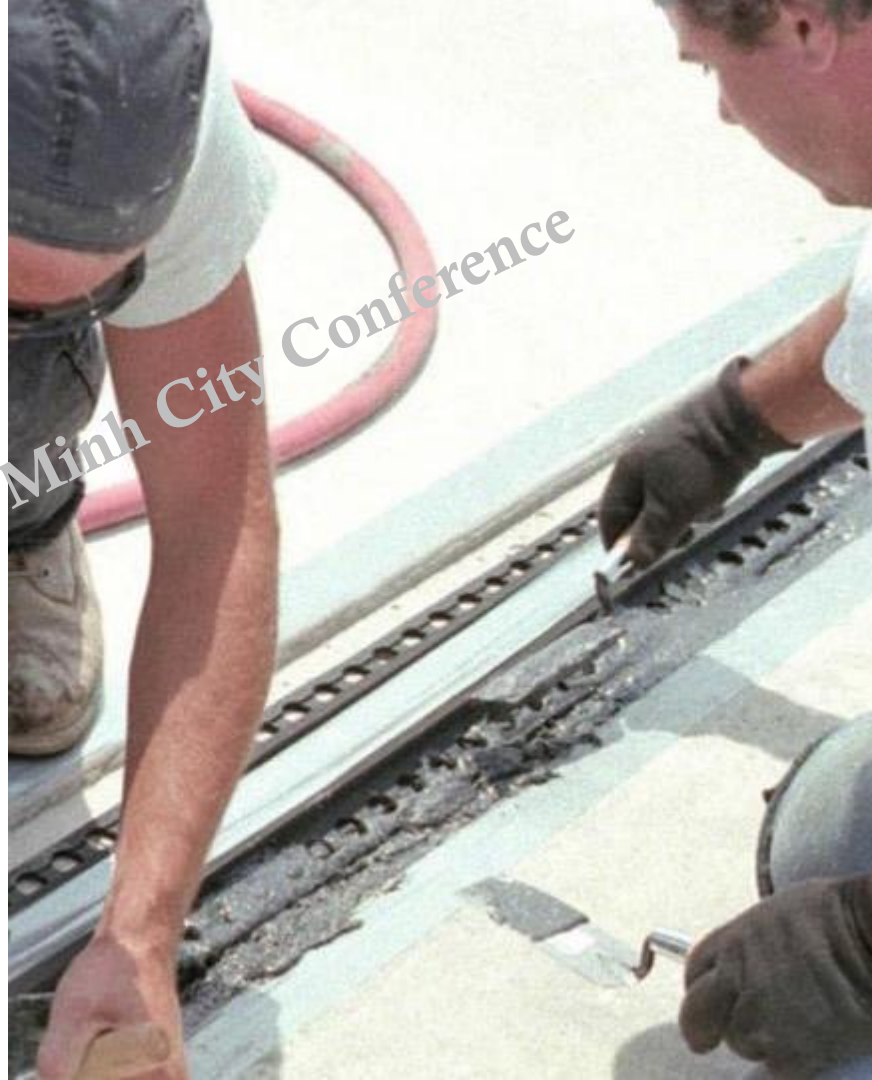
- Insert between concrete sections
- Absorb movements
- Prevent concrete pieces rupturing

Key requirements

- Excellent long term sealing performance
- Superior flex fatigue resistance

Applications

- Parking decks, bridges, highways, buildings, skywalks, etc.



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A mantra from building envelope industry:

"There are only two kinds of windows; those that leak now, and those that leak later."

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Many ways to manage the “leak now” …

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But, how to prevent “leak later” ?

