KRAIBURG TPE

CUSTOM-ENGINEERED TPE AND MORE

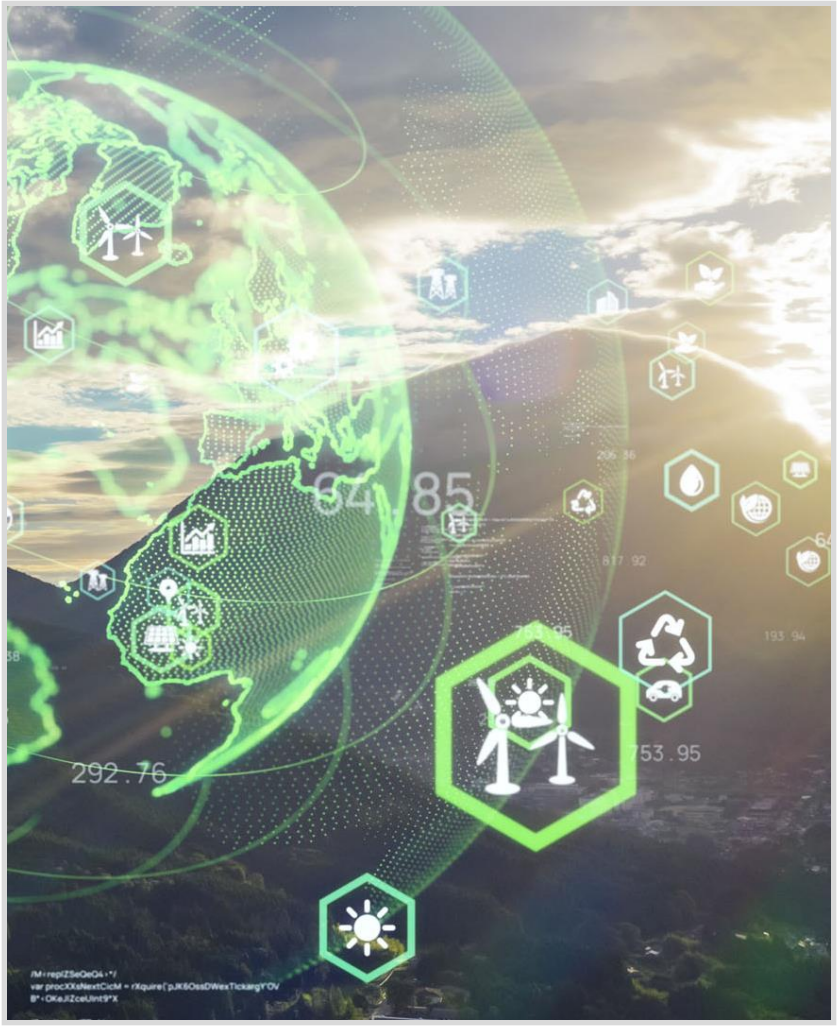
SUSTAINABILITY AND INNOVATION BY KRAIBURG TPE

JOSEF NEUER

Fundamental Understanding of Sustainability

For KRAIBURG TPE, sustainability is the much-needed balancing act between economic success, environmental protection and social responsibility.

KRAIBURG TPE considers sustainability as a vital element for the company's long-term existence and success.



Our Commitment to Sustainability

Sustainability Core topics for KRAIBURG TPE and its Stakeholders

- Circular Economy
- Climate and Energy
- Employees
- Governance and Compliance

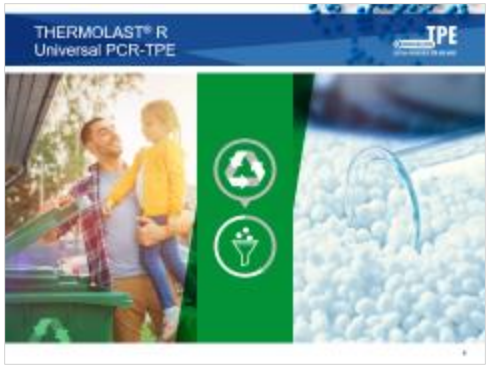
Continuous Improvement

Lifelong learning with a commitment to becoming better and more responsible each day.

