



The European voice of the **adhesive and sealant industry**

FEICA WEBINAR

Laminating Adhesives Supporting Flexible Packaging Recycling

23 April 2024

10:00 - 11:00 Brussels CET

Proceedings

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- During the Q&A session following the presentations, you will be able to use the chat box to ask questions
- In case we don't have sufficient time during the Q&A session to address your question, please feel free to send your question to info@feica.eu
- The presentation slides and recording will be sent to all webinar registrants

Agenda

- 10:00** Introduction - *Ms Jana Cohrs, Executive Director Regulatory Affairs, FEICA*
- 10:05** Why Laminating Adhesives? - *Dr Christos Lecou, Marketing Manager, Sector Industrial Adhesives, Covestro, and Member of the FEICA Expert Group*
- 10:20** Overview of recyclability guidelines and testing protocols - *Mr Arne Jost, Senior Manager Circularity Assessment & Validation, Packaging & Consumer Goods, Henkel Adhesive Technologies, and Member of the FEICA Expert Group*
- 10:35** Laminating Adhesives in Recycling of flexible packaging: State of Play and Outlook by *Mr Sergio Doldi, Technical Manager, COIM, and Member of the FEICA Expert Group* & *Mr Marc Defoin, Flexible Lamination R&D Director, Bostik, and Member of the FEICA Expert Group*
- 10:50** Q&A session moderated by Ms Jana Cohrs
- 11:00** Close of the webinar



Ms Jana Cohrs

Executive Director Regulatory Affairs, FEICA

Introduction



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16 National Associations
representing 17 Countries
450+ members



24 Direct Company Members



24 Affiliate Company Members



Contribution of the adhesives and sealants industry in Europe

19.9 billion euros contribution to the EU economy

800 adhesives and sealants manufacturers, of which **90% are SMEs**

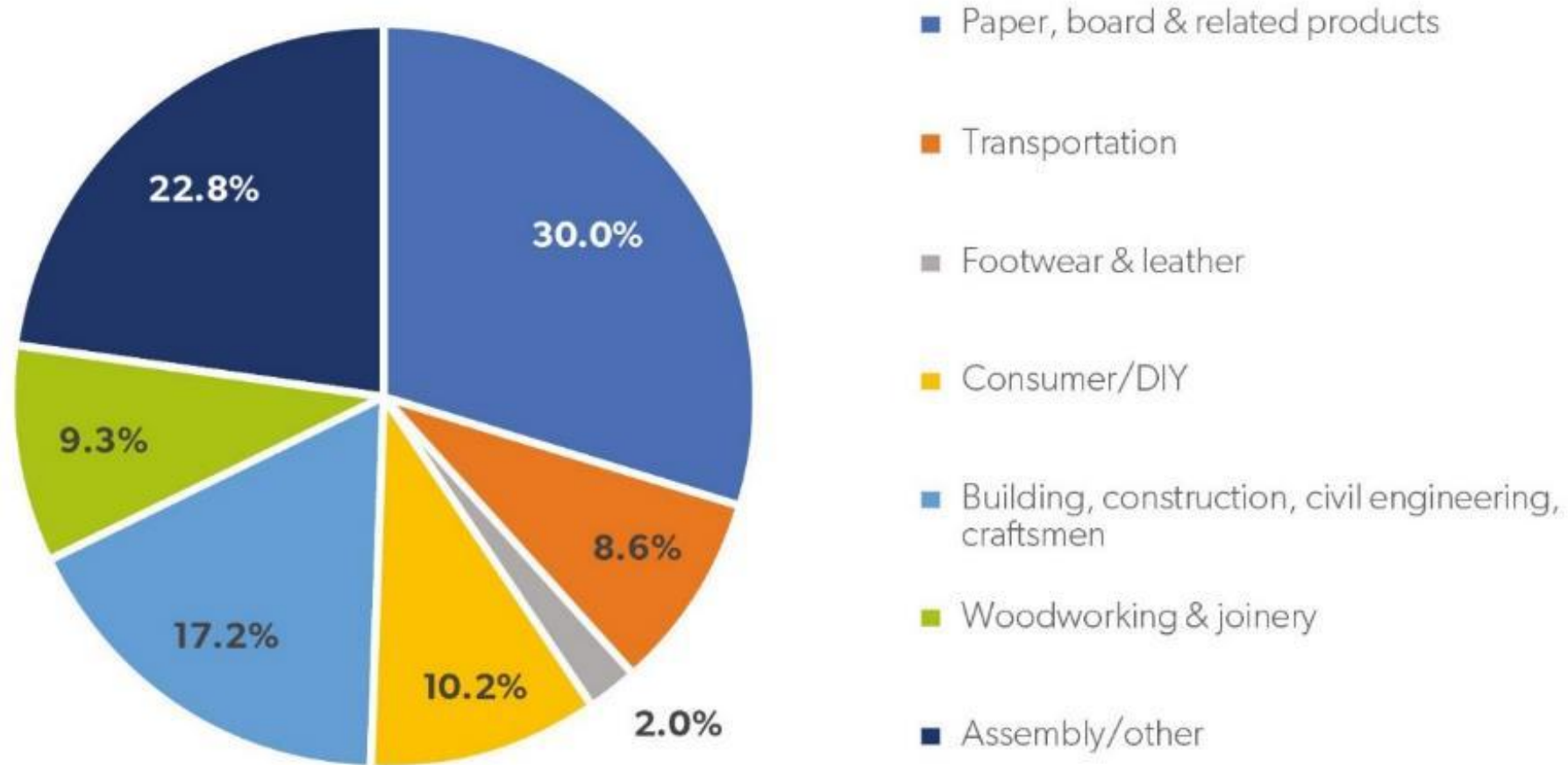
4.8 million tonnes of adhesives and sealants used in everyday products

