Performance Additives for Thermoplastic Elastomers

Evonik Nutrition & Care
Interface & Performance
Technical Service Polymers

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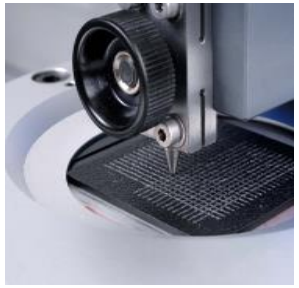
TEGOMER® and TEGOPREN®
Additives for Thermoplastic Elastomers



Scratch resistance

TEGOMER® 6264
- 2-3% used for TPE, TPO, or TPES
- Pellet form

TEGOMER® AntiScratch L
- 2% use level especially for TPES
- Liquid, can be premixed with oil used in TPES

Melt flow enhancer

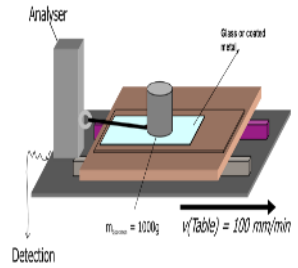
TEGOMER® M-Si 2650
- 2% use level for TPE, TPO and TPES
- Liquide

TEGOMER H-Si 6441P
- 2% used for all elastomers even TPEE, TPEA and prevents degradation of TPU
- Pellet form

Flame resistance

TEGOMER® V-Si 4042
- 1-2% used in HFFR compounds, e.g. in cable compounds or membranes based on PE/TPO or PE/EVA
- Liquid

TEGOPREN® 6875
- 1% calculated on inorganic/organic FR
- Used in FR applications of various elastomers
- liquid



COF reduction + improved haptics

TEGOMER® M-Si 2650
- 1-2% used in TPES, TPEV, TPEO, TPEE
- Liquide

TEGOMER® H-Si 6441P
- 0.5-2% used in TPEO, TPEV, TPEE, TPU
- Pellet form

Demolding

TEGOMER® H-Si 6441P
- 0.25-0.50% used in various elastomers as internal release agent
- No influence on coatability or abrasion
- Pellet form

Malodor absorber

TEGO® Sorb P.Y. 88
- 1-2% used in TPE-V and for recycling approch of various elastomers
- Pellet form

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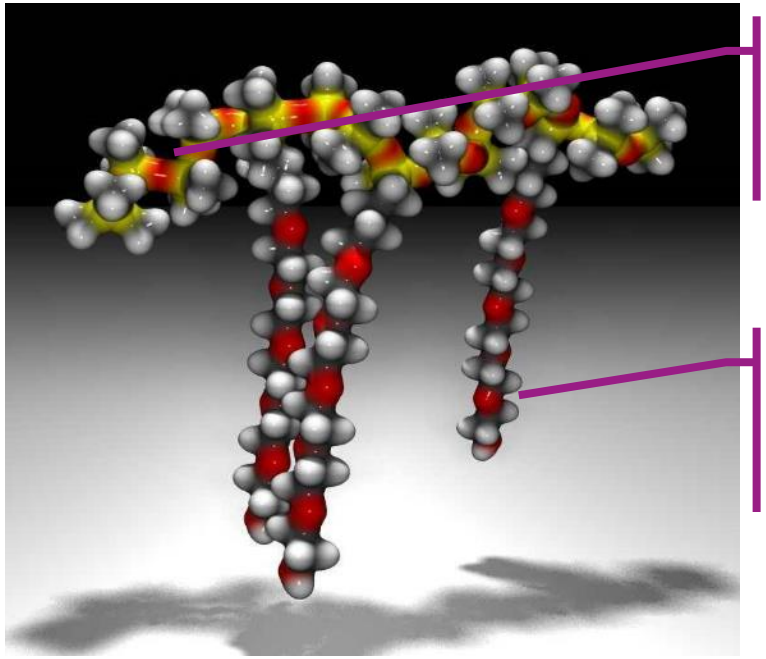
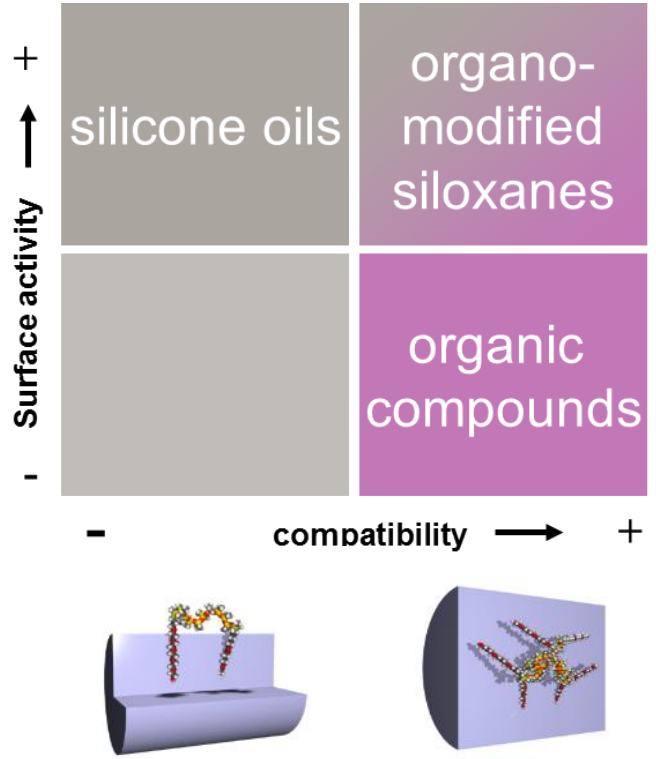
Our Core Technology – Organo Modified Siloxanes (OMS)



