KRAIBURG TPE

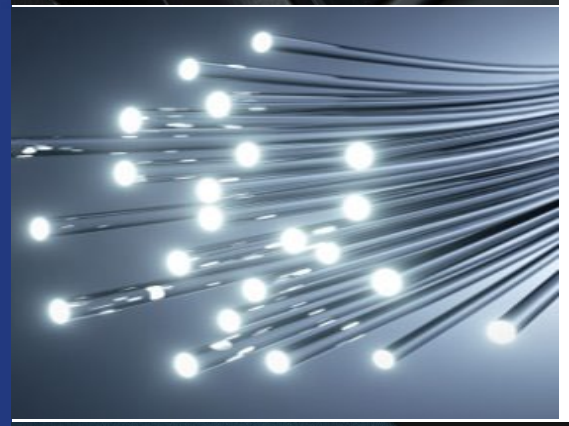
CUSTOM ENGINEERED **TPE** AND MORE

Beyond Black

Sustainable & Decorative TPEs
Illuminating Automotive Possibilities

SPE TPO Global Automotive Conference
2025




KRAIBURG TPE
Short Portrait

- Globally operating manufacturer of Thermoplastic Elastomers (TPE)
- Competence Leader in the global TPE market
- 700 employees worldwide
- 223 Mio. € annual sales in 2024
- Production capacity: 60,000 tons

KRAIBURG TPE Global Presence

Atlanta (GA) / USA
Production capacity: 10.000 t
Certified: ISO 9001, 14001
Employees: 90

Waldkraiburg / Deutschland
Production capacity: 36.000 t
Certified: ISO 9001, 14001, 50001
Employees: 420

Kuala Lumpur / Malaysia
Production capacity: 18.000 t
Certified: ISO 9001, 14001
Employees: 190

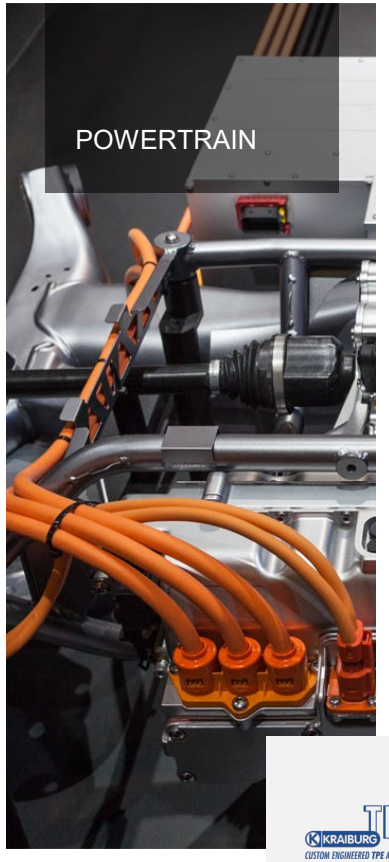
MEXICO Market

AUTOMOTIVE


EXTERIOR
APPLICATIONS


INTERIOR
APPLICATIONS


NEW MOBILITY


POWERTRAIN

Light Effect TPE

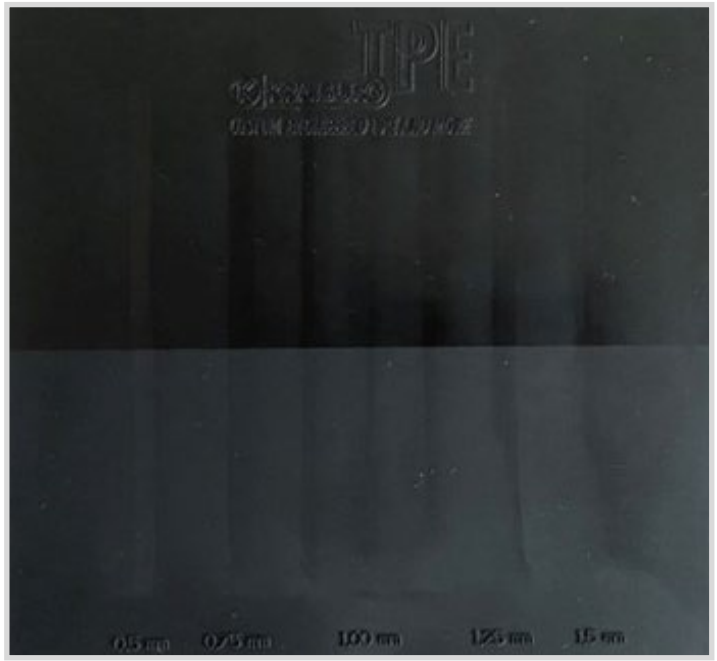
Light Effect TPE

Typical Applications:

