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Despite their common use in PP flexible packaging, cold seals and releasable lacquers are often not mentioned in any Design for Recycling Guidelines. In this context, the RecyClass PO Films Technical Committee (TC) decided to investigate the impact of cold seals adhesives and releasable lacquers on the recyclability of Polypropylene (PP) films, to deliver guidance to the industry. This testing campaign was supported by Taghleef Industries, supplier of the PP films, COIM, supplier of the laminating adhesive, and by Sun Chemical, Bostik, and Siegwerk who produced the tested samples. With the result of this test campaign, the RecyClass PO Films TC can support the PP packaging value chain with first Design for Recycling recommendations for cold seals and releasable lacquers.

While cold seal can be used alone, the releasable lacquers are used with cold seals on PP flexible packaging whenever controlled release, clean peel, and prevention of film tearing or blocking are required—especially in flow-wrap, high-speed, and easy-open applications. For this reason, four sample structures were selected and assessed, mimicking real-world PP packaging compositions (see compositions in Annex I). The cold seal chemistry was based on acrylic and natural rubber (NR), applied at 4.9 gsm dry to 40% of the surface for sample 1, and at 3.5 gsm dry on 25% coverage for sample 2 and 3, while the PA-based lacquer, used for sample 1 and 2 was coated at 1.5 gsm dry across the entire surface (see Annex 1). Therefore, in the worst-case scenario, corresponding to sample 1, the cold seal and releasable lacquer represented 6.7 and 5.2 wt% of the total weight of the packaging respectively. The control material is a 30 µm TSS PP film. Tests were conducted at the Centre Technique Industriel de la Plasturgie et des Composites (IPC) according to the RecyClass Recyclability Evaluation Protocol for laminating adhesives applied on PP Films (REP-PPflex-02).

The test campaign demonstrated stable extrusion and film production for all sample types, with only a slight pressure increase noted in samples containing metallisation. Melt filter analysis showed only a few black dots and light fumes during extrusion. No significant deviations were observed in pellet or film properties, aside from minor colour changes. Slight yellowing was recorded for samples containing cold seals and lacquers only, with a maximum deviation to the control (Δb^*) of 6.6 for sample 2 and 7.5 for sample 1. Note that these results remained within the benchmark recommendations presented in the testing procedure. Finally, the produced films showed excellent properties with very low number of gels and other defects. Despite the high haziness of the samples 3 and 4, due to the white pigment and metallisation treatment, no negative deviations could be observed regarding the number of films defects.

Overall, the quantitative analysis of the films revealed that cold seals (NR + Acrylic) up to 6.7 wt% and PA-based lacquers up to 5.2 wt% did not adversely affect recyclability, but could present a discoloration during the recycling process. Therefore, as a summary and according to the results that were obtained from the Recyclability Evaluation Protocol, the RecyClass PO Films TC defined the following level of compatibility for PP flexible packaging:

For the Design for Recycling Guidelines for coloured PP flexible packaging:

- Cold seals (NR + Acrylic) up to 6.7 wt%: Fully compatible
- Releasable lacquers (PA) up to 5.2 wt%: Fully compatible

For the Design for Recycling Guidelines for natural PP flexible packaging:

- Cold seals (NR + Acrylic) up to 6.7 wt%: Limited compatible
- Releasable lacquers (PA) up to 5.2 wt%: Limited compatible

Note that, the RecyClass PO Films TC also agreed on **extending the aforementioned Design for Recycling recommendations to PA-based inks** considering the similar chemistry involved in PA inks binders and releasable lacquers. This extension will be valid for both PP and PE flexible packaging.

While this test campaign is a first step on better understanding the impact of cold seals and releasable lacquers on PP flexible packaging recycling, the RecyClass PO Films TC continues to invite companies to test their packaging solutions according to the RecyClass Recyclability Evaluation Protocol to ensure that the combination of multiple packaging features such as cold seal, laminating adhesives, inks, etc. will not be detrimental for recycling.

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

Samples #	Film structure	Cold Seal (NR + Acrylic)	Releasable Lacquer (PA)
1	PP Monoweb, 30 µm	Yes (4.89 gsm cold seals on 40% coverage = 1.956 gsm)	Yes
2	PP Monoweb, 30 µm	No	Yes
3	PP Multilayer: • White voided (density 0.74) 28 µm • Approved LA at 2 gsm (NC 488 A + CA27) • PP film 20 µm	Yes (3.5 gsm cold seals on 25% coverage = 0.875 gsm)	No
4	PP Multilayer: • Metallized layer • Approved LA at 2 gsm (NC 488 A + CA27) • PP film 20 µm	Yes (3.5 gsm cold seals on 25% coverage = 0.875 gsm)	No
Control	Monoweb PP - TSS	No	No

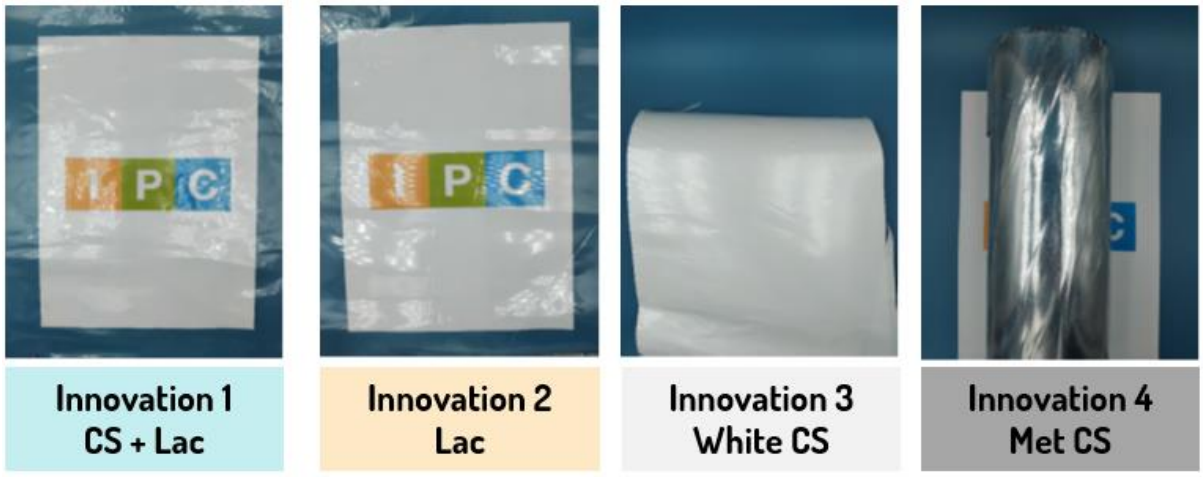

Figure 1: Composition and pictures of samples used for the test campaign.