Siloxane backbone provides high surface activity

Organic grafts provide compatibility with matrix

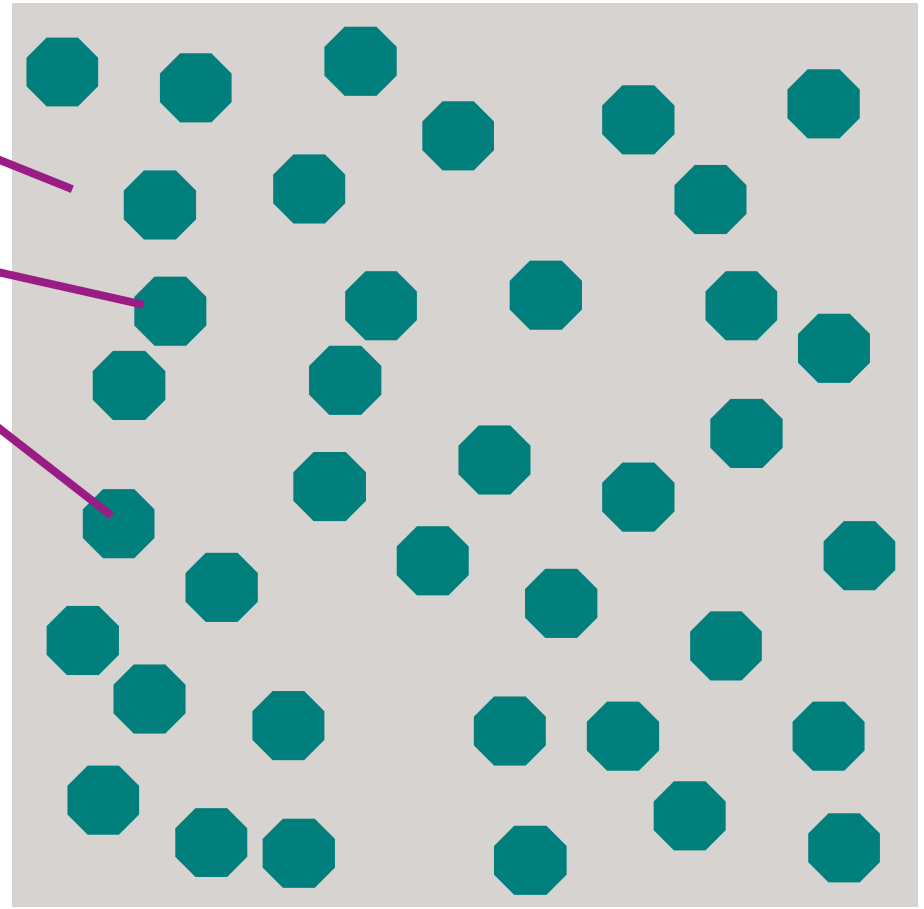


Organo modified siloxanes overcome the disadvantage of PDMS by the introduction of organic groups on the siloxane backbone generating a permanent implementation in thermoplastic and elastomeric polymers.

Compounded TPE-V and TPE-O Grades

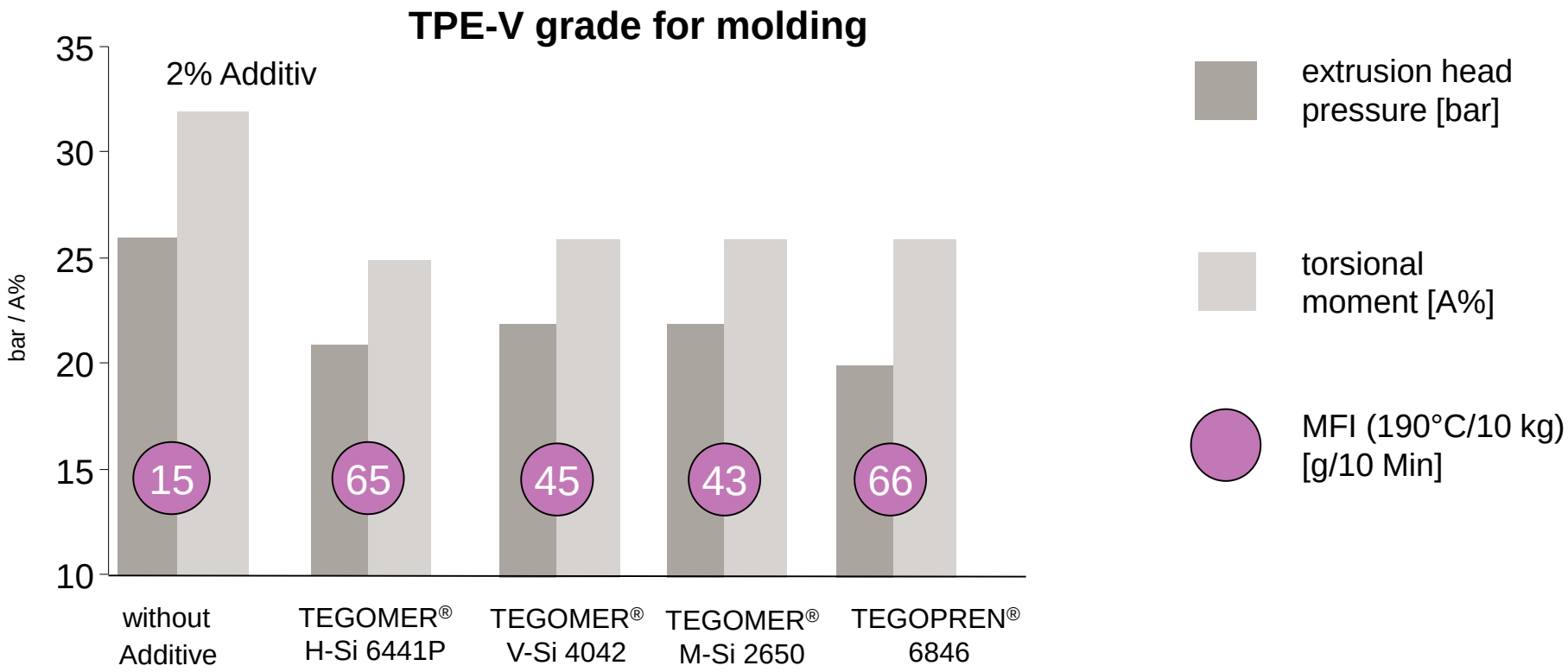
PP
Polypropylene

EPDM
Ethylene Propylene Diene Monomer



TPE-V and TPE-O grades are mixtures of thermoplastic PP with rubber-like EPDM areas. The meltability of the thermoplastic enables an easy processing by standard extrusion and molding techniques. The rubber, on the other hand, provides elasticity and softness.

OMS for improved Processing
TPE-V Automotive Application



Evonik additives allow a significant increase of the MFI and thus an improved melt flow during moulding operations. The MFI of a TPE-V cannot directly be correlated to melt flow spiral length.