- **Optical Fiber**
- **Backlighting**
- **Display Overlays**
- **Door Sill Trims**
- **Cupholder Liners**

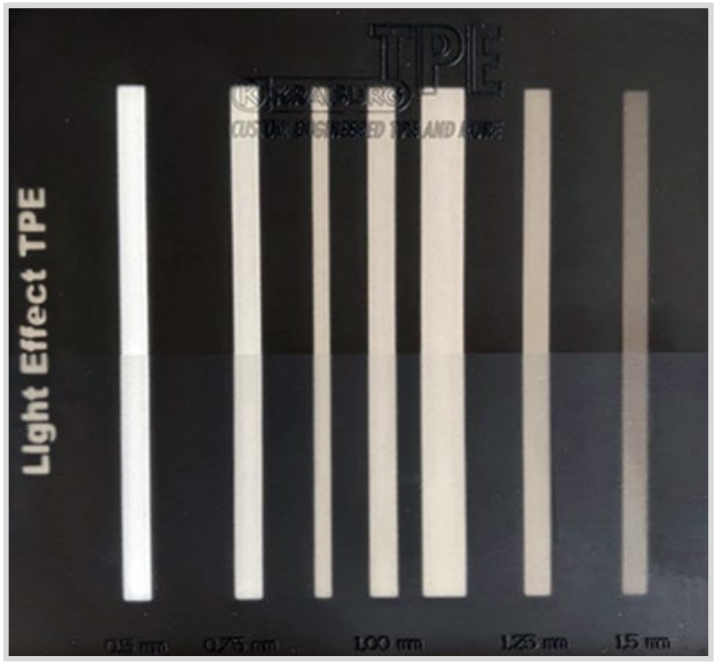

AUTO
FRONT
MODE
REAR
MAX
REAR

Light Effect TPE – Know-How Technology



Standard black surface TPE with panel effect.

- Opacity of material completely blocks light transmission

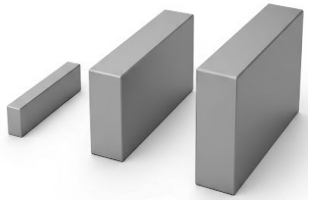


Black light effect TPE with panel effect.

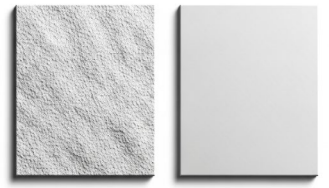
- Materials exhibits variable optical transmittance