Sustainability at KRAIBURG TPE

- Our products are
  - long-lasting
  - able to integrate functionality
  - ready for in process recycling
- Our products are available with
  - bio-based content
  - recycling content

Thermoplastic Elastomers Innovation



THERMOLAST® R
Universal PCR-TPE

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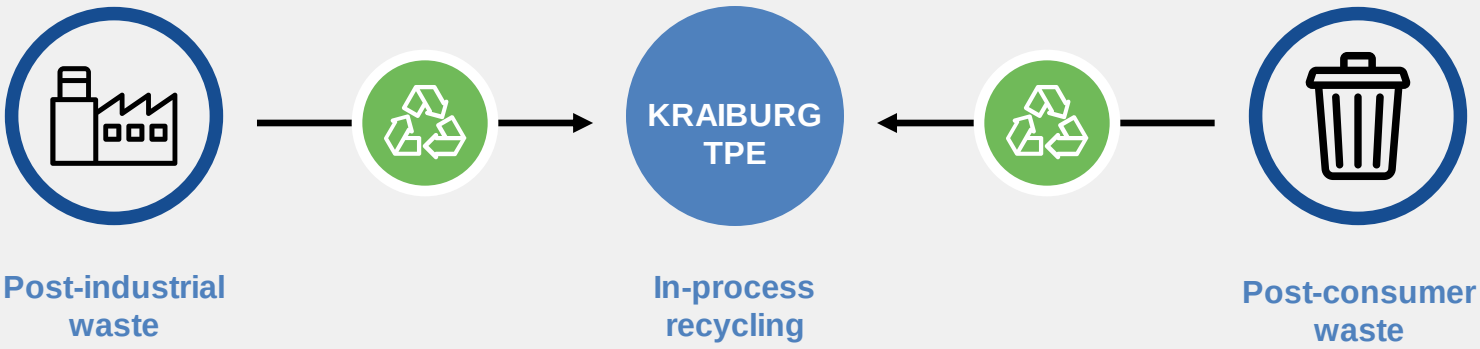
Reduce & Reuse – We close the loop

USE OF VARIOUS FEEDSTOCKS IN OUR PRODUCTS



PCR-TPEs vs. Virgin TPEs

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Comparing typical TPE from recycling and virgin resources

	TF7CGT	RC7OGG-NTRL	TC7GPN
PCR Content	0 %	27 %	0 %
Color	transparent	natural	natural
Hardness [ShA]	68	72	68
Density [g/cm³]	0.89	0.89	1.10
Tensile Strength [MPa]	7.5	7.0	10.0
Elongation at break [%]	720	650	790
Tear resistance [N/mm]	20	21	23
Spiral flow length [cm]	110	99	67
CS, 72 h @ 23 °C [%]	34	43	30

THERMOLAST® R - RC/PCR

Post Consumer Recycling TPE – RC/PCR in natural base

	RC4OGG -NTRL	RC5OGG -NTRL	RC6OGG -NTRL	RC7OGG -NTRL	RC8OGG -NTRL	RC9OGG -NTRL
PCR Content	**13 %**	**17 %**	**22 %**	**27 %**	**33 %**	**41 %**
Hardness [ShA]	40	49	62	72	79	91
Density [g/cm³]	0.88	0.89	0.89	0.89	0.89	0.89
Tensile Strength [MPa]	7.9	7.8	7.3	7.0	7.4	9.0
Elongation at break [%]	850	800	700	650	600	550
Tear resistance [N/mm]	12	13	17	21	24	37
Spiral flow length [cm]	108	103	98	99	94	110
CS, 72 h @ 23 °C [%]	26	28	35	43	45	56

THERMOLAST® R
Universal PCR-TPE

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RC/PCR Series

- Hardness range: 40-90 Sh A
- Hardness dependent PCR-Content from 13-40 %
- Natural materials

Key Features

- Adhesion to PP
- Good mechanical properties and flowability
- REACH, SVHC and RoHS
- Reliable quality and availability

Application Examples:

Function, grip and design elements, caps and closures, sealing systems, cable management