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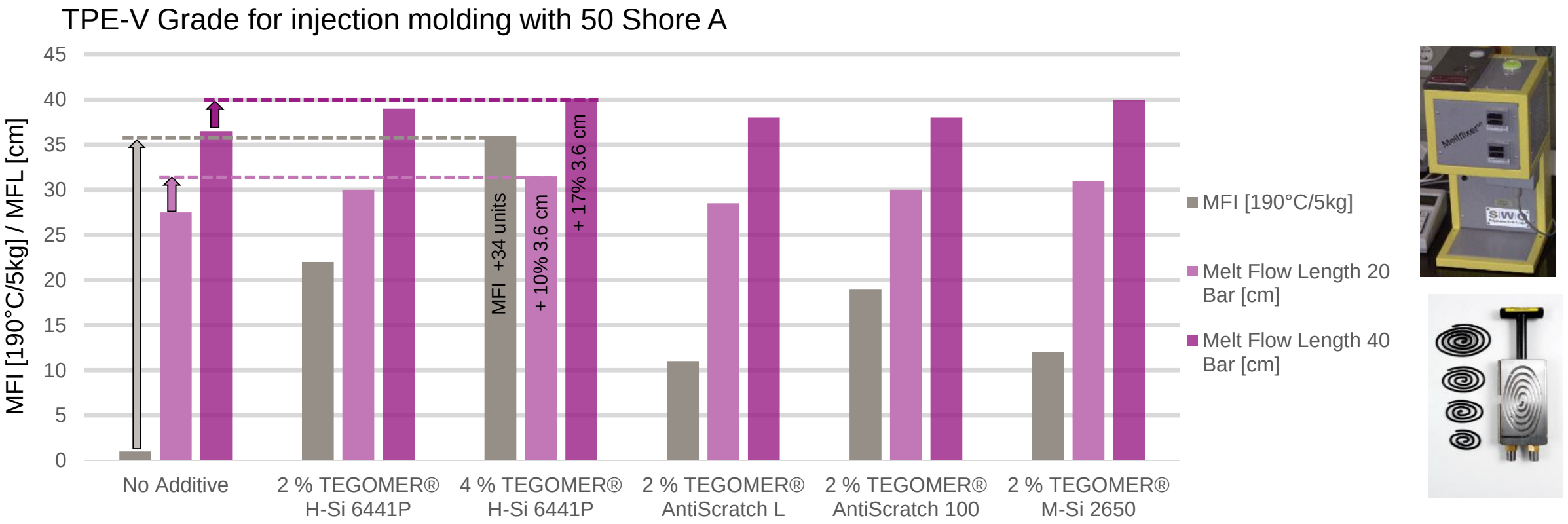
OMS for improved Processing
Melt Flow Index vs. Mold Filling



OMS orientate to internal surfaces working as an internal lubricant in high shear operations improving mold filling even at high pressure and injection speed.

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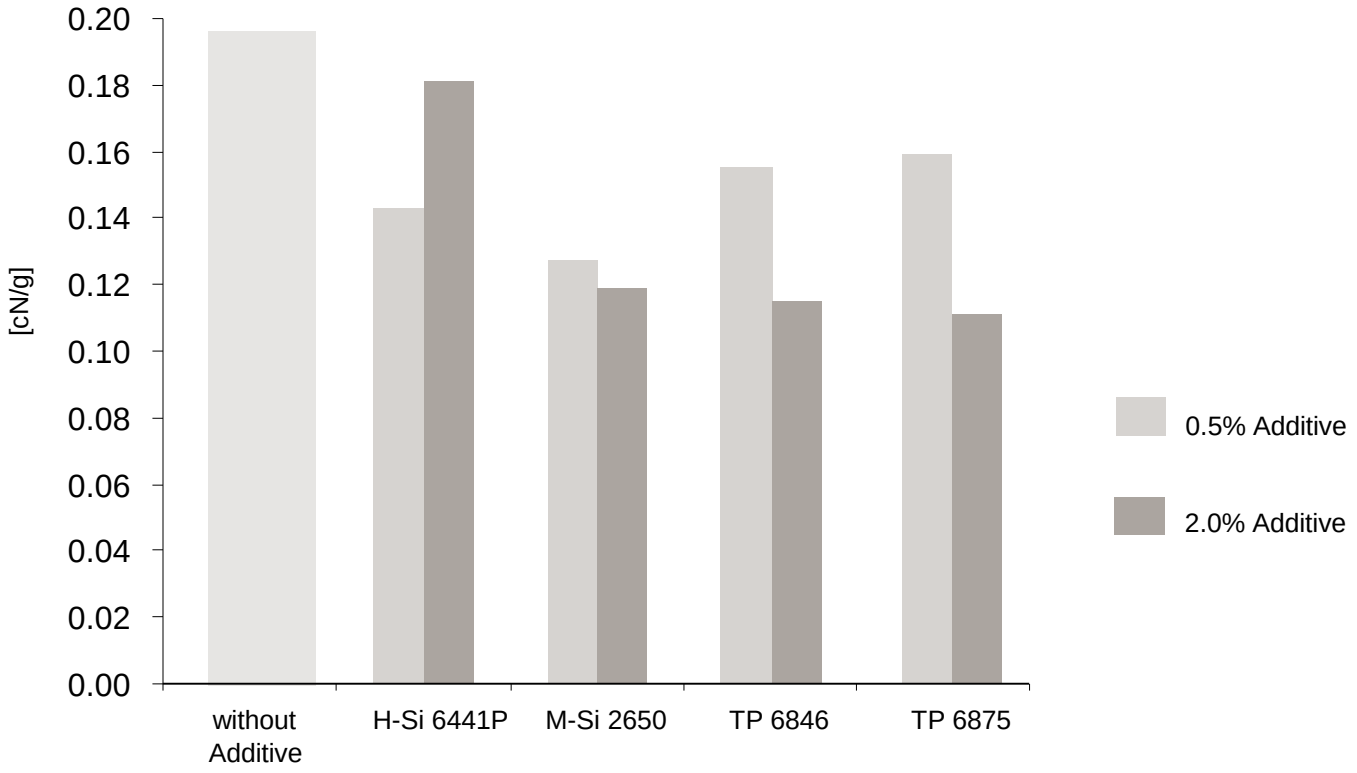
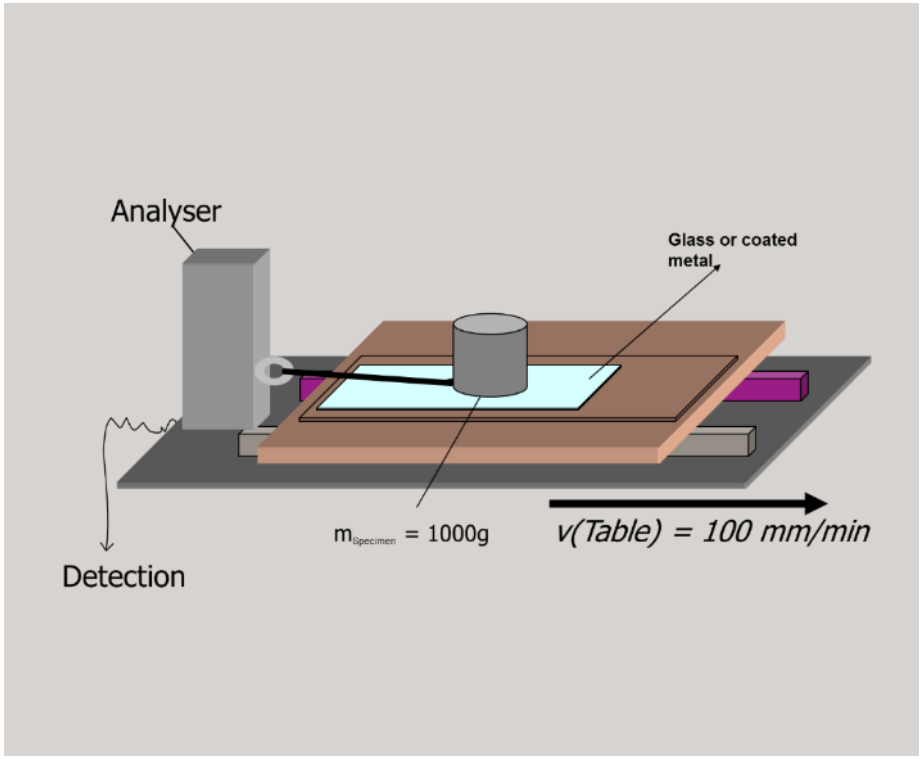
TPE-V grade for extrusion
Reduction of COF on Glass