Light Effect TPE – Know-How Technology

Light effect dependent on several factors



Part Thickness



Surface Structure

Light Source

Colorization

Light Effect TPE – Part Thickness

Exponential Decay Model for Light Intensity

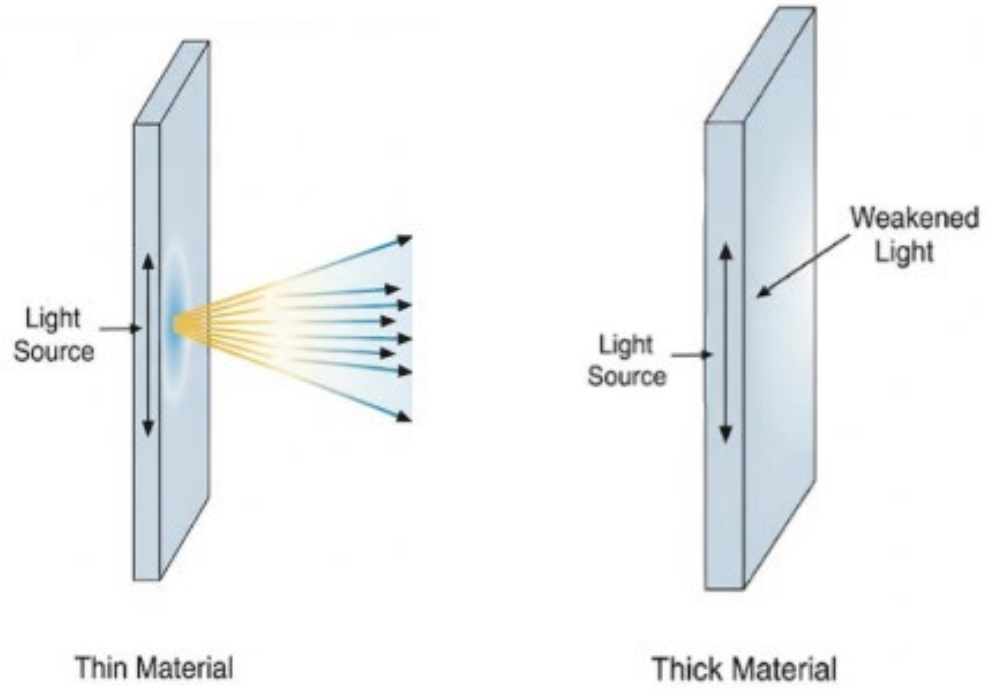
- As light passes through a medium, its intensity decreases due to degrees of absorption and scattering.
  - Beer-Lambert Law

$$I(x) = I_0 e^{-kx}$$

where:

- I_0 is the initial intensity
- x is the distance traveled
- k is the medium's absorption properties

