



## **Recyclability of barrier coating: challenges and opportunities for the paper based packaging**

# About us



Aticelca is association of the Technicians of the pulp and paper industry, member of EUCEPA. We are the technical arm o Assocarta (the association of the Italian pulp and paper industry) and we have 185 members. We organize an annual conference and other seminars, we publish technical guidance, we grand a scholarship and we develop standards on recyclability of paper products and packaging.

# Italian Paper Industry in 2023

**7.495.000 tons of paper and board produced**

**3.232.000 tons exported**

**4.899.000 tons imported**

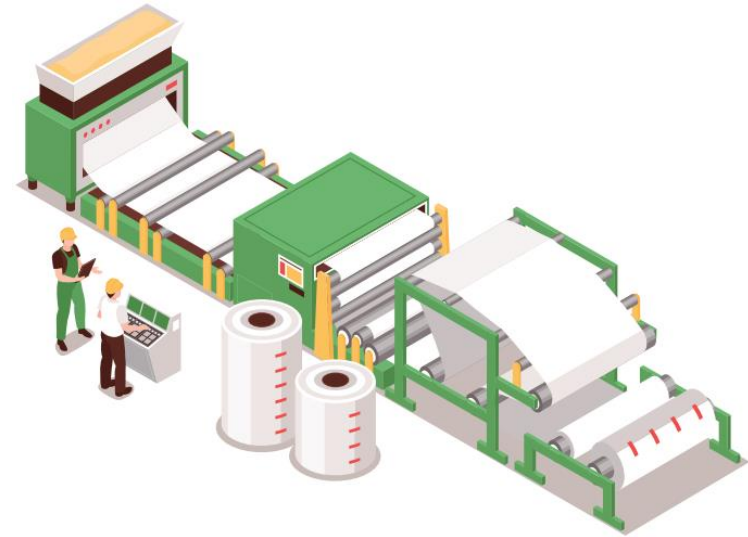
**9.162.000 apparent consumption**

**4.673.000 tons of paper for recycling recycled in Italy**

Second largest EU producer of paper and board

First EU producer of tissue

Third EU largest producer of packaging paper and board



## FINAL USES OF PAPER AND BOARD



Editoria, grafica e  
articoli cartoleria  
20,3%



Usi igienico  
sanitari  
7,5%



Fabbricazione  
cartone ondulato  
45%



Altri involgere e  
imballo  
23,2%



ALTRE

Altre  
specialità  
4%

Paper based composites packaging consumption in Italy is estimated in about 300.000 tons, including carton for liquids.

**85% of the paper based packaging are recycled**

## Focus on Recyclability



- Paper is renewable, recyclable and biodegradable.
- We have international standard for renewability (FSC and PEFC) and biodegradability (EN 13432), not for recyclability.
- EN 13430 is too much generic, just referring to check compatibility with unspecified “*available technologies*”.
- **Recyclability is a value. We have to protect and improve it via eco-design.**
- In the last years we registered a growing request to inform the customers and of consumers to be informed.
- Eco-design and information to consumers have to be based on a recognized, official and credible standard.



# What we have done

Aticelca published since 2011 the «Aticelca 501 », a standard for the assessment of recyclability of paper products and packaging.


Our system provides, as a result, a recyclability assessment expressed in a scale from A+ to C, plus the not-recyclable.

5 parameters are assessed: coarse rejects, flakes, macrostickies, adhesiveness and visual inhomogeneity.


Over 4.000 analysis has been done in the last 4 years, involving 4 labs and more than 250 companies.



## Key points



The Aticelca 501 standard is based on those key points:


- There is not just one single recycling process, therefore we are looking at the minimum standard which allows to recycle a product virtually in any recycling paper mill. Deinking and special mills are therefore not covered.
  - Focus of mixed paper from household collection, as in BtoB material is fully traced and specific assessments (or even pilot tests) or specific agreements can be done by the parties.
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## Difference between a test method and an assessment



The laboratory (now UNI 11743:2019) standard emulates, on a laboratory scale, the most common recycling process (low density pulping, epuration, paper sheet formation) up to the production of a sheet of recycled paper.