TEGOMER® M-Si 2650 is already very suitable with 0.5%.
TEGOPREN® 6875 and TEGOPREN® 6846 have to be used with 2.0%.

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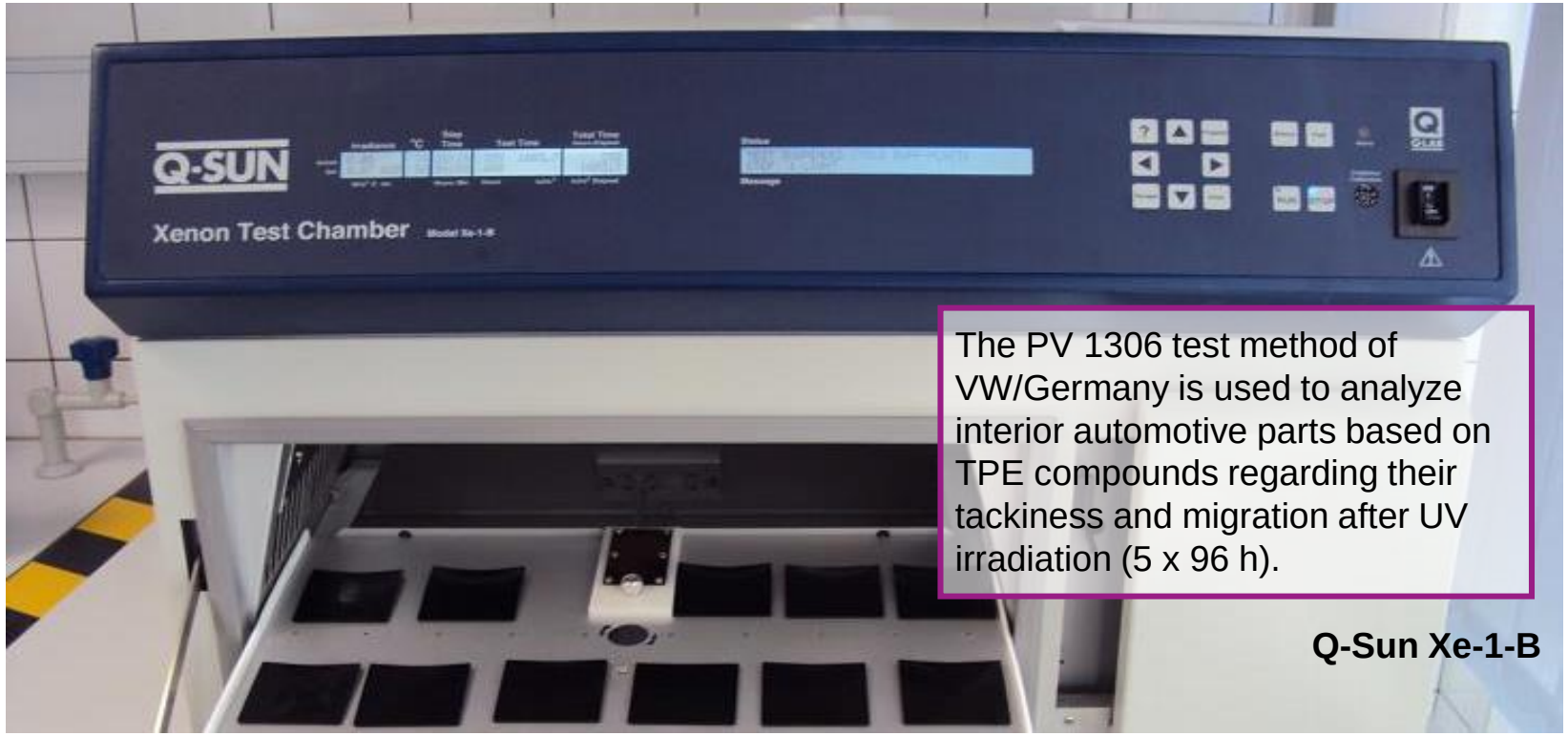
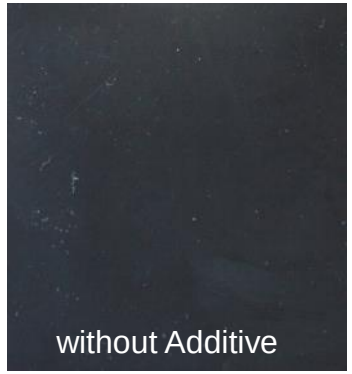
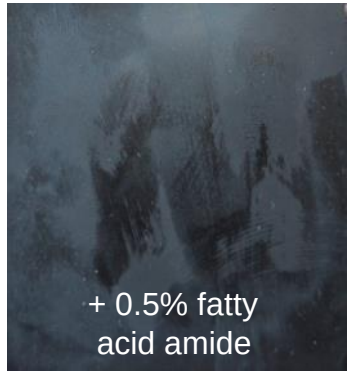
TEGOMER® in TPE-V
Additive with Long Lasting Effect and no Migration

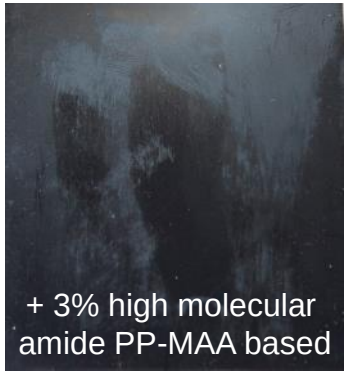


The PV 1306 test method of VW/Germany is used to analyze interior automotive parts based on TPE compounds regarding their tackiness and migration after UV irradiation (5 x 96 h).