$$T = \frac{I}{I_0} = e^{-kx}$$

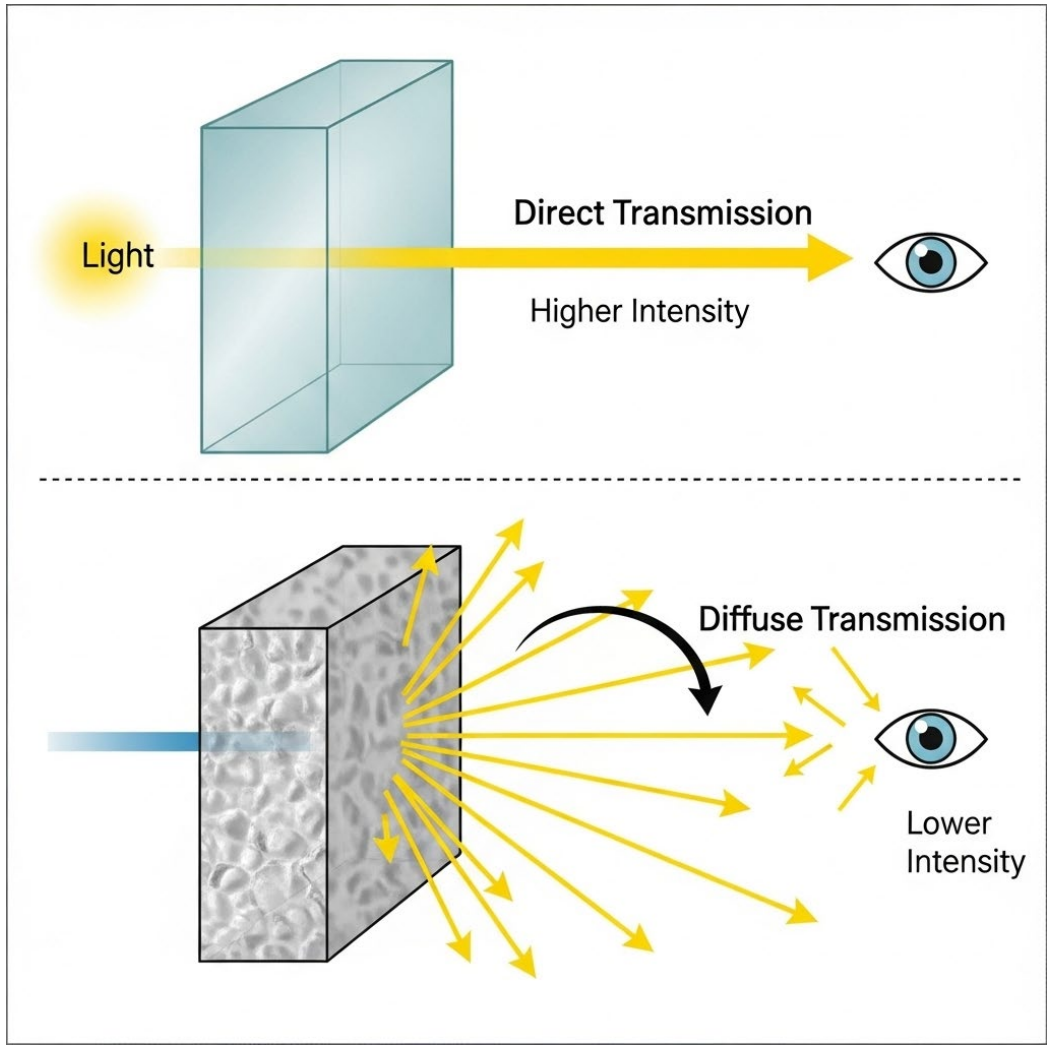


- With all other variables held constant, **increasing** part thickness **decreases** light transmittance.

Light Effect TPE – Surface Structure

Direct versus Diffused Light Transmission

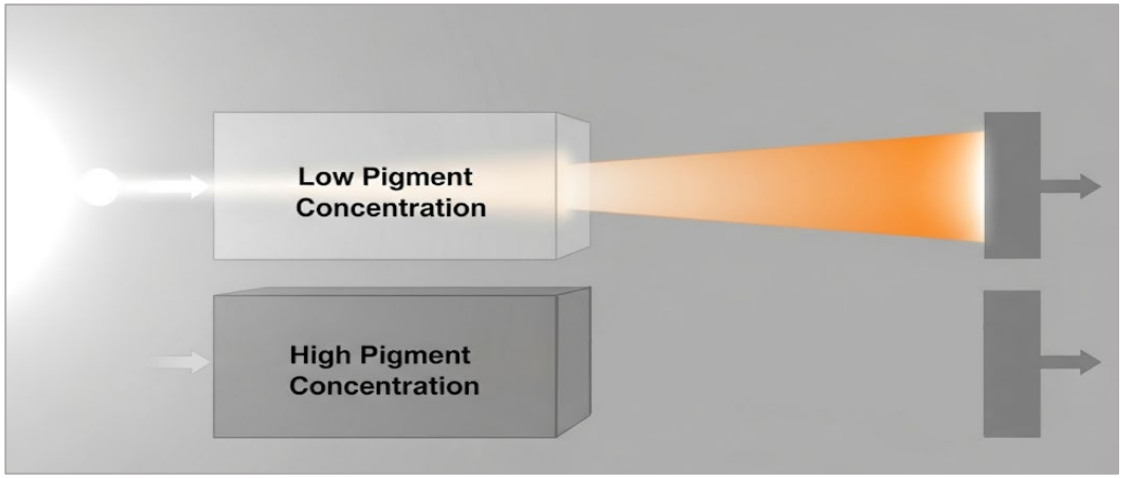
- Surface structure can impact the degree of light scattering when light travels through a medium.
- Scattering reduces the amount of light that travels straight through the medium and can impact the perceived light intensity.
- A grained or textured surface will have a **lower measured** transmittance compared to a smooth surface.

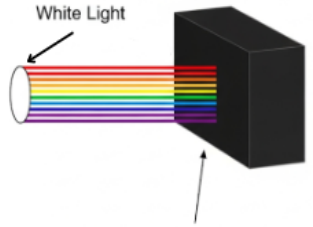


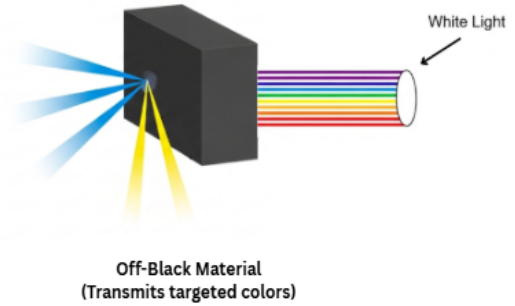
Light Effect TPE – Colorization & Light Source