Investing **470 million euros in Research and Innovation**

Employing over **45,000 people**



2022 European adhesives demand by market segment (€ million)



Source: Smithers

FEICA Expert Group

Sustainability and Recycling of Adhesives Applications in Paper and Packaging

National Associations



Company Members



**European
Food Contact
Legislation**

**Food
Contact
Additives
Association**

**Printing Ink
Joint
industry TF**

**X-sector
group**



**European Packaging
and Packaging Waste
Regulation**

**Campus
Wien**

**CEN TC
261**

**Packaging
Chain
Forum**

**European
Recovered
Paper
Council**

CEFLEX

RecyClass

4evergreen

Cooperation and communication along the supply chain

- Adhesives in packaging are very complex. FEICA is supporting stakeholders with expertise
- Cooperation amongst different actors in the supply chain is key to further improving recycling
- More information on paper and packaging is on our website: <https://www.feica.eu/our-projects/paper-and-packaging>
- For questions and comments after the webinar, please contact us at info@feica.eu



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Dr Christos Lecou

Marketing Manager, Sector Industrial Adhesives, Covestro

Why Laminating Adhesives?



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Packaging eases logistics and preserves goods

- Key functions of packaging
 - Product protection
 - Product promotion and information
 - Transport and storage effectiveness
- Adhesives are used in almost all packaging types
 - Labelling
 - Sealing
 - Lamination



Combining properties with laminating adhesives

- Used to combine different films into one packaging material
- Improvement of properties such as mechanical resistance and barrier
- Food and non-food applications
 - (Stand-up) pouches
 - Certain wrappers
 - Medical/pharmaceutical packs



Packaging design is subject to performance needs

High Performance

For laminates that are used in a sterilisation process ($>121^{\circ}\text{C}$). Aggressive, wet filling. Food and medical application, typically with AL foil as high barrier layer

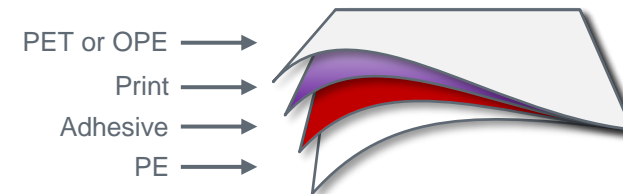
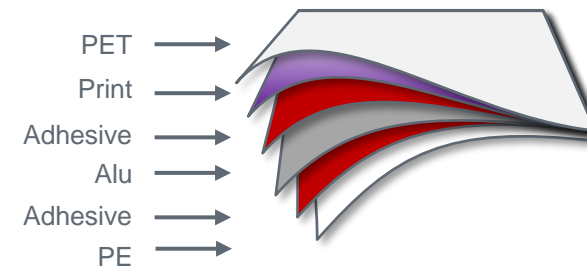
Medium Performance

For laminates that are used in pasteurisation ($<121^{\circ}\text{C}$), wet, oily, fatty filling, flavor protection, often with AL foil

General Purpose

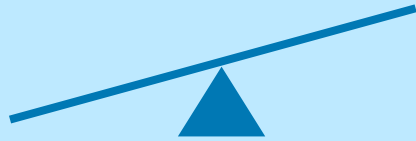
For laminates that are used with dry filling and lower processing requirements

Current examples of laminated flexible packaging (FlexPack)



Why laminating adhesives?

Low packaging to product ratio



Typically 2-3%

Highly dependent on packed goods, load, preservation & handling requirements

Outstanding logistics efficiency



26 trucks
Unfilled jars



1 truck
Unfilled FlexPacks

High production efficiency & flexibility

Easily adjustable sizes, formats & shapes

Fast roll-to-roll processing

Low energy processing

High appeal packaging

Glossy, matt, high resolution finishes

Customising haptics

Flexible packaging in a circular economy (CE)

EU food packaging utilisation in retail (in terms of primary packaging units)



EU packaging waste creation (in terms of waste material weight)



Low packaging material use



Less attractive for recycling

- Low volumes
- Various compositions
- Collection
- Sorting
- Investments

CE optimised laminates



Assessments of adhesive impact on recyclability

Flexible packaging in the framework of the PPWR*

- Counteracting the increase of packaging waste
- Reducing packaging waste in the EU by at least 15% by 2040 (vs. 2018)
- Focussing on 3 areas
 - 1) Recyclability of packaging
 - 2) Mandatory quotas for reusable packaging
 - 3) Minimum content of recycled material in packaging
- Binding and applicable to every EU state
- Expected to come into force in 2024/2025



POLL

You can **use the chat box or the pop-up screen** to participate in the poll.

Note that you can **select multiple answers.**

POLL 1

Select the most important recycling challenges for laminating adhesives:

- Laminated mono-material recyclability
- Laminated multi-material recyclability
- Maintaining bonding performance whilst being formulated for recyclability
- Adequate sorting
- Availability of state-of-the-art recycling facilities
- End markets for the recycled material