Q-Sun Xe-1-B







TEGOMER® AntiScratch L does not show any migration and tackiness in the PV 1306 test but remains in the bulk phase of the plastic part providing a long lasting scratch resistance.

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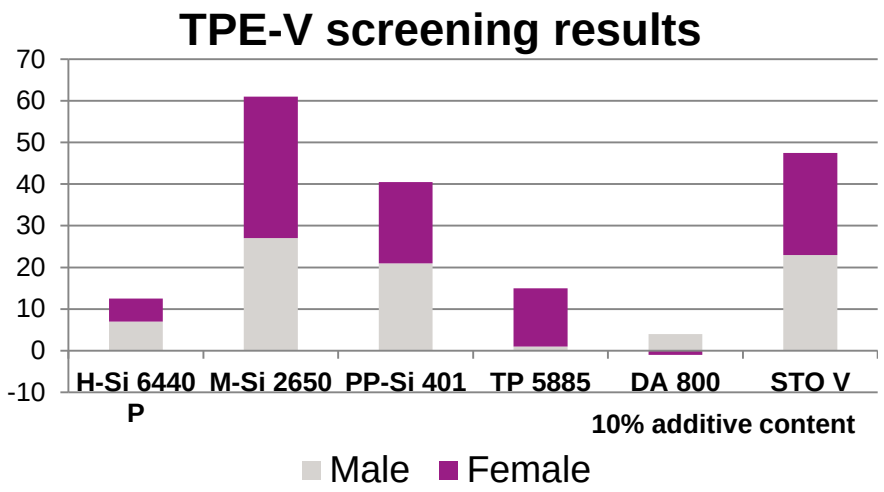
Additives to Improve Haptics of TPE Screening by Evonik



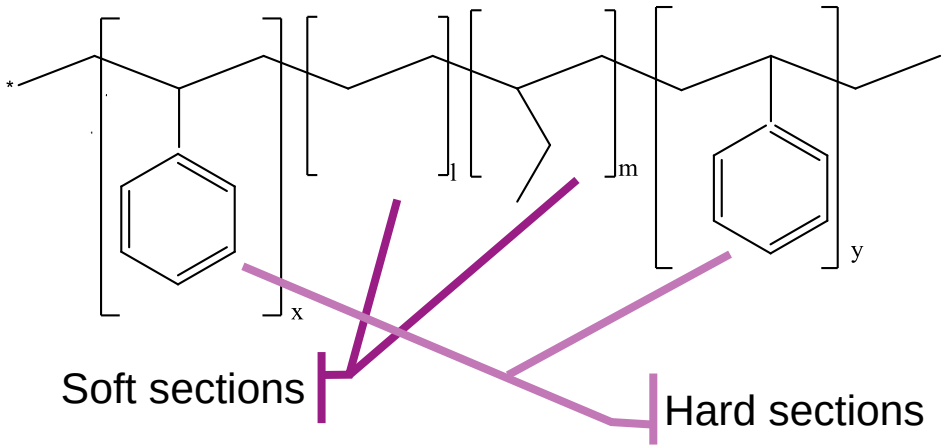
- Subjective rating by manual surface screening of injection molded plaques.
- Best results can be achieved by TEGOMER® M-Si 2650.
- Biggest differences can be seen by modifying TPE-V, lowest differences at PMMA.
- Female test persons are more sensitive, especially at grained surfaces.

Polymer	With-out	TEGOMER® H-Si 6441P	TEGOMER® M-Si 2650	(PP-Si 401)	TEGOPREN® 5885	TEGOMER® DA 800	TEGO® STO V
TPE-V	-	+	++	+	+	-	+
PMMA	O	+		O+		O	O
PP	O	+	++[1]	+	-[2]	-[3]	+[1]

1. just 5% additive content, because 10% were not moldable
2. surface defects due to incompatibility → yellowness, flowlines
3. inhomogeneous additive distribution → some flowlines

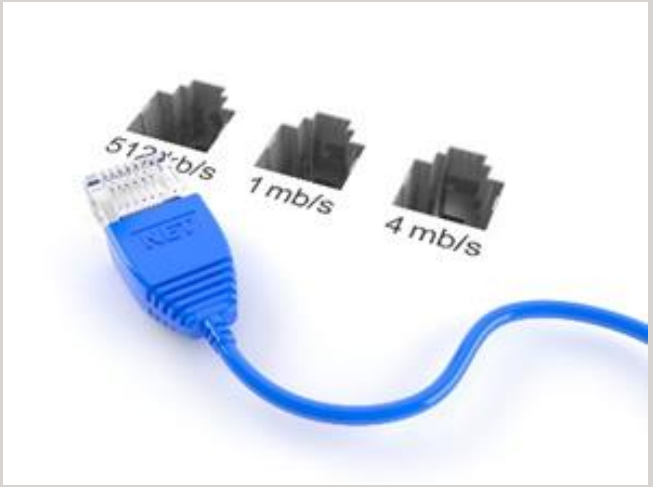
SEBS the most used TPE-S

Styrene Ethylene Butylene Styrene Copolymer



Some remarks on SEBS

- Moderate chemical and thermal resistance
- Good weathering resistance
- Only used in form of a blend with extender like PP and mineral oils
- Excellent adhesion to surfaces
- Widely used for in the automotive industries for direct molded sealing and consumer goods with lower mechanical demands
- Good cushioning properties