The Influence of Color and Additives

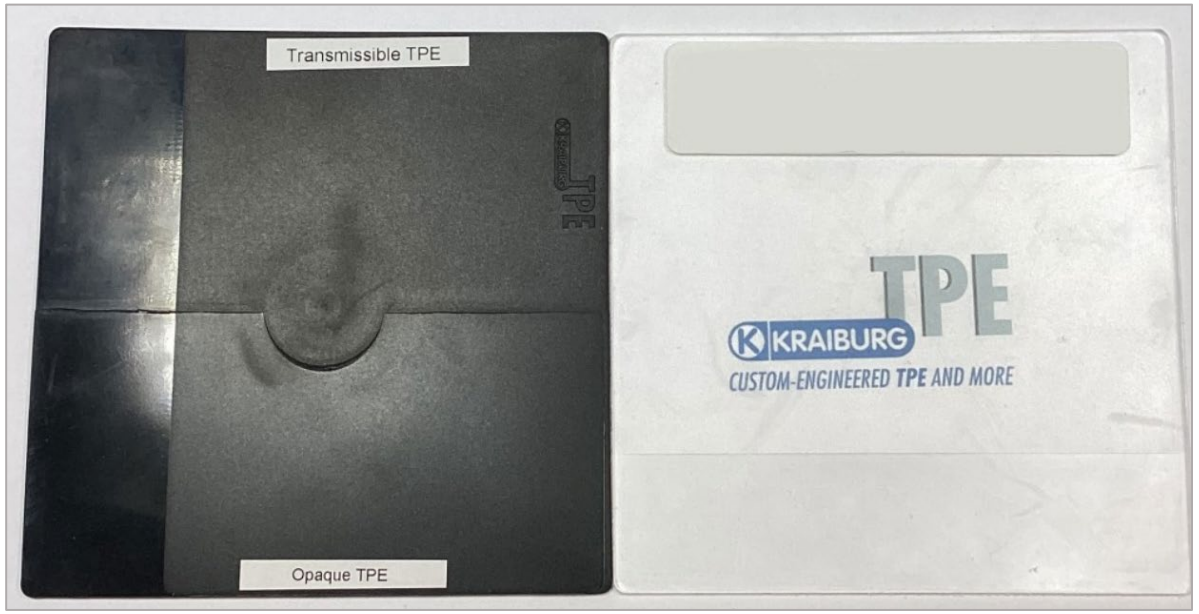
- A black material, in theory, absorbs nearly all wavelengths of visible color and reflects or transmits very little.
  - The light effect TPE grades take this into account and adjust the pigment loading at the material-level with part thickness and surface structure considered at the part-level.
  - Pigment loading and type can influence the color wavelengths that can transmit through a medium.
- Other additives can impact light transmission by reducing clarity, increasing opacity, and impacting scattering effect.







Light Effect TPE – Comparison to Transparent TPE Material



		Light Effect TPE	Transparent TPE
Avg. % Light Transmittance	0.25mm	47.0%	98.1%
	0.5mm	22.1%	96.2%
	1.0mm	4.9%	92.5%
	2.0mm	0.24%	85.5%

Exponential Decay Model for Light Intensity Measurements and Calculations

- Total transmission was measured utilizing an integrating spherical spectrophotometer.
  - Measurement taken at a known thickness allows for the calculation of the material's absorption properties and can be used to determine average light transmittance percentage at other part thicknesses.

Light Effect TPE – Properties

		Interior Applications	Exterior Applications
Hardness	**Shore A**	40 – 80	40 – 80
Density	**g/cm³**	0.90 – 1.00	0.90 – 1.00
Avg. % Light Transmittance*	**0.25mm** **0.5mm** **1.0mm** **2.0mm**	47.0% 22.1% 4.9% 0.24%	10.2% 5.7% 0.3% --
Thermal Resistance		Long-term heat stability up to 90°C	Long-term heat stability up to 90°C
Weatherability		Passes Artificial Interior Weathering (ISO 105-B06)	Passes Real-Time 2 year Florida & Arizona
Adhesion		Non-polar Thermoplastics	Non-polar Thermoplastics

* Utilized internal method for measurement (results vary on part thickness, light intensity, surface structure, and light source)