Material options for glazing gaskets

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Properties vs alternatives

Property	Santoprene™ TPV	EPDM	SEBS	PVC	Silicone rubber
Density, g/cm³	0.95 - 0.98 ~0.91 (M100) ~1.2 (W232)	~1.3	1.1 - 1.2	~1.4	~1.2
Typical hardness, Shore	35A-50D	40A-90A	25A-90A	60A-90A	50A-80A
Typical service temperature, °C (°F)	-40/+135 (-40/+275)	-50/+150 (-58/+302)	-45/+110 (-49/+230)	-30/+95 (-22/+203)	-60/+200 (-76/+392)
Compression set	◎	◎	△	X	◎
Weathering/ozone	◎	◎	△	O	◎
UV resistance	◎	◎	◎	△	◎
Oil resistance	△	X	X	O	X
Chemical resistance	◎	◎	O	O	◎
Color	Any	Normally black and grey	Any	Any	Any
Paint compatibility (water based)	◎	◎	◎	X	◎
Processability	TP	TSR	TP	TP	TSR
Recycle	Yes	No	Yes	Yes	No
Heat welding	Yes	No	Yes	Yes	No
Coextrusion	◎	◎	◎	◎	X

Indicative applications only ◎ : Excellent O : Good △ : Fair X : Poor

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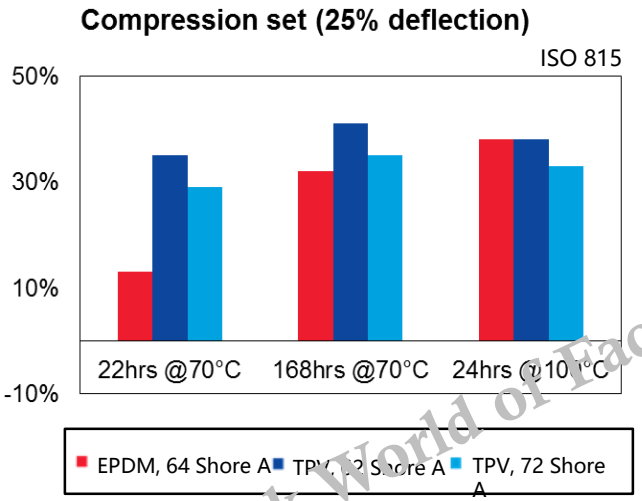
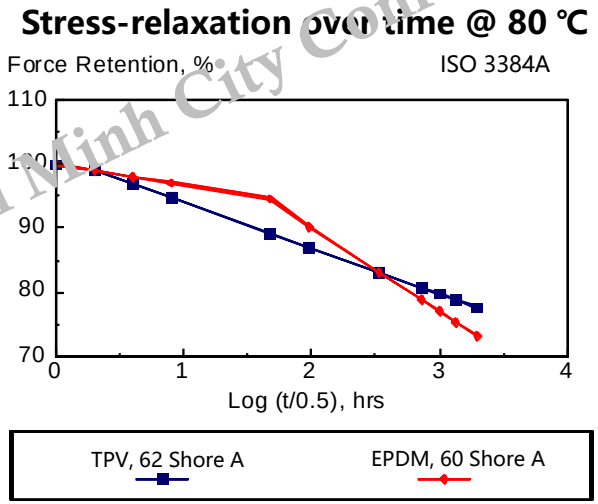
Sealing with Santoprene™ TPV

Reliable long-term sealing performance, esp. at high temperature



Typical values for reference only

Linear aging vs. EPDM



Data Source
Sealing with Santoprene™ thermoplastic vulcanizates
Technical Literature (TL00207)

