



GENERAL NOTICE 80

Impact of foil stamping on the sorting and regeneration of rigid PE packaging

SUMMARY

The aim of this general notice is to assess the sorting and recycling potential of rigid PE packaging items decorated using hot or cold stamping techniques. It concerns:

- Rigid PE bottles and dispenser bottles
- Pots, trays, tubes and other rigid PE packaging



Sorting centre

Ability of packaging waste to be channelled to the regeneration plant



Regeneration

Ability of packaging waste to be converted into ready-to-use flakes or granulate



Use of recycled material

Ability of flakes or granulate to be converted into new products

Study scope

Hot foil stamping and cold transfer are decoration processes used in packaging to achieve a localised metallic effect with a small amount of metal.

During the optical sorting phase, the infrared beam emitted by the optical sorting machine may diffuse as it reflects off the metallic surface of a packaging item. In addition, the beam cannot pass through the metallised layer. These phenomena can prevent the machine from analysing the spectrum correctly and hence defining the packaging's constituent material. Sorting tests determined that packaging decorated with hot foil stamping or cold transfer covering less than 50% of the total packaging surface (packaging body + cap/lid/etc.) is correctly directed to the stream for the packaging's main resin in sorting centres.

After concluding that proper channelling of this packaging depends on the coverage rate of the foil stamping, COTREP wanted to check that rigid PE packaging decorated with foil stamping does not disrupt the mechanical recycling and quality of the recycled material. The outcomes of pilot-scale regeneration tests indicate that rigid PE packaging partially decorated with hot or cold foil stamping does not disrupt regeneration.

Given the current state of equipment and sorting and regeneration techniques available in France, rigid PE packaging decorated with hot foil stamping or cold transfer covering less than 50% of the total packaging surface (packaging body + cap/lid/etc.) is partially compatible with the sorting and recycling of rigid PE packaging.

COTREP may review this notice in light of developments in sorting and recycling technologies, markets, or quality requirements for recycled material.

1. CONTEXT

The purpose of this notice is to assess the recycling potential of rigid PE packaging items decorated with hot or cold foil stamping.

- Hot foil stamping consists of localised application of a thin metallic layer, most often aluminium, of the required form and size onto a substrate. Pressure and a temperature of between 80°C and 160°C are applied to bond the metallic layer to the substrate. The metallic layer is sandwiched between an adhesive layer, to form a substrate/metal bond, and an optional layer of pigments/colour used to change the colour of the metal.
- Cold transfer consists of coating a metallic layer of the required form through the local application of adhesive. This is a two-stage process: application of the adhesive of the required form, then application of the film. The adhesive application stage determines the final form of the design: it enables the film to adhere solely to the required area.

In both cases, the metal's supporting structure, generally a polyester film of variable thickness, is not attached to the metal during application and does not remain on the packaging.

In this study, these two processes were considered as equivalent with an identical final structure. The two processes are therefore grouped under the term "foil stamping".

These decoration techniques account for 30% of metallic decorations used on rigid plastic packaging. The rigid PE packaging sector most concerned by this technology is beauty and personal care which accounts for more than 14,000 tonnes of rigid PE, i.e.10% of all rigid PE tonnage (bottles, dispenser bottles and other rigid packaging).

First, optical sorting tests were performed to understand how a surface covered with foil stamping can affect how packaging is directed in sorting centres.

The second part of the notice assesses the impact of foil-stamped rigid PE packaging on mechanical regeneration.

2. IMPACT ON SORTING

Feedback from sorting centres and from tests on packaging containing variable amounts of aluminium revealed that it was not directed to the metal stream owing to the low metal content of the technologies tested for this notice.

During the optical sorting phase, the infrared beam emitted by the optical sorting machine may diffuse as it reflects off the metallic surface of a packaging item. In addition, the beam cannot pass through the metallised layer. These phenomena prevent the machine from analysing the spectrum correctly and hence defining the packaging's constituent material.

Static and dynamic optical sorting tests were performed on the premises of optical sorting equipment manufacturers Pellenc ST and Tomra, with several samples of plastic packaging featuring a metallic effect. The aim was to identify disruptive effects and thresholds preventing the packaging from being detected correctly and directed to the target recycling stream.

2.1. Test samples

Tests were performed on:

- Rigid PE packaging representative of the market on which foil stamping covering 30%, 50%, 60% and 70% of the packaging surface was deposited.
- The same rigid PE packaging without foil stamping, which was used for control purposes.