SPECKLED TPE

SPECKLED TPE

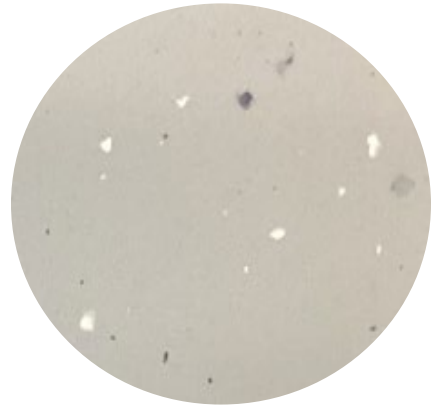
Typical Applications:

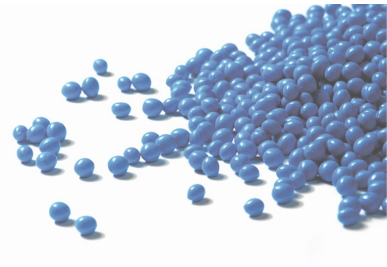
- **Interior cupholder mats & liners**
- **Floor mats & liners**
- **Wireless charging mats**
- **Center console & storage bins**
- **Shift knobs**

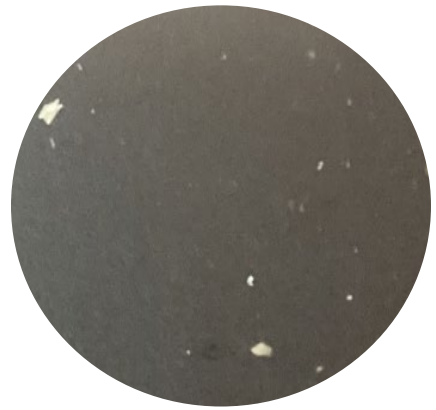
Speckled TPE – Know-How Technology

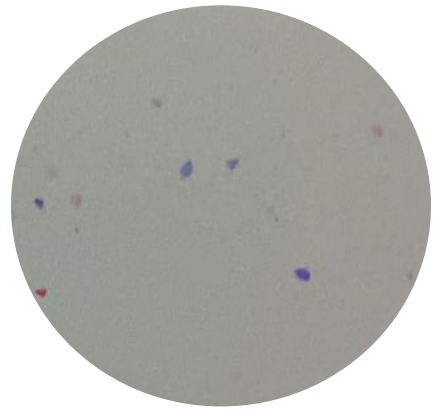
Customization

- Colorability of speckles and base TPE material is possible.
- Variation in speckle size and concentration is possible.
  - Some limitations due to processing and visibility.
- Sustainable options available.
  - Some limitations in colorability.
- Chemistry of speckled material
  - Can impact mechanical properties/material performance.







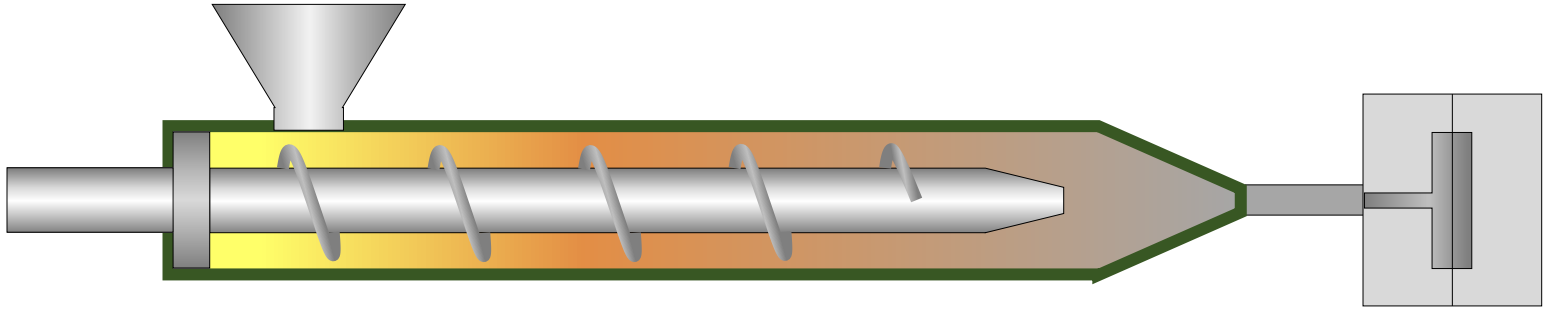


Speckled TPE – Processing

Conditions & Limitations

- Processing conditions similar to standard TPE material.
  - Speckles have little effect on processing.
  - Speckles are non-abrasive to tooling.

