

## Recyclable barrier food packaging

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*Food packaging, rather than being a simple food container, provides a physical barrier to the factors that affect food, such as humidity, oxygen or light, among others, thanks to the combination of the materials used for its manufacturing, which allows maintaining the freshness of the food for longer and extend its shelf life. But barrier packages have a big disadvantage regarding their recyclability.*

Consumers are demanding less and less processed food products, with no additives and preservatives to preserve the food quality. Therefore, high-barrier packages are the key for extending the shelf life of many products. Products such as bags and pouches, stand-up pouches, tray lidding film, forming webs, wrapping film, and blister pack base webs segment the global high barrier packaging films market. The main applications in the market include fresh food, retort convenience food, dried food, processed chilled food, snack foods and confectionery, cheese, baked goods, drinks, pharmaceutical and medical, personal care and cosmetics and others.

### **High-barrier food packaging market**

High barrier packaging films have unique properties, such as heat resistance, gas and aroma barrier, high tensile strength, puncture resistance, durability, special surface properties and a lighter packaging. Europe leads the global high barrier packaging films market in terms of both demand and production, followed by Asia and South America.<sup>1</sup>

Technologies and materials include multi-layer films such as: metallised films, biaxially oriented polyethylene terephthalate (BOPET), polyamide (BOPA) and polypropylene (BOPP or CPP), high oxygen-barrier materials (ethylene vinyl alcohol [EVOH], polyacrylonitrile, polyvinylidene chloride [PVdC], polyvinyl alcohol [PVOH] and cyclic olefin copolymer), high barrier coatings, organic liquid coatings and inorganic vapour deposition high barrier coatings such as silicon oxide (SiOx), and aluminium oxide (AlOx).

**The global high-barrier packaging film consumption was approximately 1.76 million tonnes in 2014, with a value of 12 billion euros.** It is expected to grow at a CAGR of 5.0 % between 2014 and 2019 according to a recent market report.<sup>2</sup> According to the report, there is a growing demand for packaging materials that give even greater protection in the food, beverage and pharmaceutical industries. As plastics have become more and more common, concerns about their ability to allow the exchange of gases and vapours that can compromise the quality and safety of packaged products have arisen. Therefore, a variety of barrier technologies that preserve and protect, optimise shelf life, reduce the need for preservatives, provide transparency and gloss, etc. have been commercialised. Without this barrier packaging, perishable goods could be subject to a wide range of deterioration processes.

Barrier packaging presents favourable environmental aspects, such as the minimization of food wastes or an extreme lightness. Despite of this fact, there is a considerable reduction in the use of raw materials and less consumption in transportation, among others. It could also involve

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<sup>1</sup> [www.decisiondatabases.com/ip/239-high-barrier-packaging-films-market-report#sthash.FVOy5hdn.dpuf](http://www.decisiondatabases.com/ip/239-high-barrier-packaging-films-market-report#sthash.FVOy5hdn.dpuf).

<sup>2</sup> [www.smitherspira.com/news/2014/april/high-barrier-packaging-film-consumption-forecast](http://www.smitherspira.com/news/2014/april/high-barrier-packaging-film-consumption-forecast).

negative aspects, such as the lack of biodegradation, the consumption of materials from non-renewable sources, a low recyclability and higher costs. The fact of being a multi-layered product becomes a problem at the end of its useful life: it presents in its structure more than one plastic material or even of another nature such as aluminium, which are transformed at different temperatures. This waste is difficult to recycle, even in a recycling industry as consolidated as the European one. In most cases, these packages are landfilled, energetically valorised or, to a lesser extent, they become low-quality recycled materials.

This situation results in a loss of resources that goes against the paradigm of Circular Economy. It is necessary to obtain eco-designed products from the beginning of their life to take into account the entire product life cycle of and minimize the environmental impact.

### **Recyclable food packaging with improved barrier properties**

The development of new fully-recyclable solutions with improved barrier properties from renewable sources represents an important competitiveness opportunity for Europe as described in the European Commission strategy 'Innovating for Sustainable Growth: a bio-economy for Europe'<sup>3</sup> and in 'A European Strategy for Plastics in a Circular Economy'<sup>4</sup>. Currently, metallised and modified atmosphere packages are based on the use of non-renewable materials in multilayer structures that lead to complex and expensive recycling steps.

**The RefuCoat** project, EU-funded, aims at developing a fully-recyclable food packaging with enhanced gas barrier properties and new functionalities using high performance coatings: Active coatings and barrier coating will be developed to be used in films and trays as an alternative to current metallised and modified atmospheric packaging (MAP) to avoid the use of non-renewable materials.

The project is focused on two kinds of packages:

1. The Refucoat project plans to develop fully-recyclable packages based on bio-PET and bio-PE combined with hybrid and active coatings for cereals and savoury products in order to replace metallised films by using hybrid barrier coatings. Hybrid organic-inorganic coatings are the best solution beyond of the state-of-the-art solution. It is based on the combination of high oxygen-barrier bio-polymers and SiO<sub>2</sub> particles. Previous laboratory tests have demonstrated high barrier properties using coating layers of a few microns. The removal of metallic barriers, which are one of the biggest obstacles to recycle and their replacement by coatings with greater compatibility with materials, will lead to more recyclable products and therefore higher-quality recycled materials will be obtained from them. This environmental benefit will be increased by using materials from renewable sources, which have a lower carbon footprint and are recyclable in the same way as the same materials of fossil origin, thus reducing the consumption of materials of non-renewable origin.
2. Regarding chicken meat products, RefuCoat plans to develop a fully biodegradable package based on the manufacturing of middle-chain resins to develop a fully biodegradable packaging for chicken meat products. In this case, a completely recoverable container will be obtained by biodegradation (compostability), which will

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<sup>3</sup> [http://ec.europa.eu/research/bioeconomy/pdf/official-strategy\\_en.pdf](http://ec.europa.eu/research/bioeconomy/pdf/official-strategy_en.pdf)

<sup>4</sup> Brussels, 16.1.2018 SWD(2018) 16 final COMMISSION STAFF WORKING DOCUMENT Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "A European Strategy for Plastics in a Circular Economy" {COM(2018) 28 final}

allow a product life end complementary to mechanical recycling to obtain a high-quality fertilizer to be used as a soil improvement.

The products generated will be validated and compared to current metallised, non-bio-based alternatives in industrial products, in performance and recyclability.

The RefuCoat consortium is formed by 12 synergistic partners, 7 of them BIC members, which represent the entire value chain, as well as SME partners (MIPLAST and IRIS), industrial partners (GRUPO APEX, MANOR FARM, DACSA and BIOPOLIS), and RTO partners (THUNEN, CIB- CSIC, AIMPLAS, EUFIC, Fraunhofer and AINIA). Refucoat is expected to have a great impact in the performance of food packages, the reduction of landfilled wastes, the cost and environmental effectiveness in processing by Life Cycle and Techno-Economic Assessment, the improved preservation of food products, new markets and contribution to KPI of BBI-JI. REFUCOAT has received funding from the Bio-Based Industries Joint Undertaking under the European Union's Horizon 2020 Research and Innovation programme under grant agreement 745791.



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