2.2. Results of static tests

The packaging was positioned beneath the optical sorting machine with near infrared (NIR) technology in conditions representative of optical separation equipment operation in French sorting centres. The results were as follows:

- The foil-stamped parts of the packaging were not detected by the optical sorting machine because of the reflection produced.
- Only the parts without foil stamping were detected and recognised by the optical sorting machine.

2.3. Results of dynamic tests





COTREP provided pilot sorting lines with a packaging stream from French sorting centres. 100 samples were injected into the hollow container stream. The machines were set to eject packaging made of the target resin based on the standard settings used in French sorting centres. The results were as follows:

- With a coverage rate of up to 50% of the packaging, it was directed to the correct stream.
- Above a 70% coverage rate the packaging was not correctly directed to the target recycling stream (half of the packaging items were not directed to the target recycling stream).

In addition, channelling of this type of packaging may be affected by other design factors that reduce the detectable surface on the target material (e.g. smaller packaging items than those tested, packaging with a closure system made of a different material from the main packaging body, etc.).

Foil stamping present on a rigid PE packaging item should not exceed a coverage rate of 50% of the packaging to ensure it is correctly directed to its recycling stream.

IMPACT OF RIGID PE PACKAGING WITH FOIL STAMPING ON SORTING PROCESSES

SORTING PROCESSES	IMPACT	DESCRIPTION
 METAL SORTING		<i>No impact on metal sorting processes</i>
 OPTICAL SORTING		<i>No impact on optical sorting for packaging featuring foil stamping with a coverage rate of less than 50%</i>

 Caution
  No impact

To ensure that packaging is directed to the appropriate recycling stream, packaging decorated using foil stamping technology should not exceed 50% coverage.

3. IMPACT ON REGENERATION

3.1. Principle and analytical criteria

In its recyclability study, COTREP assessed the impact of rigid PE packaging decorated with foil stamping on the regeneration process and quality of rPE¹ produced from rigid PE household packaging.

These tests were performed on a pilot scale based on protocols defined by COTREP for recycling rigid PE packaging. The protocols are representative of industrial practices applied by regeneration plants processing streams in France². Various physical-chemical criteria were measured during the test phases and compared to those of a standard sample composed of 100% rPE. The technical characteristics of the recycled material were evaluated with a view to reprocessing as bottles (extrusion blow moulding).

3.2. Test samples











Tests were performed on laminated rigid PE tubes with foil stamping covering 60% of their visible surface to maximise potential impact. The samples were unsoiled.

The standard stream used for the study comprises 100% rPE extruded sheets produced exclusively for the study from granulate sourced from French selective collection (rigid PE standard).

Tests were performed with 2% and 10% foil-stamped PE tubes by mass to account, respectively, for estimated volumes marketed in 2023 and a scenario where all packaging in the cosmetics sector is decorated with foil stamping.

3.3. Results

IMPACT OF FOIL STAMPING ON RIGID PE PACKAGING REGENERATION PROCESSES

RECYCLING PROCESSES	IMPACT	DESCRIPTION
 SHREDDING		No impact on shredding
 WASHING AND SPINNING		No impact on washing and spinning
 FLOTATION AND DRYING		No impact on flotation or drying
 EXTRUSION/ GRANULATION		No impact on extrusion/granulation
 EXTRUSION BLOW MOULDING		No impact on extrusion blow moulding



Caution



No impact

¹ rPE means recycled material from rigid PE packaging

² For further information, see the protocols: **Test protocol rigid PE-1 and rigid PE-2** on the COTREP website: www.cotrep.fr

TECHNICAL CONCLUSIONS

Through tests performed by COTREP, it was possible to assess the impact of rigid PE packaging decorated with foil stamping on sorting and mechanical regeneration of rigid PE household packaging.

Results obtained show that **the compatibility of packaging with foil stamping depends on the foil stamping coverage rate.**

Given the current state of equipment and sorting and regeneration techniques available in France, rigid PE packaging decorated with foil stamping covering less than 50% of the total packaging surface (packaging body + cap/lid/etc.) offers partial compatibility in the rigid PE stream.

It should be noted that the assessment of metal quantities in the recycled material was not concerned by these tests and may be addressed in further studies.

COTREP may review this notice in light of developments in sorting and recycling technologies, markets, or quality requirements for recycled material.