Adhesives and Coatings for Circular Flexible Packaging

Presented by:

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Current news headlines

https://recyclingportal.eu/Archive/46623

https://www.forbes.com/sites/sap/2019/03/22/can-a-circular-economy-help-clean-the-oceans/#48cc1dc25264

The Circular Economy
More than just recycling

It is a model for a future economy.

It is broader than just recycling.

It covers also design and the use of recycled materials.

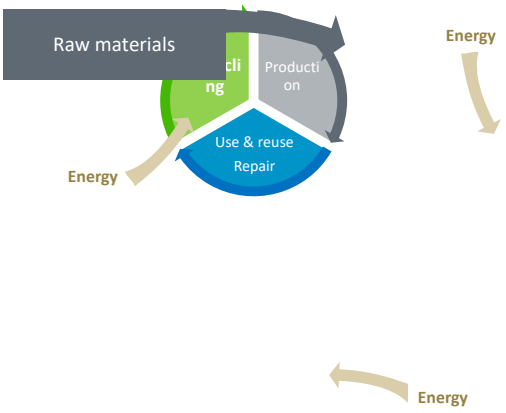
It is a new paradigm: to include the end of life in the design of articles.

It requires new, innovative solutions that will change the market.

The Circular Economy
Definition

*"A **circular economy** is a regenerative system in which resource input and **waste**, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops."*[1]

This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and **recycling**.



*[1] Geissdoerfer et al., Journal of Cleaner Production **143**, 757–768.*

What is waste? What is recycling?

Waste

Waste is anything for which the generator or holder has no further use and which is discarded or is released to the environment.

Recycling

Reprocessing, by means of a manufacturing process, of a used material into a new product, a component incorporated into a new product; **excluding** energy recovery and the use of the product as a fuel.

Every material for which we do not have a recycling process becomes waste eventually

Waste management in practice

Collection

Sorting

Recycling

All three steps are important to achieve high recycling rates and optimum quality

Collection

Typical collection pathways

communal pickup

recycling yard

dedicated bins

in-store return

- *Only waste that is collected can be recycled*
- *Separate collection makes sorting easier but has practical limits*
- *Waste that is collected can not pollute oceans*

Plastics pollution and the circular economy

Through additional **investments** in waste **collection** worldwide, plastics pollution can already be avoided.

A circular economy only starts with collection. It generates **value** from todays waste by **recycling** it.

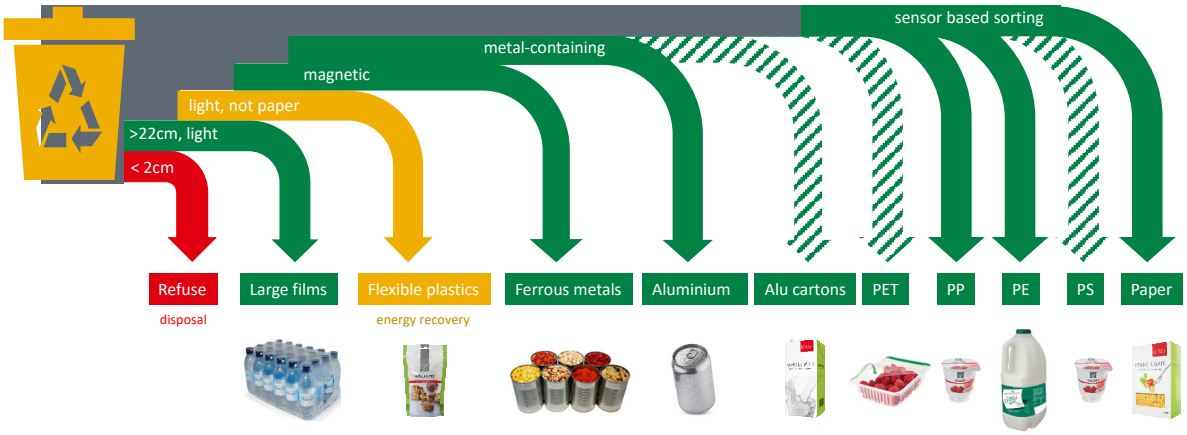
Waste management and recycling

Collection
Only waste that is collected, can be recycled.

Sorting

Recycling

Automated sorting



Automated sorting can achieve excellent results today. However, not all output streams are recycled yet.

Waste management and recycling

Collection
Only waste that is collected, can be recycled.

Sorting
Many different types of waste exist that cannot be re-processed together.

Recycling

Strong impact of adhesives and coatings on the recycling step!

Mechanical recycling: importance of compatibility

Closed loop recycling
Needs excellent compatibility and stream purity

Open loop recycling
Needs compatibility

Low value downcycling
Needs limited compatibility

Compatibility of materials is key.
Incompatible materials need to be separated before mechanical recycling.

Recycling: where do we stand today?