THERMOLAST® R
RC/FG for Interior Applications

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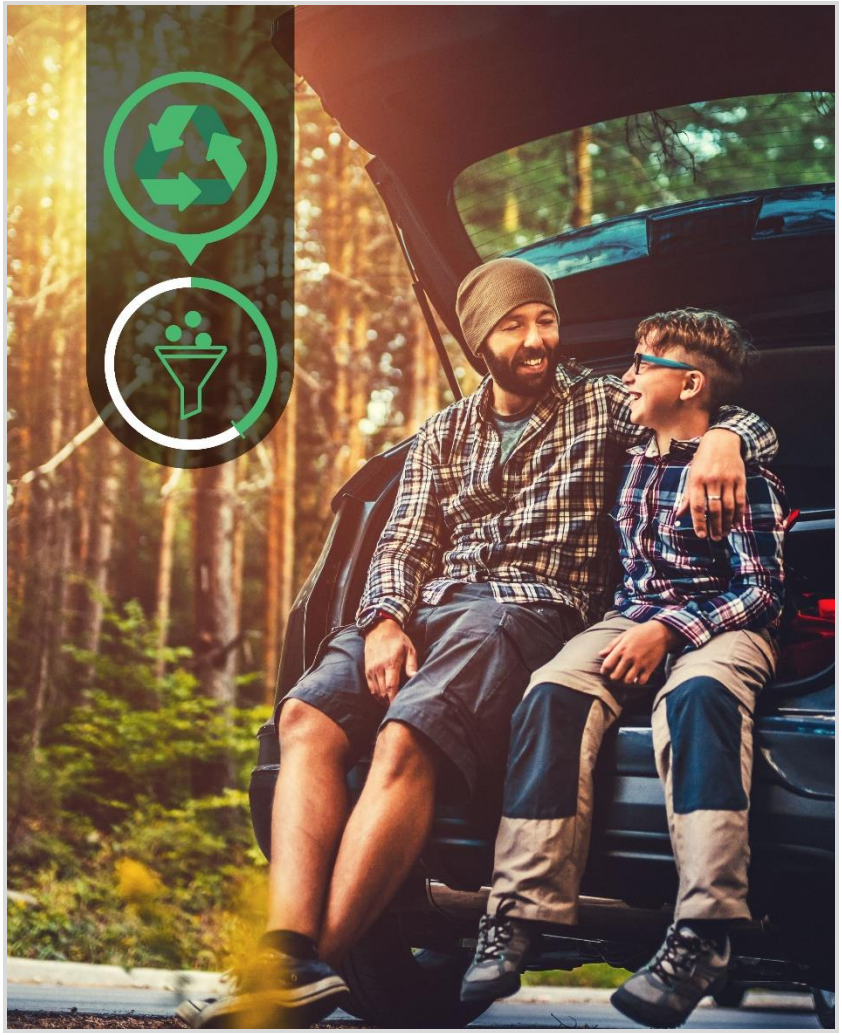
Market Demands Interior