Agenda

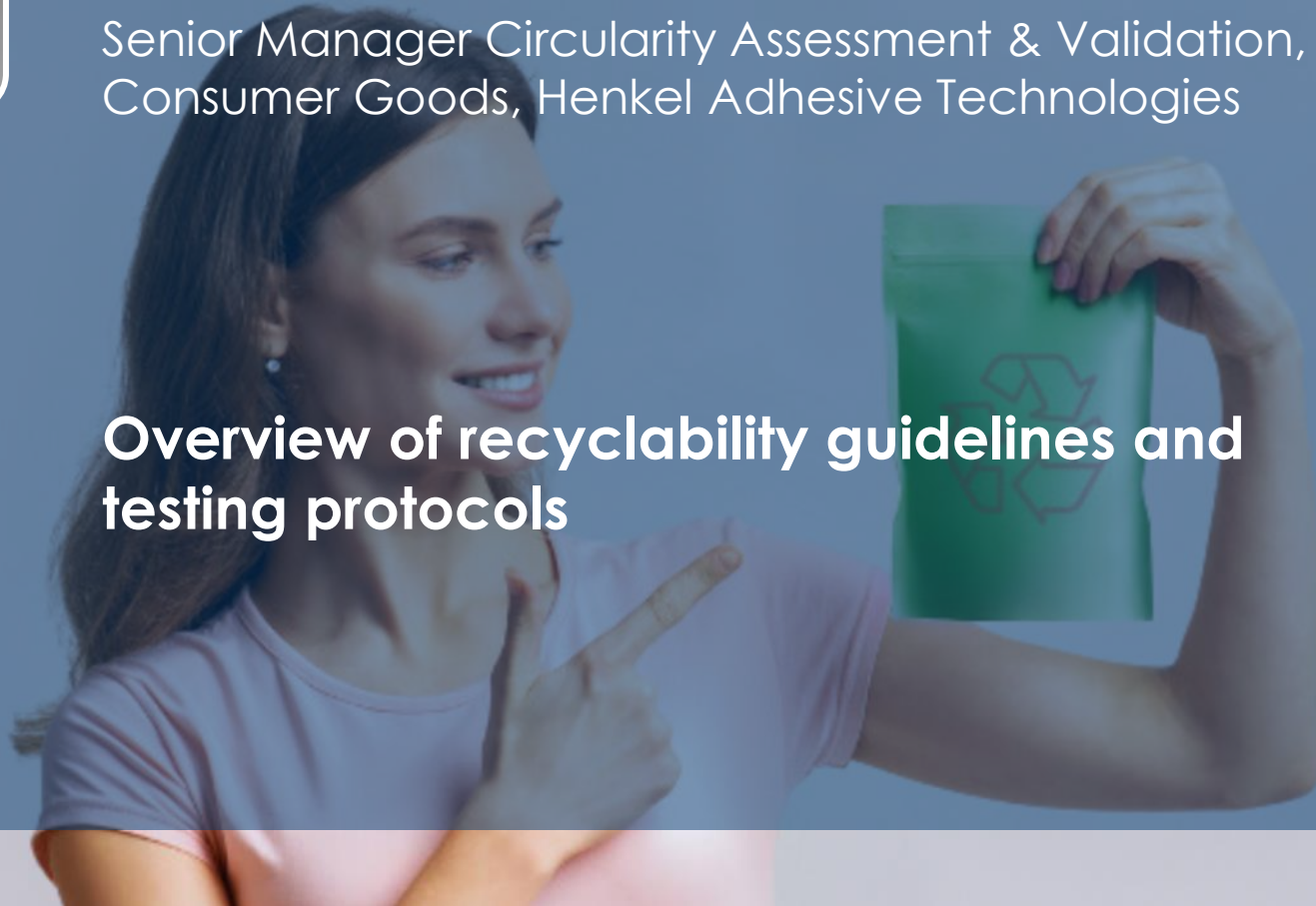
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Mr Arne Jost

Senior Manager Circularity Assessment & Validation, Packaging & Consumer Goods, Henkel Adhesive Technologies

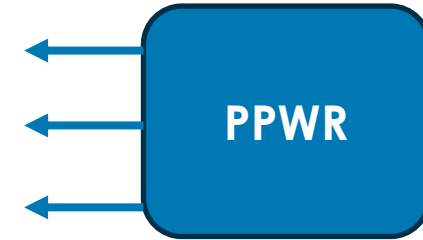
Overview of recyclability guidelines and testing protocols



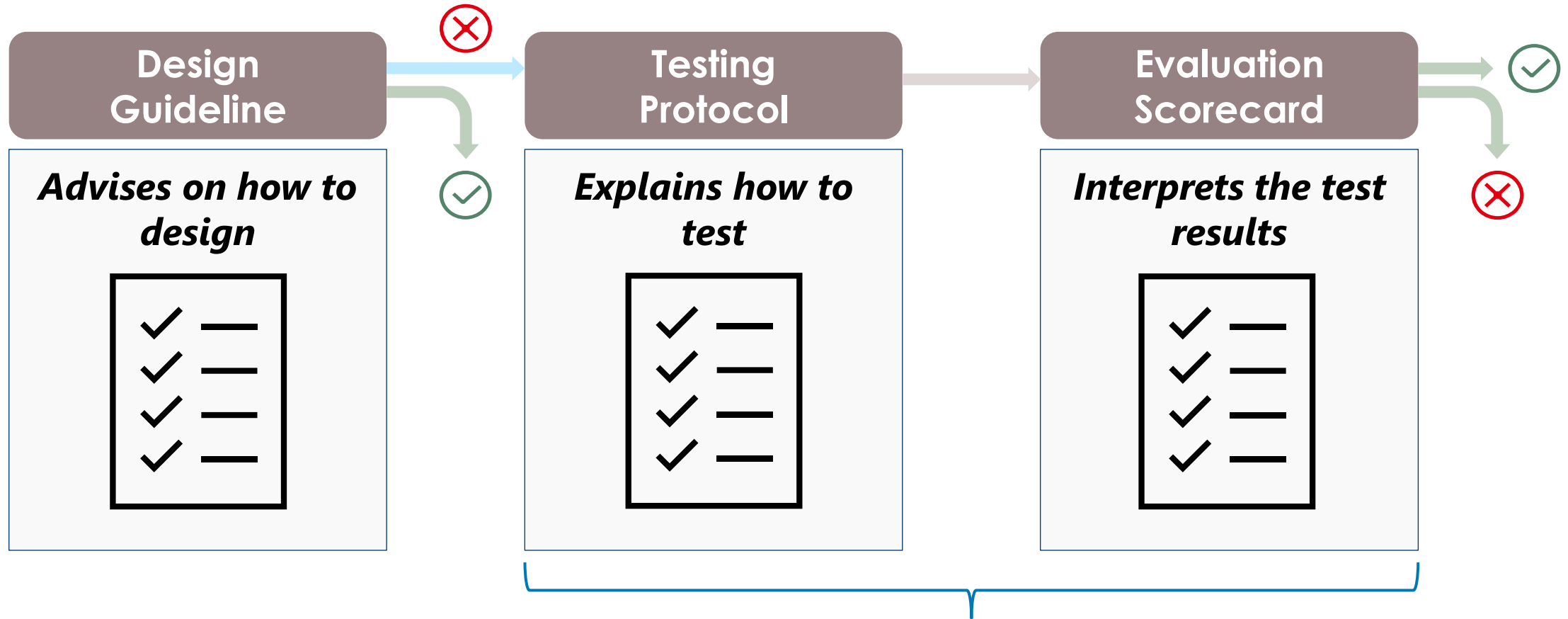
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Major trends in flexible packaging design