The Aticelca 501 assessment weights the results and provides a level of efficiency based on National collection system and commonly available recycling technologies in Italy.





# Further steps

We also grant the use of a logo to declare the recyclability level.




More than 850 grant to use the logo issued up to now.

In 2023 we issued the “Aticelca 502” standard for measuring the separability.



# European scenario



In 2019 we asked via UNI to CEN and CEPI to start the development of a European recyclability standard providing our system as a draft.

Since 2022 CEPI issued its own standard (without the assessment).

In June Cen started a working group aiming at developing a En standard based on CEPI experience.

In the meantime 4Evergreen project is developing an assessment system, as well as some countries.

The new PPWR requires the development of a recyclability assessment.



# Barrier coating recyclability assessment




Our extensive experience shows that barrier coatings may have very different behavior during the recycling process and there are cases where the correct Recyclability Level cannot be assigned due to interference from coating and/or metallisation particles in the macrostickies test.

In other cases, particularly when the quantity of fragments/particles is very high or when their adhesive behaviour is not well defined, the repeatability and reproducibility of the results obtained are not satisfactory.

During the year 2023, we coordinated a research project with 14 companies to investigate solutions to eliminate these interferences when assessing the recyclability of paper and board treated with barrier coatings and/or metallisation.

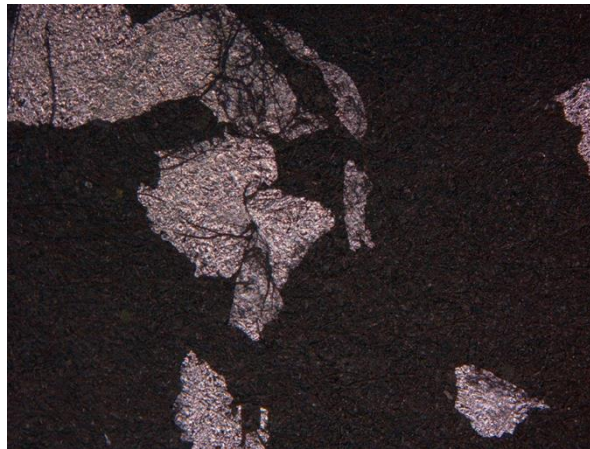
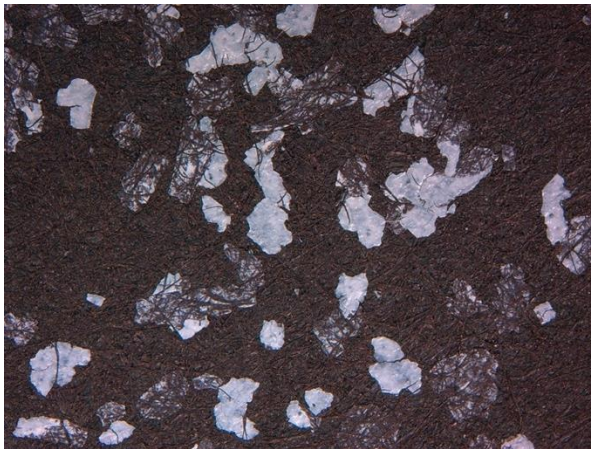
The 14 companies: Bobst Italia Spa, Burgo Group Spa and its owned Mosaico Spa, Eurobrilliance, Fedrigoni Spa, Henkel AG & CO. kGaA, Huhtamaki Flexible Packaging Germany GmbH & Co.KG, Jujo Thermal Ltd, Nissha Metallizing Solutions NV, Plastigraf Trevigiana Srl, Reno De Medici Spa, Sacchital Spa, Sappi Netherlands Services BV, Seda Italy Spa and UPM Specialty Papers Oy. Assocarta, Assografici, Comieco and Eco Studio Spa attended as observers. The project was coordinated by Aticelca and the experimental laboratory activity was carried out by Innovhub-Area Carta and Lucense-Centro Qualità Carta.