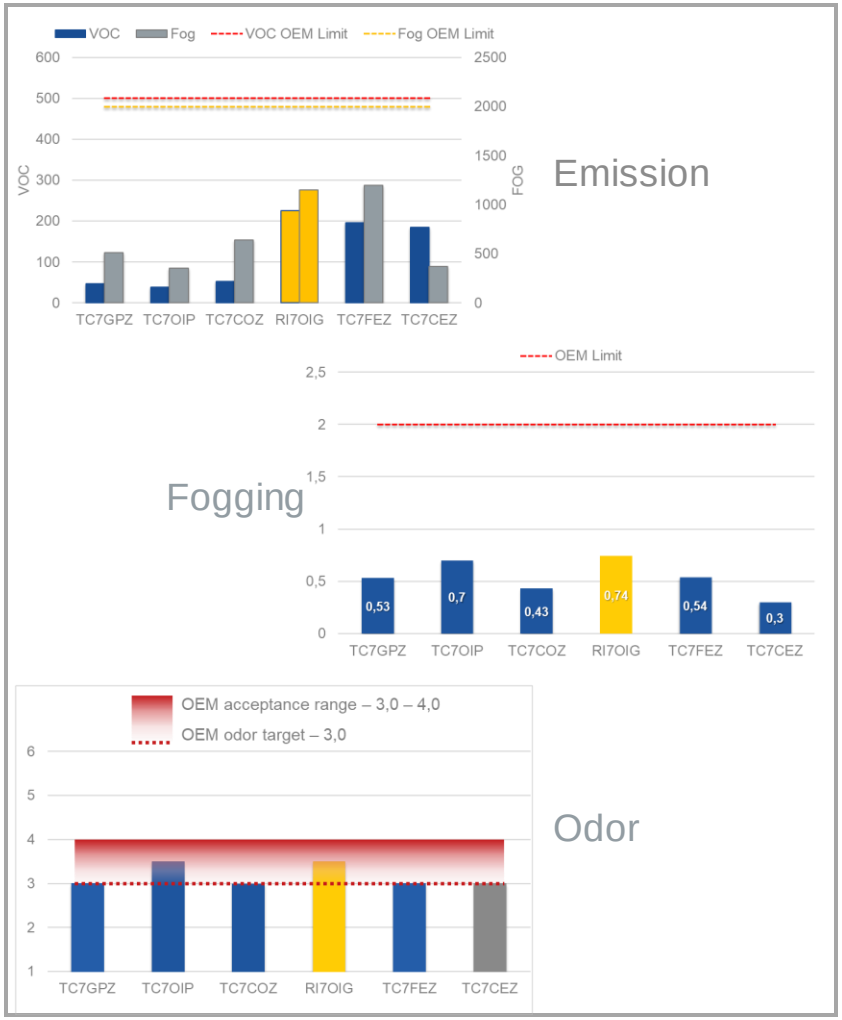
- % Recycled content > 20 %
- Competitive cost performance
- Adhesion to PP
- Hardness range from 60 to 80 ShA
- Low density (part weight reduction)
- Interior requirements (Emission/Odor/Fogging)



Interior Materials - Requirements

Fulfilment of OEM interior specifications

- Thermodesorption [VOC/FOG]
  - *VDA 277 / VDA 278*
- Odor
  - *VDA 270 B-3*
- Light Fastness (UV Interior)
  - *DIN EN ISO 105-B06 (Method 3)*
- Flammability (FMVSS)
  - *ISO 3795 / DIN 75200 / 49 CFR § 571.302*



New Interior Recycling Series

- Series will be named: **RC/FG**
- Compounds will be named: **RI#OIG-BLCK***

THERMOLAST® **R**

Based on Post **I**ndustry Recycling Material

60 – **8**0 ShA

Olefin based

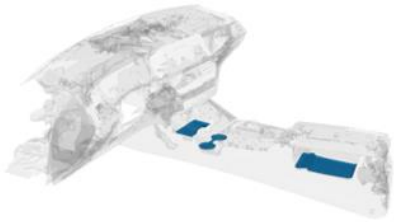
Suitable for automotive **I**nterior

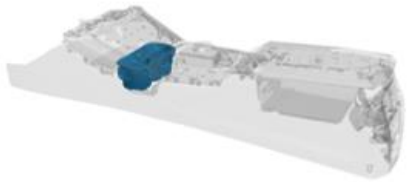
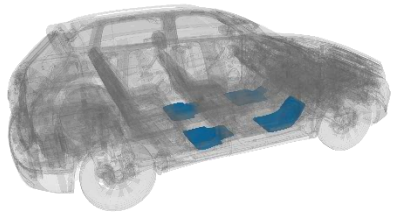
General Purpose

Colored in **BL**A**CK**

***Compounds will be produced for EMEA region only

Portfolio Recycling Interior Series RC/FG



			RI6OIG-BLCK	RI7OIG-BLCK	RI8OIG-BLCK
Recycling content [%]*			**> 21**	**> 25**	**> 30**
Hardness	DIN ISO 7619-1	Sh A	61	70	81
Density	DIN EN ISO 1183-1	g/cm³	**0.93**	**0.94**	**0.94**
Tensile Strength	DIN 53504/ISO 37	N/mm²	7,.0	9.0	11.0
Elongation at break	DIN 53504/ISO 37	%	800	750	750
Flow Spiral	200° / 760 bar	cm	**83**	**78**	**70**
Abrasion	ISO 4649:2014 - Method A	mm³	264	167	132
Fogging	DIN 75201-B	mg	0.74	0.66	0.69
Odor	VDA 270 B-3	Rating	3.5	3.5	3.5
Emission	VDA 278 VOC, Fog	µg/g	225 / 1150	283 / 1280	339 / 1220