- From multi-material to '**mono**'-material
- From plastics to **paper**
- Phasing out of **barrier materials**, e.g., aluminum, PVC, PVDC
- Still, the **consequences of the PPWR** remain unclear to the industry, especially on recyclability and recycled content,
- Future PPWR-related trends:
 - Portfolio streamlining
 - Design simplification
- **Unsolved:** Flexible structures will come under pressure (recyclability, recycled content) but they are best performers when it comes to **carbon footprint** or **LCA!**



The Recyclability Testing Triad



Can be combined into one document!

The Design Guidelines (advise on how to design)

A



Z

- APR (USA)
- **CEFLEX (EU)**
- CEN – EN 13430
- COTREP (F)
- **cyclos-HTP (EU)**
- RECOUP (UK)
- **RecyClass (EU)**
- ZSVR – German minimum standard (D)
- *Others: see FEICA Report on Laminating Adhesives in Flexible Plastic Packaging Recycling*



Bold → Relevance for lamination adhesives

The RecyClass Guidelines: lamination adhesives

		Compatibility		
		Full	Limited	Low/No
LDPE	Natural	-	Aliphatic PU ≤ 2.5%	Anything else!
	Colored	PU/WBA ≤ 3%	PU/WBA 3 - 5%	
PP	Natural	Aliphatic PU ≤ 2.3%	Aliphatic PU 2.3 - 4.5%	
	Colored	PU ≤ 3%	PU 3 - 4.5%	
PU = polyurethanes WBA = water-based acrylics		Laminating adhesives approved as fully compatible by RecyClass; To be tested if in combination with a barrier material'	Laminating adhesives approved as limitedly compatible by RecyClass; To be tested if in combination with a barrier material	Laminating adhesives specially developed for high thermal applications above boiling and/or for high chemical resistance

The RecyClass Guidelines: lamination adhesives

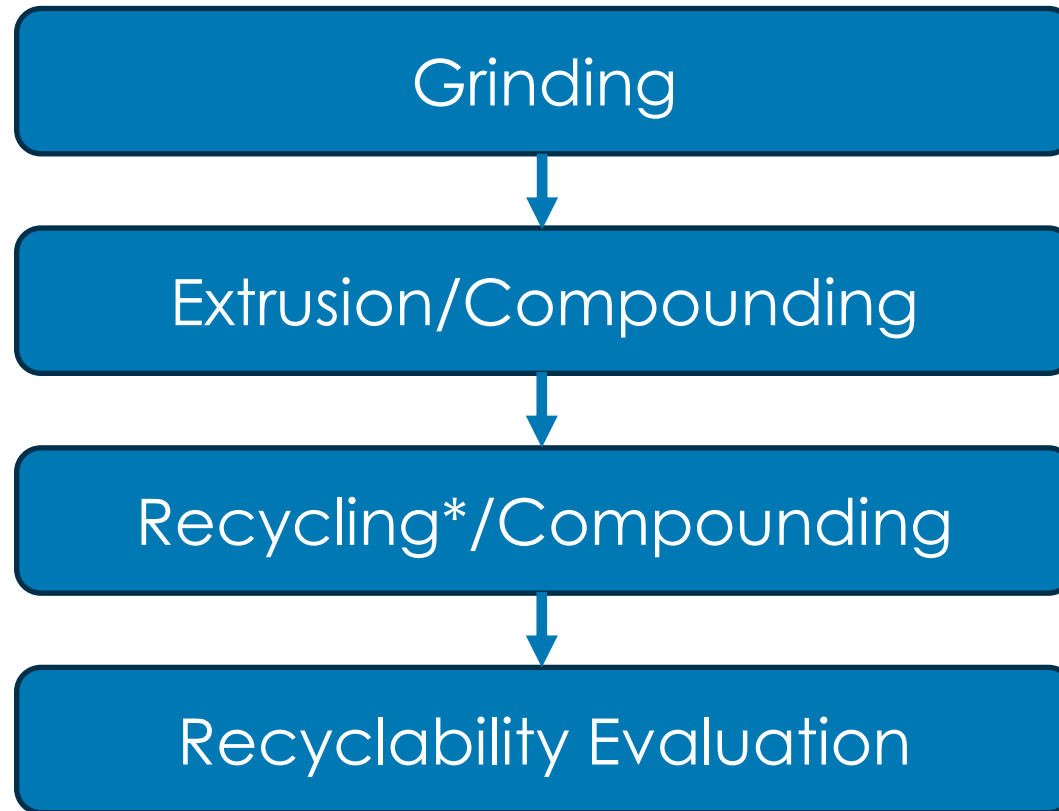
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The flexpack Testing Protocols