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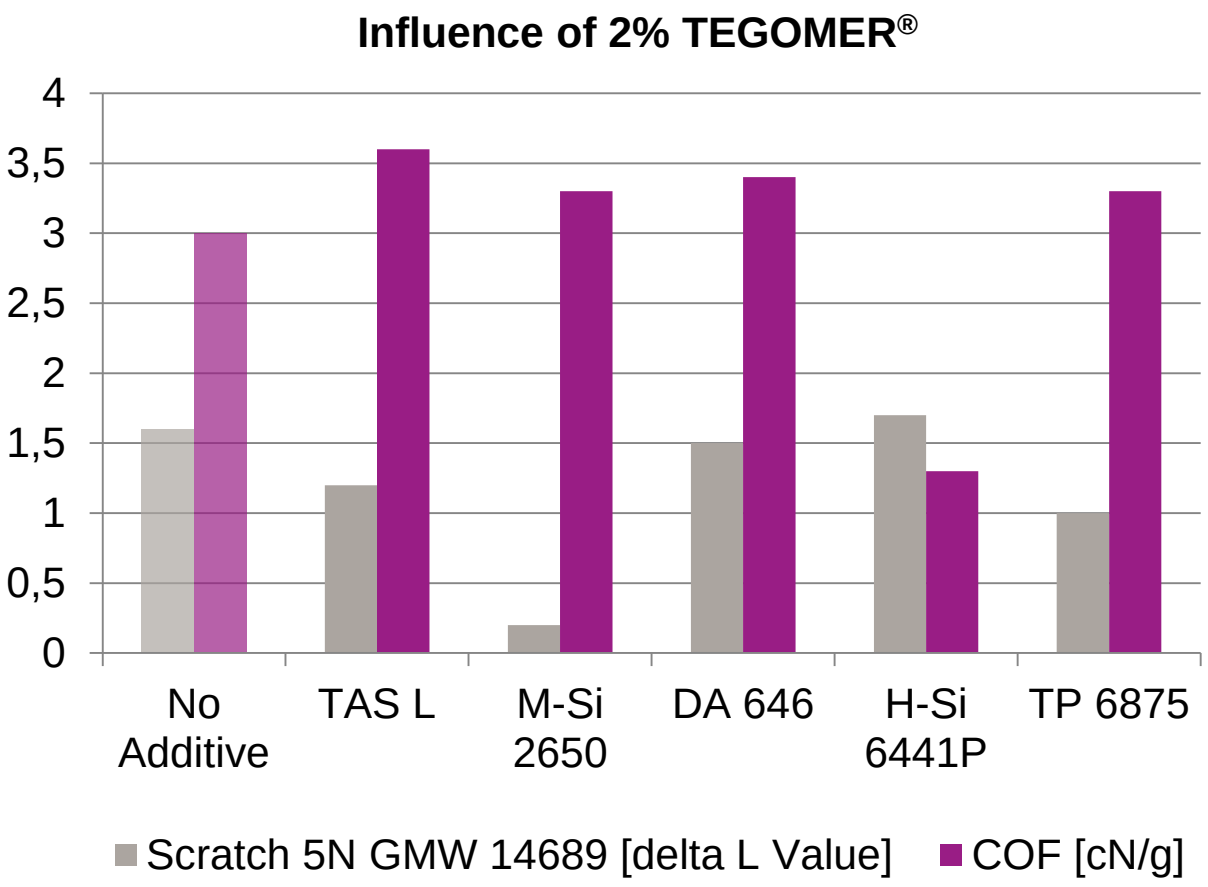
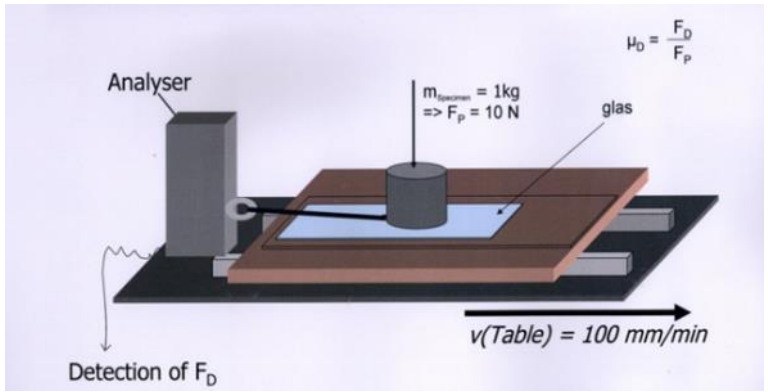
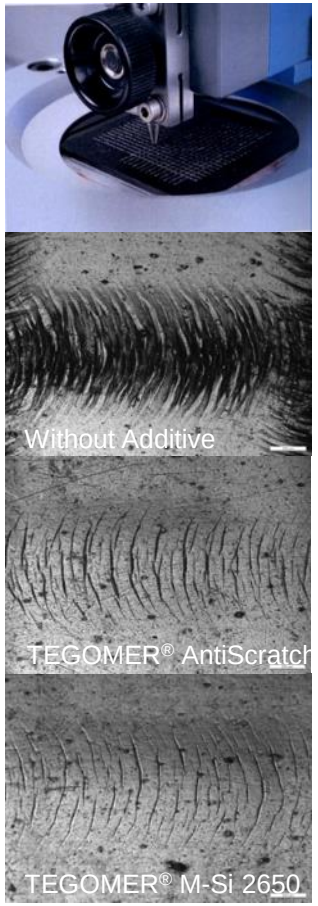
TEGOMER® in SEBS
Influence on Scratch Resistance and COF