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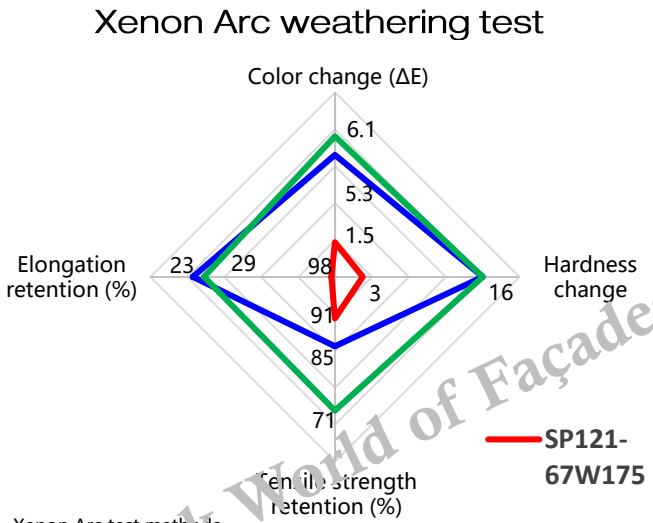
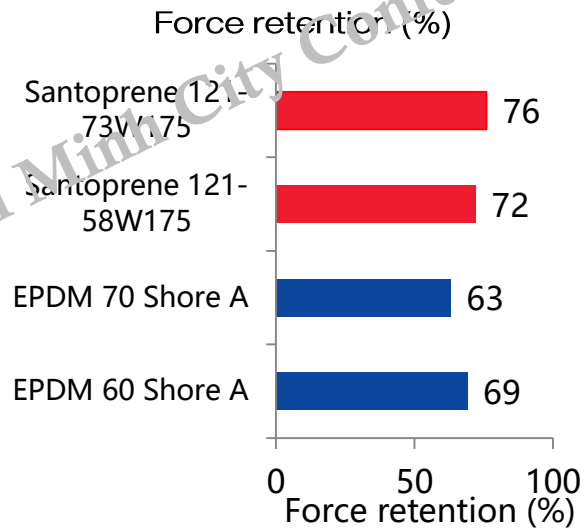
Excellent weathering resistance

Excellent compression set



Xenon Arc test methods
- Color change: SAE J1545 3000hrs (4703 KJ/M2 - 340 nm)
- Hardness change: ASTM D2240 3000hrs (4730 KJ/M2-340 nm)
- Tensile strength retention: ASTM D412 3000hrs (4730 KJ/M2-340 nm)
- Elongation retention: ASTM D412 3000hrs (4730 KJ/M2-340 nm)

Higher force retention



Force retention (%) after 2,500 hrs. at 80°C

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Standard

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Standards-ASTM E2203

Property	Test Method Based on	ASTM E2203	121-58W175	ASTM E2203	691-65W175	8221-70	121-67W175	ASTM E2203	121-73W175
Hardness, Shore A	ASTMD2240	64±3	61	73±3	70	72	73	80±3	78
Tensile strength MPa	ASTM D412	5.8	6.3	7.2	6.3	6.9	7.0	9.7	9.0
Elongation, %	ASTM D412	340	471	380	446	596	462	460	496
Heat aging 70hrs, 100℃ change in	ASTM 573								
Hardness		±3	1	±3	0	1	0	±3	0
Tensile strength, %		±5	-3	±5	-5	-7	-2	±5	-5
Elongation, %		±5	-5	±5	-5	-14	-4	±5	-7
Compression set, %	ASTM D395, Method B								
22hrs, 100℃		<= 35	27	<= 38	28	44	30	<= 40	31
70hrs, 100℃		<= 40	31	<= 43	32	49	34	<= 45	35
70hrs, 125℃			43	-	-	58	43	-	42
22hrs, 70℃		-	27	-	-	38	29	-	34
Brittle temperature, ℃	ASTM 746	-62	-60	-60	-	-62	-59	-62	-60
Tear strength, KN/m	ASTM D624	20	18	20	21	27	20	30	24

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Portfolio choices to meet E2203, 8221 series offer more vivid coloring but comparative compression set

Product and value proposition

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Santoprene™ TPV - Value in construction

Excellent long term sealing and weathering performance

- Wide service temperature range (-40°C~135°C)
- Good UV and ozone resistance

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Santoprene™TPV - Value in construction

Design and processing flexibility

- Consistent dimensional stability
- Hard-soft co-extrusion, injection molding, blow molding, foaming, etc.
- Easy coloring
- Good material compatibility, no polycarbonate or acrylic attack

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Santoprene™ TPV - Value in construction

Optimum working efficiency

- Significant energy saving with thermoplastic processing
- Heat weld corners without adhesion and molding

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Santoprene™ TPV - Value in construction

Improved sustainability performance versus EPDM

- Recyclability of scrap during manufacturing process
- Light weighting due to lower density (0.95-0.97)
- Lower VOC

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Extensive technology expertise

30+ years of design experience

Broad technology database

- Finite element analysis data
- Compression stress relaxation
- Injection molding flow analysis
- Shrinkage data

Strong local support

- Shanghai technology center
- On site customer support

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Reference buildings

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Buildings with Santoprene™ TPV seals