→ explain how to test

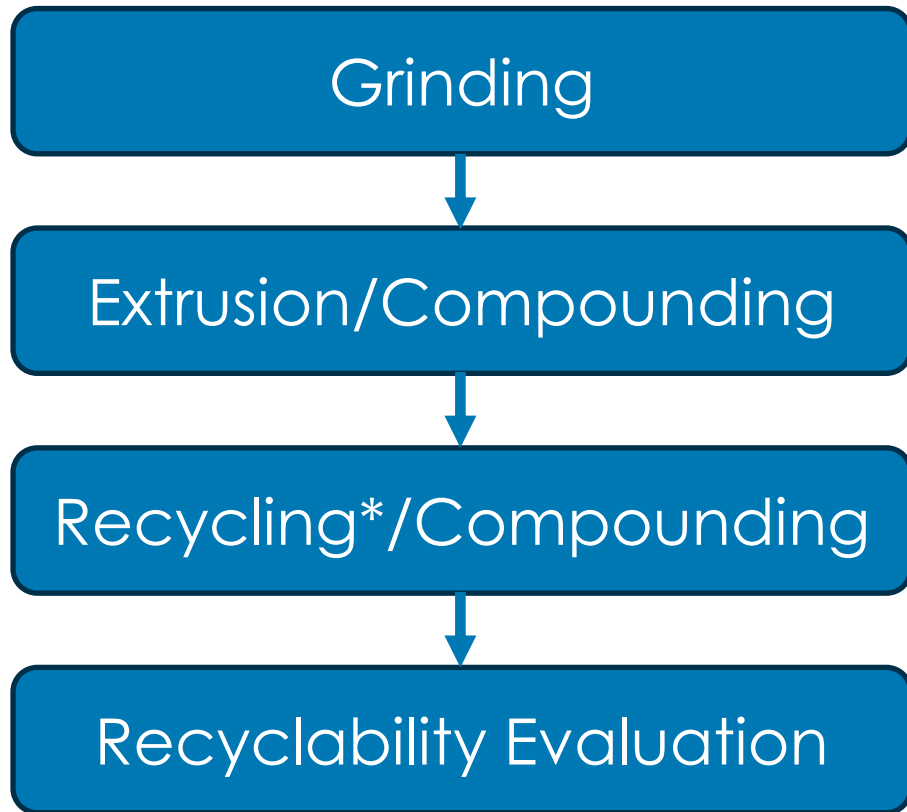
	APR (US)	COTREP (F)	cyclos-HTP (EU)	RecyClass (EU)
Sorting	✓		✓	✓
LDPE Recycling	✓	✓	✓	✓
PP Recycling			✓	✓

The flexpack Testing Protocols – Procedure (simpl.)



*Film blowing, film sealing, injection molding

The Testing Protocols – Comparison



cyclos-HTP	RecyClass
Similar extrusion process; different compounds.	
Film blowing, film sealing, injection molding	Film blowing
Against recycled material; significant neg. deviation → k.o.	Against virgin material; 25% deviation accepted.

*Film blowing, film sealing, injection molding

Recyclability Testing – Key Take-aways

- With the **PPWR**, the packaging landscape in Europe and in exporting countries will change.
- There are today a lot of packaging **design guidelines**. The PPWR will harmonize the landscape.
- A lot of flexpack guidelines do not look at **lamination adhesives** specifically.
- **RecyClass** has the most explicit flexpack design guidelines with reference to lamination adhesives.
- **cyclos-HTP**'s and RecyClass's flexpack testing protocols are similar from a procedural point of view but differ largely in their recyclability evaluation.



POLL

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POLL 2

Which characteristics are most important for recyclability testing protocols?

- Country-specific frameworks
- European harmonisation
- Scientific validity
- Economic viability
- Practicability in current recycling infrastructure set-up
- High quality recycled output