*RC/FG only with PIR raw materials

Portfolio Interior, 70 ShA, PP-Adhesion

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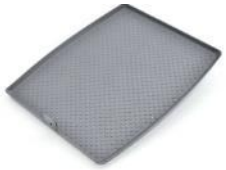
NEW

			TC7GPZ	TC7COZ	RI7OIG-BLCK	TC7FEZ
	Highlight		General purpose	General purpose Low density	Recycling Interior	Surface finish Best Abrasion
Recycling	Content	%	-	-	25	-
Hardness	DIN ISO 7619-1	Sh A	68	72	70	72
Density	DIN EN ISO 1183-1	g/cm3	1,1	0,98	0,94	0,93
Tensile Strength	DIN 53504/ISO 37	N/mm2	9,0	11,0	9,0	6,0
EB	DIN 53504/ISO 37	%	700	750	750	600
Possible Adhesion			PP	PP	PP	PP

Possible Applications

Anti Slip Mats

- Replacement for TC6GPZ or TC6COZ-Grades
- New Solution RI6OIG-BLCK with 20% Recycling Content
- Suitable for Automotive Interior
- Higher recycling content possible with higher hardness.
  Up to **30 % at 80 ShA**.

	TC6GPZ	⇔	RI6OIG-BLCK
RECYCLING CONTENT in %	0	⇧	20.0
Hardness in ShA	59	⇨	61
Density in g/cm³	1.1	⇩	0.93
Tensile Strength in MPa	8.0	⇨	7.0
Elongation at Break in %	750	⇗	859
Flow spiral in cm	67	⇗	83

Possible Applications

Cupholder

- Replacement for TC7GPZ or TC7COZ
- New solution RI7OIG-BLCK with 25% Recycling Content
- Suitable for Automotive Interior
- Higher recycling content possible with higher hardness.
  Up to **30 % at 80 ShA**

	TC7GPZ	⇔	RI7OIG-BLCK
RECYCLING CONTENT in %	0	⇧	>25.0
Hardness in ShA	68	⇨	70
Density in g/cm³	1.1	⇩	0.94
Tensile Strength in MPa	9.0	⇨	9.0
Elongation at Break in %	700	⇗	750
Abrasion in mm³	320	⇩	167

Possible Applications

Floor mats

- Replacement for TC8COZ or special floor mat grades
- New Solution RI8OIG-BLCK with 30% Recycling Content
- Suitable for Automotive Interior
- Good abrasion values for demanding surfaces

	TC8COZ	⇔	RI8OIG-BLCK
RECYCLING CONTENT in %	0	⇧	>30.0
Hardness in ShA	80	⇨	81
Density in g/cm³	0.985	⇩	0.94
Tensile Strength in MPa	14.9	↘	11.0
Elongation at Break in %	743	⇨	750
Abrasion in mm³	120	⇨	132

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Circular Economy and our Contribution

Circularity of Materials

Rising ecological concerns on plastic use, especially with end-users and politics led to new regulations and laws.

Circularity of materials has become one of the most important topics

- Design for Recycling
- Recyclability of materials
- Use of recyclates instead or next to virgin plastics

TPS have so far been perceived as non-recyclable and interfering with recycling of other plastics.

Proof of Recyclability

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How was it possible?

With CYCLOS HTP we jointly tested representative compounds for

a) Co-Recycling with HDPE

b) Co-Recycling with PP

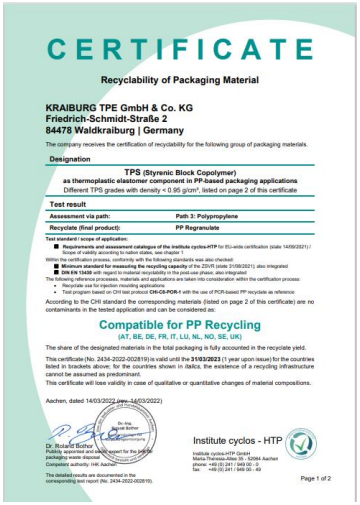
The results are:

No significant changes in processing, MFR and mechanical properties for all test compounds in PP and HDPE recycling stream observable

→ Compatible for PP-Recycling

→ Compatible for HDPE-Recycling

Yes we can!