North America

Scotia Plaza, Toronto

Location	Building
Toronto, Canada	Scotia Plaza Tower
St. Louis, Missouri, USA	Botanical gardens
St. Louis, Missouri, USA	Metropolitan Square
Alexandria, Virginia, USA	Shirlington Gateway office
Philadelphia, Pennsylvania, USA	Liberty Plaza

Europe

Canary Wharf, London

Location	Building
Madrid, Spain	Torre Azca building
Ghent, Belgium	Sidmar headquarters
London, U.K.	Canary Wharf Tower

Asia

Oriental Pearl Tower, Shanghai

Location	Building
Seoul, Korea	Haesung 1 building
Singapore	Environment building
Singapore	Marina Bay sands
Kuala Lumpur, Malaysia	Bank Pembangunan
Hong Kong, China	Central Plaza
Hong Kong, China	HK airport (Expansion joints)
Beijing, China	Oriental Plaza
Shanghai, China	Pudong airport (Expansion joints)

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A committed supplier

- Quality and consistency
  - Maintains stable process and reduces material waste
  - Eliminates risk of variable final product performance
  - Ensures consistent performance for every project worldwide
- Technical support and extensive design expertise
- Supply and security
  - 40+ years of market presence with broad portfolio
  - Global product availability
  - Continuous investment and long term commitment:
    +25% global manufacturing capacity increase (May 2019)

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Conclusion

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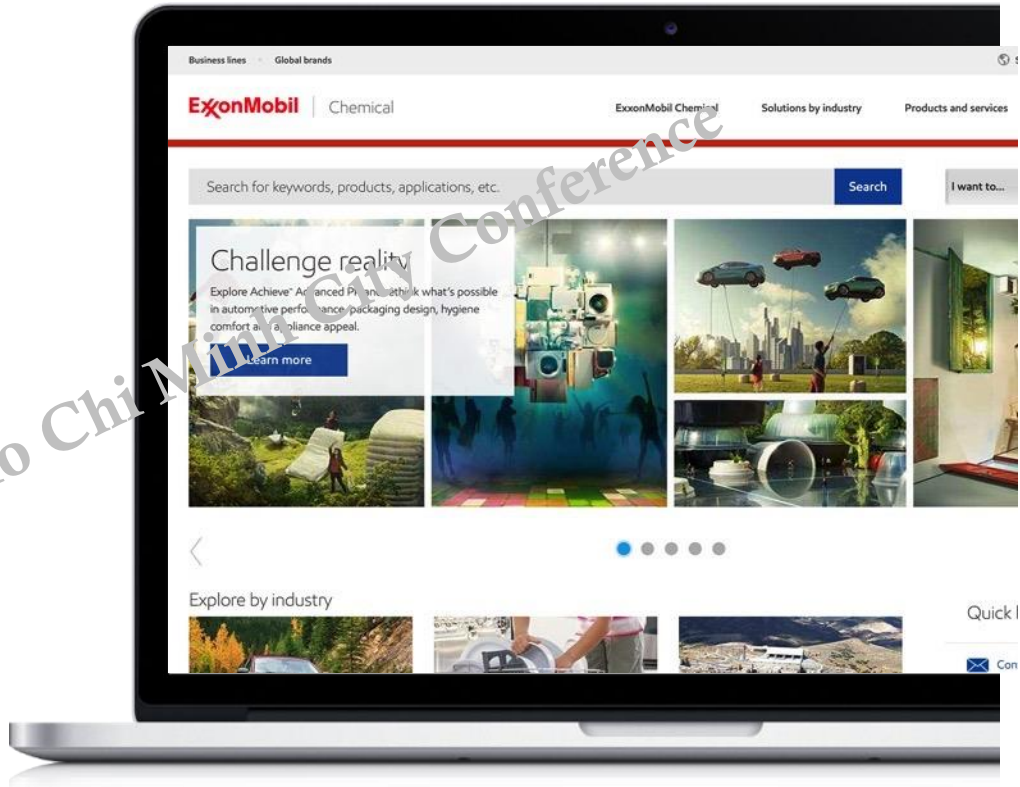

www.santoprene.com

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