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Mr Sergio Doldi

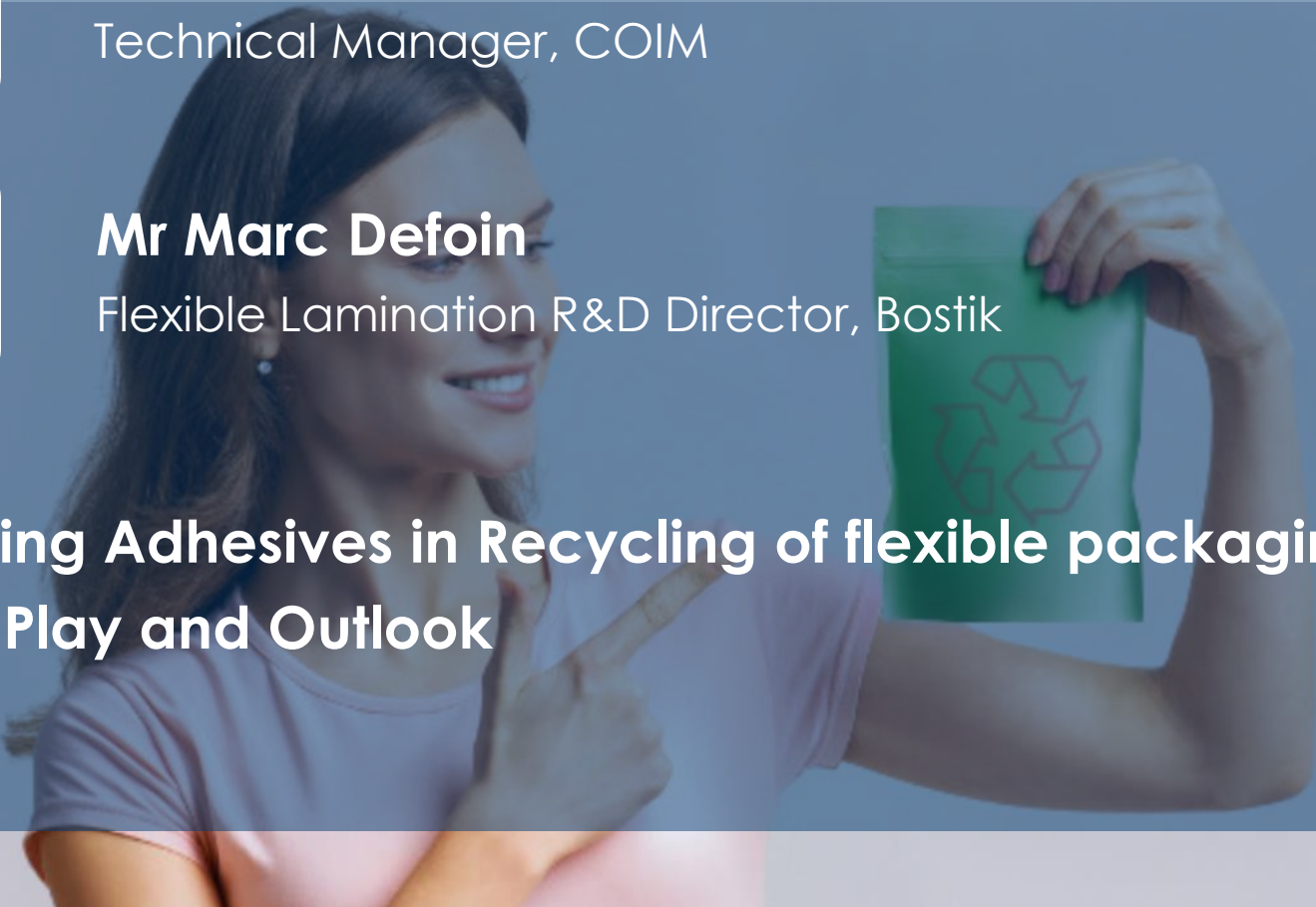
Technical Manager, COIM



Mr Marc Defoin

Flexible Lamination R&D Director, Bostik

Laminating Adhesives in Recycling of flexible packaging: State of Play and Outlook



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Recycling of flexible packaging: the starting point

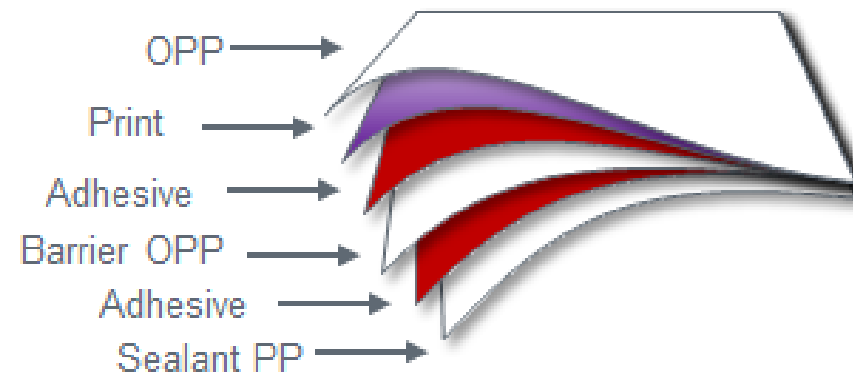
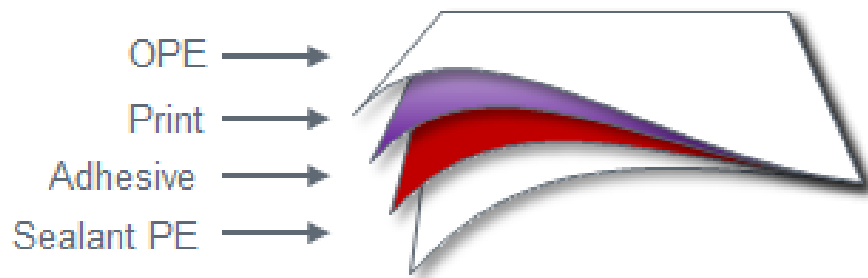
Recycling of flexible packaging is still being developed; this is mainly due to a number reasons, like:

- ❑ Complex structures made of several layers (needed to ensure the functionality of the packaging)
- ❑ Light weight of FP: recycling has low economic attraction
- ❑ Small size, often escaping from sorting (going into waste)
- ❑ Multi materials, non-homogeneous polymers as target materials

Laminating adhesives at the core of the flexible packaging recycling

Transition from multi- to mono-material laminates is strongly recommended to facilitate the recycling of the flexible packaging.

Laminating adhesives can efficiently support the production of laminated mono-material structures, too.



Laminating adhesives at the core of flexible packaging recycling

In this context:

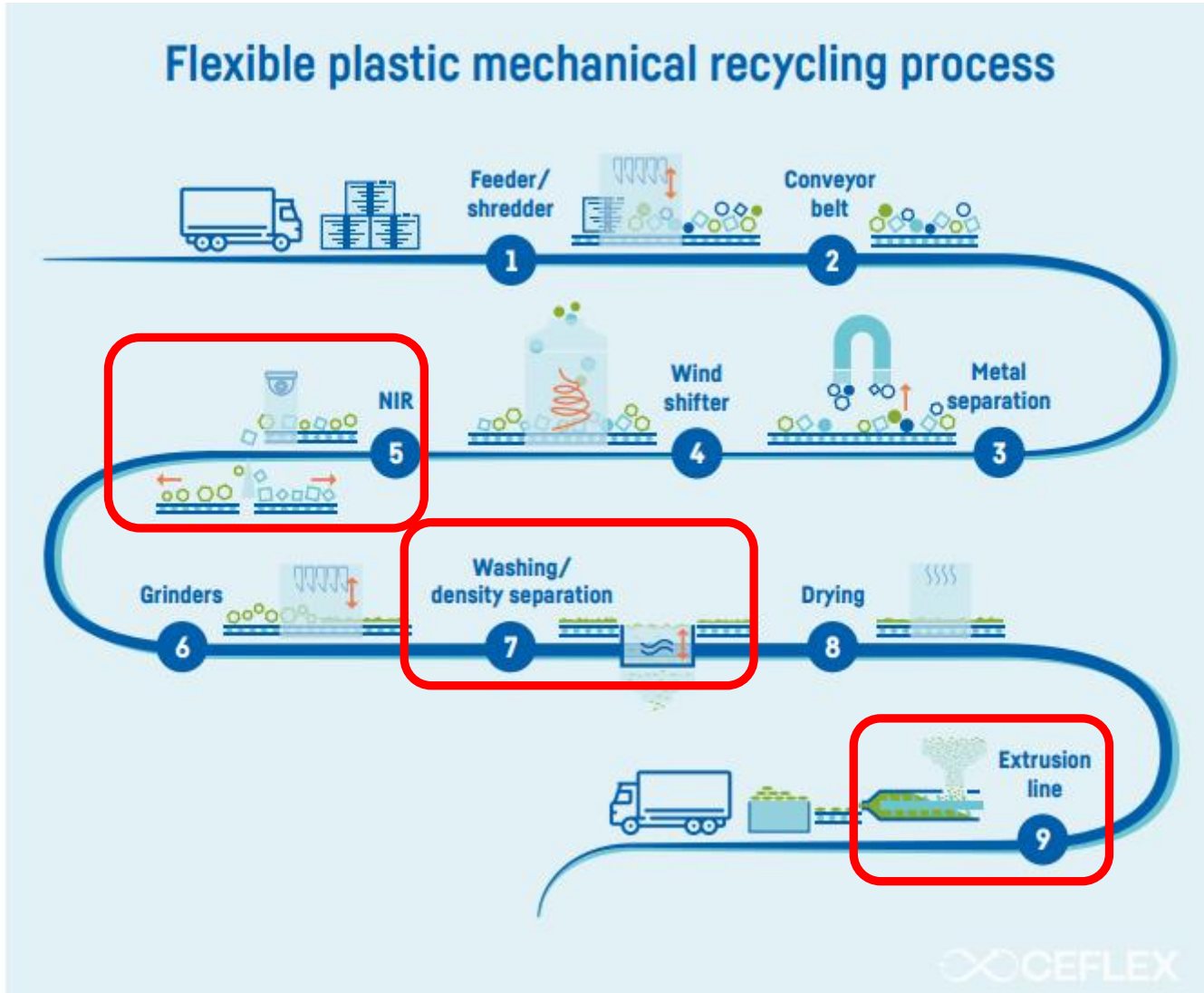
‘Laminating adhesives, just as other non-target materials, are required to be compatible with recycling processes for flexible plastic packaging, so as to not disturb the process itself or the quality of its output’.

(FEICA, Laminating adhesives in the context of flexible plastic packaging recycling)

A challenge for the adhesive industry, that came together to understand more, to explore possible effects of laminating adhesives in recycling



3 key validated steps



The steps which have been investigated (or are under investigation) for flexible materials containing laminating adhesives are:

- NIR-based sorting
- Washing/density separation
- Compatibility with the PO extrusion process

NIR-based sorting

In no case have laminating adhesives been found to affect the sensor-based sorting of plastic waste.

Ceflex NIR sorting study: no impact from laminating adhesives on sorting of many different laminated structures

Material reference	Material	Classification	Comment	Next steps
Adhesives-1, Adhesives-4,	PP structures containing PU and acrylic laminating adhesive	PP	Adhesives did not influence the classification result as they did not influence the NIR spectrum substantially or at all	Information to be reviewed and translated into design guidance as is appropriate
Adhesives-3	PE structures containing PU laminating adhesive	PE		
PET-2, PET-7	PET, PE MMML structures containing unspecified laminating adhesive	PET or PE		
PET-4	MMML structures containing PET and PP layers	PET or PP		
PET-20	MMML structures containing PET and PET layers	PET		