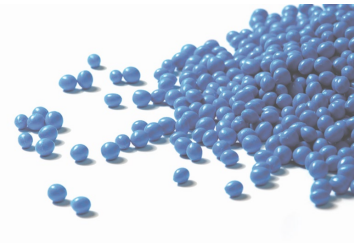
- Particle size of speckles is critical depending on gate size.
  - Size too large can lead to:
    - Blockage of gate and nozzle (or potential destruction of speckled material).
    - Non-uniformity throughout TPE matrix.



Speckled TPE – Chemistry

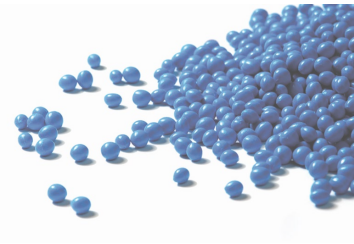
Material	Chemistry Type	Compatibility with TPS	Cost	Potential Processing Impact	Mechanical Performance Impact
Cellulose	Organic Polymer	-	Low	• Hygroscopic material • Temp. limitations for processing	• May lower impact resistance
Mica	Inorganic Mineral	+ (Treated)	High	• Can abrade equipment if untreated • High concentrations increase material viscosity	• Decreases elongation
EPDM Granules	Non-polar Rubber	-	Low	• Requires higher processing temps and shear • Could agglomerate if not properly mixed	• EPDM type can impact adhesion
Colored Flakes	Thermoplastics	++	Medium	• Easy to disperse throughout matrix • Minimal impact to current process of TPS material	• Inconsistent speckle size can lead to inconsistent mechanical performance
Biopolymer Flakes	Biobased Polymer	-	High	• Temp. limitations for processing • Hygroscopic material	• Can lower density of material • Widely depends on chemistry

Speckled TPE – Properties



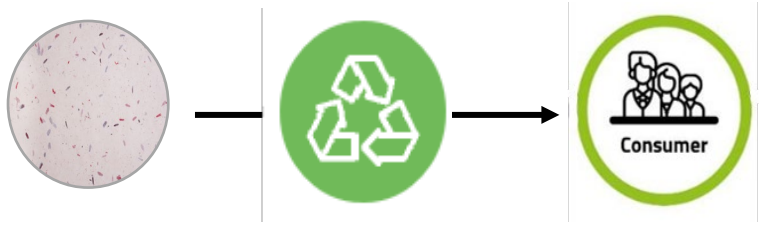
		HRI9341/370	HRI9341/371	TC9GPZ
Hardness	Shore A	95	95	89
Density	g/cm³	0.929	0.934	1.100
Tensile Strength	MPa	7.5	8.1	13.5
Elongation at Break	%	338	378	650
Tear Strength	N/mm	43.6	44.4	38.0
Kinetic Coefficient of Friction	200g Dry PTFE	0.16	0.16	0.28
Weatherability		SAE J2412 (1240 kJ/m²) DE: 0.76	SAE J2412 (1240 kJ/m²) DE: 1.73	SAE J2412 (601.6 kJ/m²) DE: 1.02
Adhesion		Non-polar thermoplastics	Non-polar thermoplastics	Non-polar thermoplastics
Sustainable Content		45%	45%	0%
Base Color		Dark Gray	Brown	Black

Visualizing Sustainability Through Speckled TPE Design



- Reduces pigment loading
  - Supports in the reduction of VOC emissions from masterbatch.

- Speckled TPE visually communicated the use of recycled content
  - Either using recycled content raw materials in the TPE matrix and/or the speckled materials.
  - This aligns with many OEM initiatives to increase sustainable content within automotive vehicles that the consumers can see.



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KRAIBURG TPE

CUSTOM-ENGINEERED **TPE** AND MORE

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