# The problem

Examples of a sample prepared for the macrostickies analysis where the measurement can not be performed due to the interference due to the presence of barrier coating fragments.



Example of a sample prepared for the macrostickies analysis where the barrier coating and the metal fragments shows no adhesive behaviour and macrostickies are not present.

# Results

Column on the right shows the results for each of the 38 samples analysed during the project.

22 (58%) show no interference with the standard test method for classification purpose;

8 (21%) show an interference, due to coating, which is solved by the “dark powder procedure”;

9 (24%) still show an interference for classification purpose which is not solved yet.

Type of product	Phase 2: Standard procedure	Phase 5 – Dark powder
Coated	No interference (A+)	No need
Coated	No interference (A+)	No need
Coated	No interference (A+)	No need
Coated	No interference (A+)	No need, A+ confirmed
Coated	No interference (A due to F.R.)	No need
Coated	No interference (A due to F.R.)	No need
Coated	No interference (B due to C.R.)	No need
Coated	No interference (B due to F.R.)	No need, B confirmed
Coated	No interference (B due to F.R.)	No need
Coated	No interference (B due to F.R.)	No need
Coated	Interference (A due to MS)	A confirmed
Coated	Interference (A due to MS)	A confirmed
Coated	Interference (A due to MS and F.R.)	Not applicable, A confirmed
Coated	Interference (NE/NR due to MS)	Not recyclable
Coated	Interference (NE/NR due to MS)	Not recyclable
Coated	Interference (NE/NR due to MS)	Not recyclable
Coated	Interference (NE/NR due to MS)	Not recyclable
Coated	Interference (NE/NR due to MS)	Not recyclable
Coated	Interference (NE/NR due to MS)	Not recyclable
Metal lised	No interference (Not Recyclable due to C.R.)	No need
Metal lised	No interference (B due to V.I.)	No need
Metal lised	No interference (Not Recyclable due to C.R.)	No need
Metal lised	No interference (B due to C.R.)	No need
Metal lised	No interference (B due to V.I.)	No need
Metal lised	No interference (A due to C.R.)	No need
Metal lised	No interference (Not Recyclable due to MS)	No need
Metal lised	No interference (Not Recyclable due to MS)	No need
Metal lised	No interference (Not Recyclable due to MS)	No need
Metal lised	No interference (Not Recyclable due to MS)	No need
Metal lised	No interference (Not Recyclable due to MS)	No need
Metal lised	No interference (Not Recyclable due to MS)	No need
Metal lised	Interference (B due to MS)	Not applicable
Metal lised	Interference (NE/NR due to MS)	Not applicable
Metal lised	Interference (NE/NR due to MS)	Not applicable
Metal lised	Interference (NE/NR due to MS)	Not applicable
Metal lised	Interference (NE/NR due to MS)	Not applicable
Metal lised	Interference (NE/C due to MS)	Not applicable
Metal lised	Interference (NE/NR due to MS)	Not applicable
Metal lised	Interference (NE/NR due to MS)	Not applicable



## Conclusion (1)

The fact that barrier coatings and metallisations may have different behaviour has been confirmed by the 38 samples analysed; Additional filtration is not able to separate macrostickies from fragments of barrier coating and metallisation; Additional epuration with a cyclone is not practicable at laboratory scale with the equipment used during this project. Furthermore, due to the density of the coatings and metallizations similar to paper it does not seem to be a viable option; Metallised and barrier coated paper which hasn't any adhesive behaviour, in the absence of other sources of macrostickies, can be assessed by the use of the microscope and, only for barrier coated paper, by the addition of a step with dark powder.