CERTIFICATE

Recyclability of Packaging Material

KRAIBURG TPE GmbH & Co. KG
Friedrich-Schmidt-Straße 2
84478 Waldkraiburg | Germany

Designation

TPS (Styrenic Block Copolymer)
as thermoplastic elastomer component in PP-based packaging applications
Different TPS grades with density < 0.95 g/cm³, listed on page 2 of this certificate

Test result

Assessment via path:	Path 3: Polypropylene
Recyclate (final product):	PP Regranulate

Compatible for PP Recycling
(AT, BE, DE, FR, IT, LU, NL, NO, SE, UK)

Institute cyclos - HTP

Page 1 of 2

CERTIFICATE

Recyclability of Packaging Material

KRAIBURG TPE GmbH & Co. KG
Friedrich-Schmidt-Straße 2
84478 Waldkraiburg | Germany

Designation

TPS (Styrenic Block Copolymer)
as thermoplastic elastomer component in HDPE-based packaging applications
Different TPS grades with density < 0.95 g/cm³, listed on page 2 of this certificate

Test result

Assessment via path:	Path 2: Polyethylene
Recyclate (final product):	HDPE Regranulate

Compatible for HDPE Recycling
(AT, BE, DE, ES, FR, IE, IT, LU, NL, NO, PT, SE, UK)

Institute cyclos - HTP

Page 1 of 2

Cyclos HTP

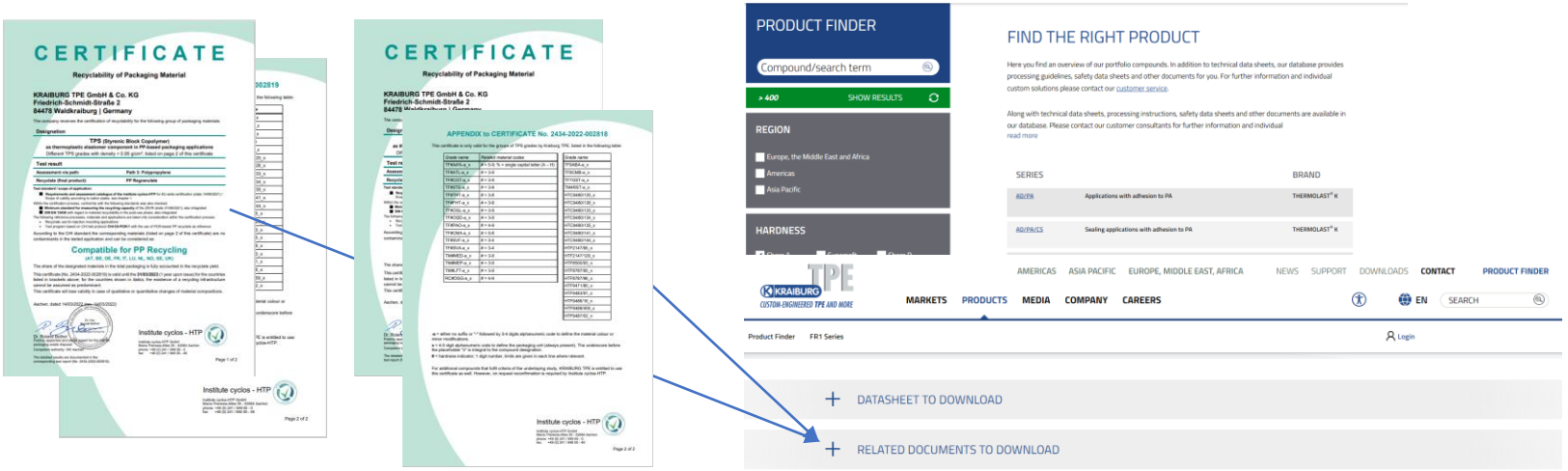
Test Institute for Recyclability Confirmation

Cyclos HTP is a well-known institute for the certification of packaging solutions. The evaluation is based on the specifications of the "Zentrale Stelle Verpackungsregister".

These include sorting tests, as well as mixing tests on the influence of the packaging on the quality of the recycle stream.

Our Certificates

Available in Product Data Base



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This document is valid until: December 2023

For more information about KRAIBURG TPE please visit:

www.kraiburg-tpe.com