RecyClass

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RECYCLASS TECHNICAL REVIEW

Brussels, 24 January 2023
Revised: 10 July 2025

The RecyClass HDPE and PP Technical Committees (TCs) investigated the impact of PP on the recyclability of HDPE rigid packaging as well as the impact of HDPE on PP rigid packaging. These two test campaigns were performed with samples representing 2.5, 5 and 10 wt% PE in PP and vice versa. Tests were carried out following the procedures described by both RecyClass Recyclability Evaluation Protocols for HDPE and PP containers[1].

For these specific test campaigns, and in order to have samples with a precise composition, RecyClass HDPE and PP TCs decided to use pellet blends as samples rather than packaging. Innovation samples were prepared using 90/10 HDPE/PP or PP/HDPE blends that got extruded once at 220 °C in order to replicate the thermal history of a plastic packaging. The obtained pellets were then considered as "innovation samples". For the evaluation of PP impact on HDPE stream, 3 different blends were tested, representing the 3 big families of PP-based polymers: PP homopolymer, PP random copolymer, PP block copolymer. For the HDPE in PP test campaign, only one sample was selected and tested. Compositions were chosen to be representative of the share of HDPE and PP in respectively PP and HDPE packaging market.

The recyclability evaluation was performed at the Institut für Kunststofftechnologie und -recycling (IKTR), by following the RecyClass Recyclability Evaluation Protocol for HDPE or PP Containers[2] depending on the test campaign. The control material used for the test corresponded to the same HDPE and PP grade used as main component of the blends, respectively Hostalen GF4750 and Borealis HC600TF.

For both test campaigns, the extrusion monitoring showed stable and comparable extrusion, injection moulding and blow moulding processes no matter the composition of the blends. For the PP in HDPE test campaign, main deviations to the benchmark recommendations of RecyClass Recyclability Evaluation Protocol for HDPE Containers were about the top load and drop impact resistance of bottles with up to 20 % decrease of the properties compared to the control material. For the HDPE in PP test campaign, main deviations to the benchmark recommendations of RecyClass Recyclability Evaluation

[1] RecyClass Recyclability Evaluation Protocols

[2] RecyClass Recyclability Evaluation Protocols

Protocol for PP Containers were about the stress and strain at break properties with up to 40% and 55% decrease of the respective properties compared to the control material.

The outcome of these test campaigns was that an amount of HDPE or PP superior to 10 wt% in the opposite packaging is detrimental for HDPE and PP recycling. As a summary and according to the results that were obtained from the Recyclability Evaluation Protocols, the RecyClass HDPE and PP Technical Committees defined the compatibility of PP and HDPE respectively with the HDPE and PP recycling as follows:

For the HDPE stream:

- **Limited compatible** with HDPE if PP **≤** 10 wt% of the total weight of the packaging.
- **Low compatible** with HDPE:
  If PP is between 10 and 30 wt%, leading to 2 class deduction.
  If PP > 30 wt%, leading to 3 class deduction.

For the PP stream:

- **Limited compatible** with PP if HDPE **≤** 10 wt% of the total weight of the packaging
- **Low compatible** with PP if HDPE > 10 wt%

Revision – July 2025

The RecyClass HDPE Technical Committee has reviewed the presence of polypropylene (PP) in the high-density polyethylene (HDPE) recycling stream, primarily originating from plastic closures.

The Committee evaluated the potential implementation of flake sorting technologies at recycling facilities as a means to reduce the PP content in the HDPE fraction to below 1 %. Following extensive deliberation, and considering the growing adoption of flake sorting systems by recyclers as well as the demonstrated ability to achieve high-quality PE fractions, the Committee has resolved to revise the classification of PP closures in the Design for Recycling Guidelines as outlined below:

For the HDPE stream:

- **Full compatible** with HDPE if PP closures **≤** 10 wt% of the total weight of the packaging.
- **Limited compatible** with HDPE if PP closures > 10 wt% of the total weight of the packaging.

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PP not coming from closures (e.g. blended in the main body) will be considered as limited compatible.

The recommendations for PE in PP remain unchanged.

These recommendations might be further discussed after gathering more information regarding the following points:

- Amount of PP in the input material of the HDPE stream.
- Level of purity of the HDPE fraction at recyclers facilities using flake sorting.
- Level of purity and potential final application for the sorted PP rich fraction.
- Possibility of the facilities to cope with an increased % of PP in the input material in terms of efficiency.
- Yield of the process (Amount of HDPE that is lost in the PP sorted fraction).

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Annex I

Table 1: PP grades used for the PP in HDPE test campaign

PP grade	MFI (230°C/2.16 kg) (g/10 min)	Tensile modulus (MPa)	Charpy 23°C (kJ/m²)	HDT B (°C)	Application
Borealis HE125MO (**homopolymer**)	12	1550	3.5	88	Caps & Closures
Borealis BD950MO (**block copolymer**)	8	1500	8.5	110	Caps & Closures
Borealis RF366MO (**random copolymer**)	20	1200	5.5	75	Caps & Closures

Table 2: HDPE grade used for the HDPE in PP test campaign

HDPE grade	MFI (190°C/2.16 kg) (g/10 min)	Tensile modulus (MPa)	Charpy 23°C (kJ/m²)	Application
Hostalen GF4750	0.4	1000	12	Blow moulded bottles