## Conclusion (2)

Modification of the macrostickies analysis by the addition of a step with dark powder provided a solution for white coating barrier to measure macrostickies even in presence of the interference of fragments of the coating;

Barrier coating having a strong sticky behaviour are assessed as macrostickies;

Interference issue due to metallised and/or coloured barrier coatings remains unsolved but promising evidences show that those interferences may be solved by the use of coloured powder and or by the use of inks that react differently with metal particles and macrostickies.

# The dark powder procedure

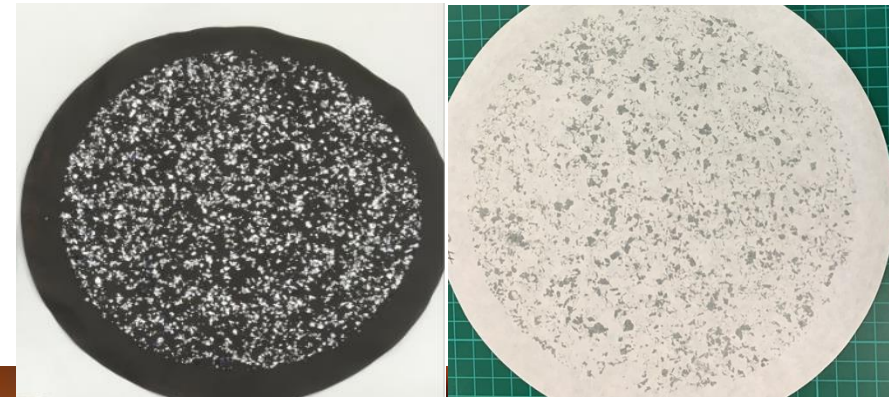
An integration to the Aticelca 5010 assessment system has been developed to introduce a step with the dark powder in the macrostickies measurement in case of interferences due to barrier coating.

This integration is meant to be used in case of an interference in the macrostickies measurement due (but not exclusively) to barrier coatings.

This addendum is provided to UNI for the revision of the UNI 11743:2019, if any, to CEPI and to 4Evergreen for their knowledge.

Example of a sample prepared for the macrostickies analysis integrated with the dark powder procedure,

Left picture shows the sample treated with white powder on inked sheet and the right picture shows the sample treated with dark powder on un-index sheet.



## A new project




Based on those results, we have now launched a new research project to solve the issue of colored/printed barrier coatings and metalisations.

The research activities are carried out by Innovhub and Lucense, with the coordination of Aticelca.

It is open to any company producing paper and board and paper and board products with coating or metallization, producers of chemicals and coating and metallization technologies.

The project will start in December 2024 and will end by the of 2025.




## Research program



The project will study an analysis procedure and types of contrast powder (colored or fluorescent powder) to distinguish between the presence of Macrostickies from non-adhesive interfering particles by means of color contrast.

The activity will include the selection of a software suitable for the measurement of the colored particles area.

Once validated the procedure, we will draft a proposal to amend the technical standard in order to overcome interference problems in the testing of Macrostickies in case of metalised paper and/or colored/printed coated papers.





## Further investigations



The assessment involved only the sticky behavior and optical inhomogeneity caused by barrier coatings and metalisation.

Competitor materials, as plastic layers, create higher level of rejects but the technology to address them is rather easy and already in place in any recycling paper mill.

Other aspects will be addressed in the next revision of the Aticelca 501 assessment system (e.g. soluble substances, intentionally added PFAS).

Other aspects may be investigated in the future (e.g. microplastics generation, optical inhomogeneity quantification).



# Conclusions




Barrier coating and metallization can extend the application of paper and board packaging, opening to new markets and opportunities for our sector.

Experience shows that those material do not behave all in the same way during the recycling process.

When introducing new products on the market the recyclability needs to be investigated, in order to preserve the value of recycling of paper and board products.

To keep updated the test methods to consider new products and innovations is fundamental to grant the access to the market.



Thanks



[www.aticelca.it](http://www.aticelca.it)



Discover the sustainability features of paper: [it.lovepaper.org](http://it.lovepaper.org)