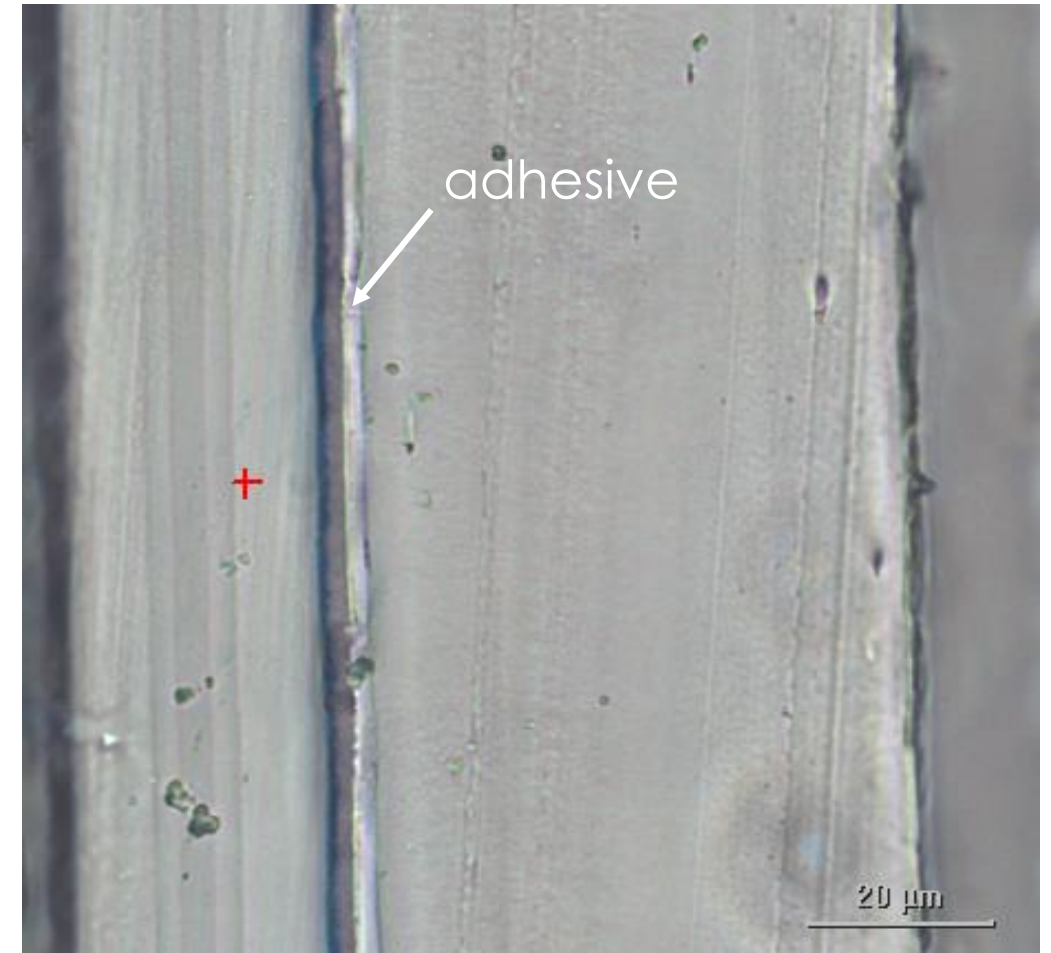
Table 18 Results of the laminating adhesive samples

Courtesy from Ceflex

Washing/density separation

No case of laminating adhesives affecting density-based sorting of plastic waste has been reported.

Laminating adhesives are present in flexible packaging structures in a low weight percentage (often $< 5\%$) with a negligible impact on the overall density of the packaging item.



Washing/density separation

- ❑ Washing processes for flexible packaging waste today are generally mild
- ❑ Laminating adhesives are required to be highly resistant against liquids (such as the filling goods)
- ❑ Laminating adhesives are located in between water-impermeable plastic layers

Therefore, **a removal of laminating adhesives with wash water is generally not expected to be an applicable requirement** (in the present conditions).

Recommendation:

Distinguish laminating adhesives from labelling adhesives!

Compatibility with PO extrusion process

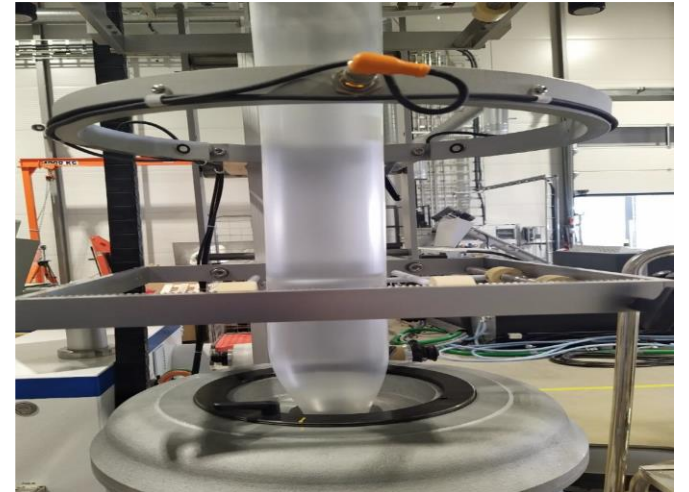
❑ RecyClass:

Participation of major adhesives manufacturers in Laminating Adhesives working group.

- Wide testing campaigns on both PE and PP films based on Recyclability Evaluation Protocols
- Assessment of impact on the extrusion process stability and quality of the recyclate (discoloration, gel particles, etc.)

❑ Ceflex mechanical recyclability testing study (ongoing)

❑ Company-specific recyclability evaluations



Compatibility with PO extrusion process

A challenge for the adhesive industry, but solutions are already being provided.



It is possible to design adhesives showing good compatibility in mechanical recycling as demonstrated by several tests run at both industry and institute levels.

Several laminating adhesives have been tested and approved by initiatives of single adhesives manufacturers.

DfR Guidelines as study outcome

The outcome of the previously mentioned studies are becoming the baseline of the current DfR guidelines (i.e. RecyClass: Last update January 2024, Ceflex Phase 2 ongoing).

DfR guidelines should be living documents, intended to be updated when new studies become available, reflecting the status of evolving knowledge.

It is essential to always be able to challenge the guidelines by means of testing.



Laminating adhesive current status

A deep knowledge of the different kinds of adhesives and their behaviour inside the recycling processes is crucial to ensure compatibility with the existing (and upcoming) recycling technologies.

An extensive investigation into raw materials and their combinations is a big step to cover the need.

Formulation design and testing are key to keep our adhesives in line with a challenging landscape.



Next steps

The Adhesives Industry is working to support existing and emerging technologies for new recycling paths, targeting a high quality output material.

Knowledge is evolving; we are strongly committed to study, monitor and understand more to support a circular economy for flexible packaging.

Each segment of the value chain has its own expertise: stay in touch with us for any discussion related to laminating adhesives. We'll be glad to support you.



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Jana Cohrs

Executive Director Regulatory Affairs, FEICA

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THANK YOU

THANK YOU

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