Formulation	%bw
SEBS	46
OIL	50
TEGOMER® / TEGOPREN®	2
COLOUR MASTERBATCH	1.3
ANTIOXIDANTS	0.7





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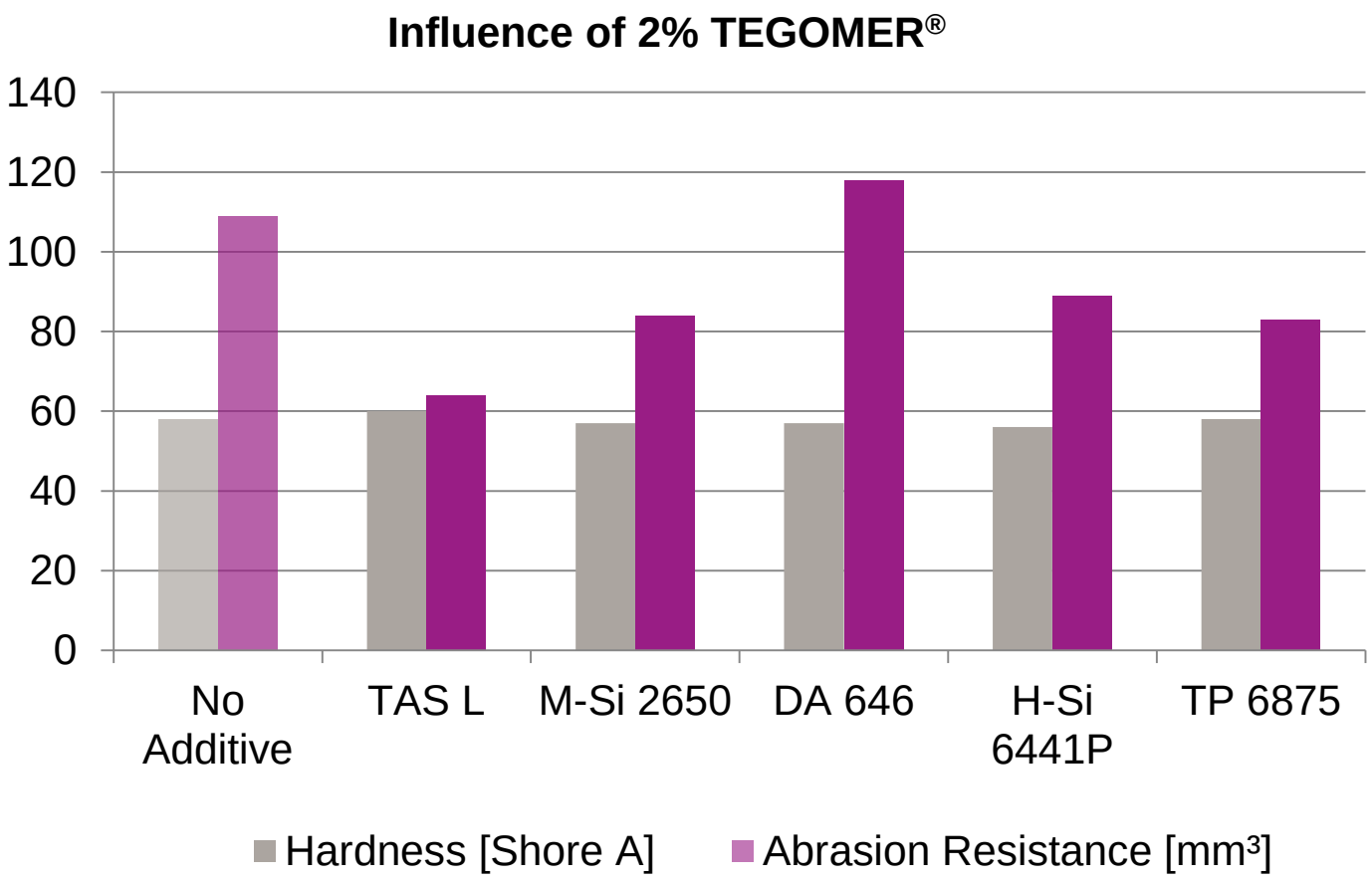
TEGOMER® in SEBS
Influence on Abrasion Resistance vs. Hardness



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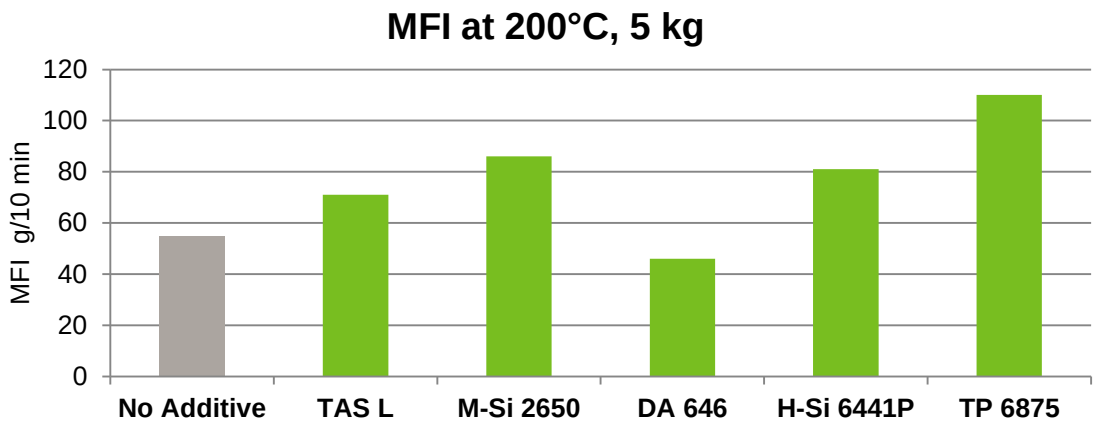
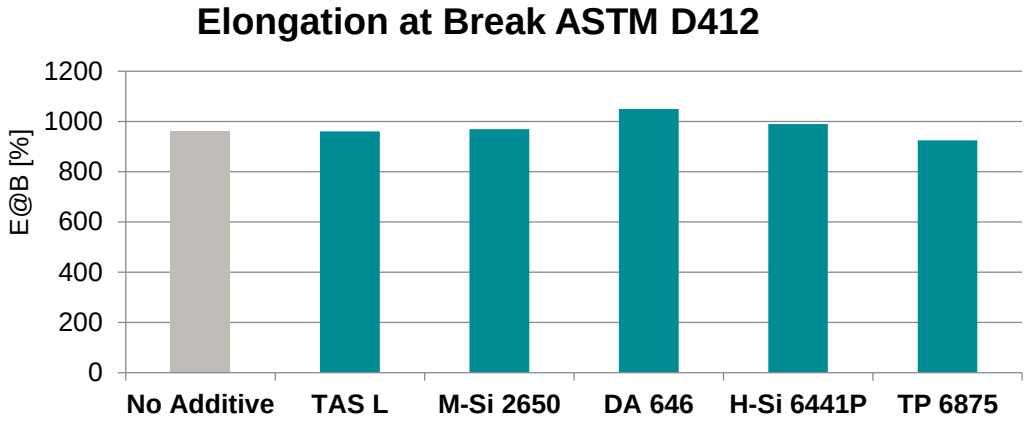
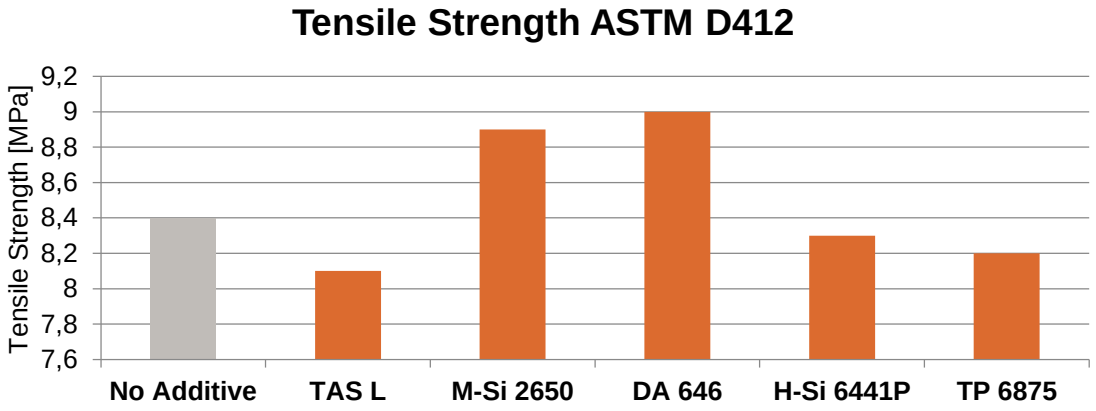
TEGOMER® in SEBS
Influence on MFI, E@B and Tensile Strength