>75%	>90%	>70%	>60%	>90%	~ 0%
					Incompatible multi material items

Paper based flexible packaging

Heat seal	Cold seal

Validated repulpable Henkel solutions available

Recyclable paper packs: only an option for dry and not moisture sensitive goods

Plastic packaging: from needs to actions

Consumer & NGOs → **Packaging industry** ← **EU commission & member states**

"Why?"	How?	"What?"
▪ Pollution of the environment ▪ Ocean plastics ▪ Depletion of resources ▪ Conditions in less affluent countries	**Design guidelines** Henkel CEFLEX Henkel ELLEN MACARTHUR FOUNDATION PCEP POLYOLEFIN Circular Economy Platform	▪ Mandatory recycling quotas for plastics ▪ Single use plastics bans ▪ Eventual ban of specific materials

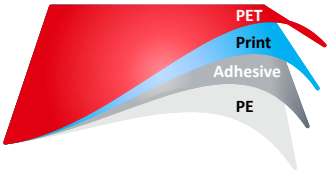
*We need to **design** packaging for recycling to solve the circular economy challenge*

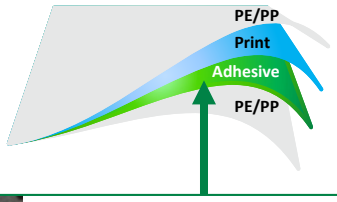
Addressing the circular economy challenge
Designing flexible packaging in line with recycling guidelines

1. Compatibility | **2. Debonding** | **3. Replace layers**

Design for compatibility with mechanical recycling

Incompatible multilayers | **Following new guidelines** | **Example**





- Compatible with **recycling**
- Good properties of recycled plastic; tested with PE & PP
- No odour and low discoloration

We have already confirmed good recyclability for PE and PP laminates made with optimized Henkel solvent free adhesives

Design for compatibility with mechanical recycling

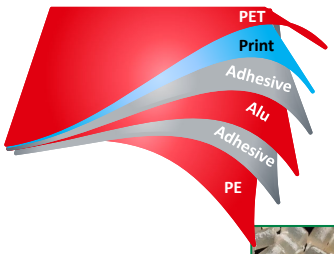
		Optimized SF adhesive PE/PE laminate	- PE film	Optimized SF adhesive OPP/OPP laminate	- OPP film	Reference SF adhesive OPP/OPP laminate
Technical properties	Unit					
Tensile strength	MPa	11.8	12.6	25.1	29.4	-
Elongation at tensile strength	%	127	129	9.9	9.4	-
Nominal elongation at break	%	134	134	101	226	-
E Modulus	MPa	180	143	984	1205	-
Melt conditions	°C/kg	190 / 2.16	190 / 2.16	230 / 2.16	230 / 2.16	-
Melt flow rate MFR	g/10min	0.7	0.7	3.3	4.6	-
Melt volume rate MVR	g/10min	0.9	0.9	4.4	6.2	-

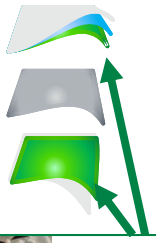
recycled PE/PP samples

Adhesives impact recyclate quality: excellent properties can be achieved.

Debondable adhesives for incompatible layers

Incompatible multilayers | **With new process** | **Example**





PET recycling

Alu recycling

PE recycling

- Validated **debondable** adhesives
- Good properties of recycled plastic; tested with PE
- No odour and low discoloration

Debondable Henkel adhesives for the process of Saperatec GmbH

Debondable adhesives for incompatible layers

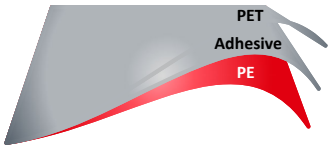
Technical properties	Unit	Test Method	Reference PE film	Solvent free adhesive	Solvent based adhesive
Tensile strength	MPa	DIN EN ISO 527/1/2	12.6	11.9	12.1
Elongation at tensile strength	%	DIN EN ISO 527/1/2	129	93	123
Nominal elongation at break	%	DIN EN ISO 527/1/2	134	111	131
E Modulus	MPa	DIN EN ISO 527/1/2	143	176	166
Melt flow rate MFR (190°C/2.16kg)	g/10min	EN ISO 1133	0.7	0.7	0.8
Melt volume rate MVR (190°C/2.16kg)	g/10min	EN ISO 1133	0.9	0.9	1.0
Ash content	%	EN ISO 3451-1		<=0.1	<=0.3
Density	g/cm³			0.932	0.936

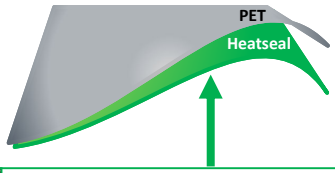
Recycled PE samples

Excellent results with specific solvent free and solvent based adhesives!

Replace incompatible layers with coatings

Incompatible multilayers	With Henkel coating	Example

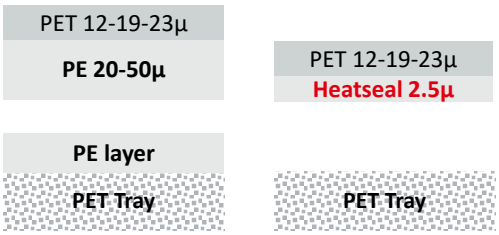




- **Compatible** with recycling
- Good blending into PET
- No odour and low discoloration
- High transparency

New heatseal products enable redesign of polyester trays and lids by removing the incompatible PE layer

Replace incompatible layers with coatings



- **Recyclability**: tray & film form a monomaterial assembly
- **Transparency**: BOPET to replace PP or PET/PE
- **Lightweighting**: lid reduced more than 50wt%

Tray becomes monomaterial – complete assembly is almost entirely PET

Key points

- Intense public and regulatory focus on (plastic) packaging creates a new business environment
- Packaging design often must undergo change to be recyclable and remain part of the solution
- New cross-industry guidelines are emerging
- **[be more] sustainable:**
  - **Adhesives** for mechanical recycling & layer separation
  - **Coatings** that enable new designs

"Thank You" for your attention

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