RecyClass

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RECYCLASS TECHNICAL REVIEW

Brussels, 5 July 2023

The RecyClass PO Films Technical Committee investigated the impact of metallisation on recycling of PE and PP films. This campaign started in May 2020 and was part of a cooperation with COTREP to align on future recommendations to be given to the industry. After about 2 years of investigations, by both organisations, the RecyClass PO Films Technical Committee decided to define metallisation as compatible with both PE and PP flexible packaging recycling streams.

The test campaign on metallisation aimed at three different objectives: 1) Investigating the impact of metallisation on MDO-PE and BOPP films recycling, 2) Evaluate the effect of combination of laminating adhesive and metallisation in typical LDPE/met/MDO-PE or cPP/met/BOPP laminates, 3) Comparing COTREP and RecyClass recyclability evaluation protocols.

Samples were produced and provided with the support of SAES Coated Films, Coim, Taghleef Industries and Dow. Overall, 4 different structures were evaluated, 2 metallised MDO-PE with an optical density about 2.5 and 2 metallised BOPP with an optical density about 2. Each time, one film was monolayer and another one was laminated to either LDPE or cPP. The composition of the films evaluated is reported in the Annex 1. Finally, Dow LDPE 310E grade and Taghleef Industries TSS BOPP were used as control material.

In order to compare COTREP and RecyClass protocols, RecyClass Recyclability Evaluation Protocols were adapted with a blend containing 15 % innovation film (A.15) instead of 25 % (A.25). Both protocols are also opposing in the selection of the control material, where COTREP requests using a PCR LDPE, while RecyClass uses a virgin LDPE grade. Performing RecyClass protocols on met-MDO-PE with each control material led to significant differences, in particular with the rapid saturation of the melt filters during extrusion by using PCR LDPE as control material, that led to a high increase of pressure after less than 1h extrusion (about 70 % increase). The use of PCR LDPE as control material showed high ash content, multiple melting temperatures different than the one of PE, and poor quality of blown films obtained after conversion.

Recyclability evaluations performed according to RecyClass procedures (virgin control LDPE or BOPP) showed overall good properties of pellets and films. As expected, pellets and films were tinted with grey colouration due to the metallised layer. Besides, the presence of metallisation led to a thin grey deposit on top of melt filters, which after more than 1h of extrusion can lead to saturation and pressure increase.

Despite these residues on melt filters, films were produced via blow moulding for PE and via cast film for PP, with good mechanical properties and no increase of numbers of gels or specks compared to control.

Finally, the presence of laminating adhesives in combination with metallisation in common laminates structures showed more deposit and build-ups on melt filters, probably related to aggregates formed by laminating adhesives with aluminium. In addition, the films made from metallised laminates exhibited up to 3 times more gels & specks than the control film.

As a summary and according to the results that were obtained from the Recyclability Evaluation Protocol, the RecyClass PO Films Technical Committee defined the compatibility of the metallisation with the PE and PP film recycling stream as following.

- For PE and PP film transparent streams:
  - Non-compatible since generated pellets will be grey coloured instead of transparent.
- For PE and PP film coloured stream:
  - Limited compatible: For both coextruded and laminated films.

Note that this decision was also taken to harmonise with the recommendation given by COTREP, which defined metallisation as “tolerated compatibility” which is comparable to RecyClass limited compatibility definition.

It is important to keep in mind that apart from the impact on recyclability, metallisation can alter the sorting of a packaging. Indeed, metallisation can lead to overexposure of NIR detector during the sorting process, therefore not making possible the detection of the packaging material. For this reason, the PO Films Technical Committee would like to recommend performing sorting test on metallised packaging to ensure that metallisation will not hamper the NIR detection. Current recommendation according to sorting tests performed on metallised packaging is to limit optical density of metallised layer below a value of 2.5 or 2.6. Note that optical density is proportional to the thickness of the aluminium deposit.

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About RecyClass

RecyClass is a non-profit, cross-industry initiative advancing recyclability, bringing transparency to the origin of plastic waste and establishing a harmonized approach toward recycled plastic calculation & traceability in Europe. RecyClass develops Recyclability Evaluation Protocols and scientific testing methods for innovative plastic packaging materials which serve as the base for the Design for Recycling Guidelines and the RecyClass Online Tool. RecyClass established Recyclability Certifications for plastic packaging, Recycling Process Certification and Recycled Plastics Traceability Certification for plastic products.

RecyClass – Plastic Future is Circular

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Annex I

Table 1: Metallised structures evaluated for the metallisation test campaign.

Innovation	Thickness [µm]	Optical Density	Adhesive [g/m²]	Control material
met MDO-PE	20	2.4-2.7	-	R-310E DOW
Laminate met MDOPE	70	2.4-2.7	1.7	R-310E DOW
met-BOPP	18	2	-	Mono BOPP film
Laminate met-BOPP	35	2	2.2	Mono BOPP film