Property	1st Choice	2nd Choice	3rd Choice
Hardness and E@B		No significant influence	
MFI	TEGOPREN® 6875	TEGOMER® M-Si 2650	TEGOMER® H-Si 6441P
Tensile Strength	TEGOMER® DA 646	TEGOMER® M-Si 2650	
Scratch Resistance	TEGOMER® M-Si 2650	TEGOPREN® 6875	TEGOMER® AntiScratch L
Abrasion Resistance	TEGOMER® AntiScratch L	TEGOMER® M-Si 2650	TEGOPREN® 6875
COF	TEGOMER® H-Si 6441P		

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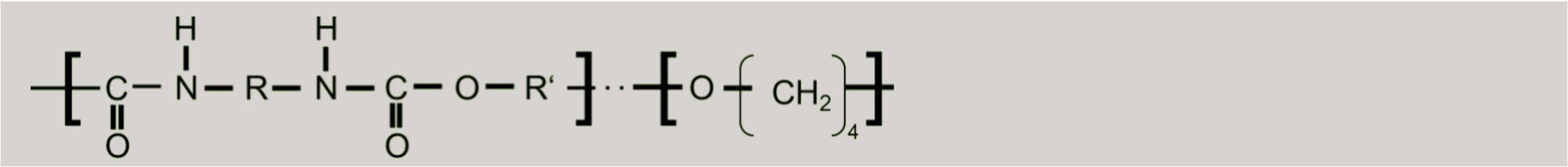
TPU a very special TPE Type

Multi phase block copolymer (polyester or polyether based) out of

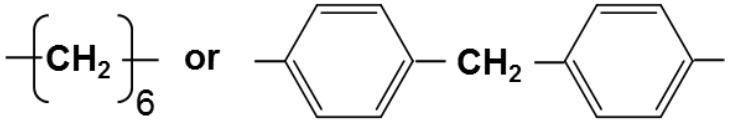
- A polyol or long chain diol
- A chain extender
- A diisocyanate16



Special Properties of TPU‘s

- Highest strength among the TPE‘s
- High resistance against cut propagation
- High abrasion resistance and cushioning effect
- Good adhesion on solid surfaces
- Good UV stability

Typical Raw Materials

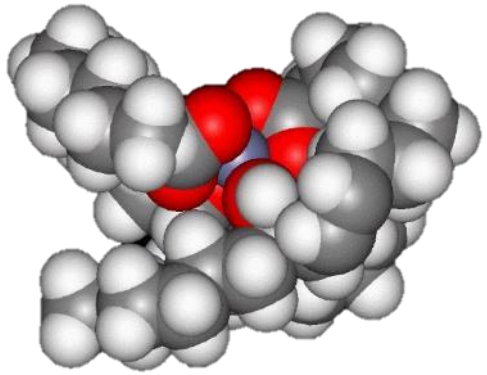
R =  **or**

R‘= Chain extender

The Right TEGOMER® grades for Different Application

	Product	PEO	TPE-V	TPU	TPE-S	TPO	Soft PVC
Improvement of Melt Flow	TEGOMER® H-Si 6441P	X	X	X	X	X	X
	TEGOMER® M-Si 2650		X	X	X		
	TEGO® Sorb PY 88 TQ		X				
Flame Resistance	TEGOMER® V-Si 4042	X	X		X	X	X
	TEGOMER® FR 100	X	X		X	X	
COF / Abrasion Reduction	TEGOMER® M-Si 2650		X	X	X		
	TEGOMER® H-Si 6441P	X	X	X	X	X	X
	TEGOMER® H-Si 2315			X			
Scratch Resistance	TEGOMER® AntiScratch 100	X	X			X	
	TEGOMER® AntiScratch L	X	X		X		
	TEGOMER® H-Si 6441P	X	X	X	X	X	X
	TEGOMER® 6264				X		

TEGO® Sorb PY 88 T.Q.
Giving the world a clean smelling back



TEGO® Sorb PY 88 T.Q. helps to meet critical organoleptic and olfactory demands.

Non reversible absorption of Sulphur and Nitrogen containing impurities creating malodor.

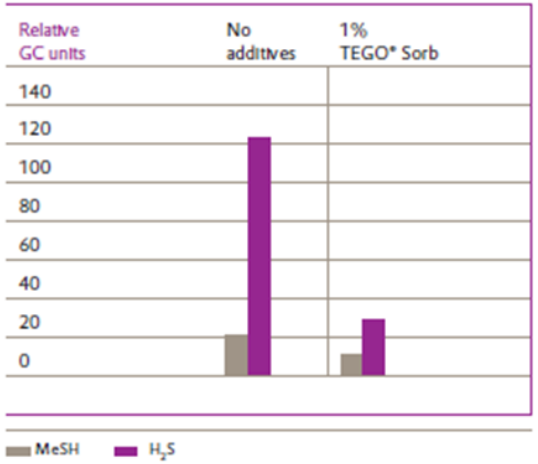
Suitable for preventing emission from recycled polymers, pigments, TPE's, PA …

Dosage: 0.5-2.0%

One Example

- Recycled grade of PA6 containing Mercapto Sulphur components which generate odor
- Addition of 1 % TEGO® Sorb PY 88 leads to reduction of these smelling components by 25–to 50 %
- characterization of VOC by thermo-desorption (GC-MS 90°C) VDA-Norm 278

Figure 19: Reduction of hydrogen sulfide and mercapto methane by TEGO® Sorb



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