

Frequently used films for printing and laminating

Part 1: A system in the face of confusion

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This first of a series of articles provides an overview of commercially available synthetic films for printing and laminating. To keep the focus of the article as tight as possible, only films are mentioned which are typically used for food packaging.

There are reliable indicators that in the years to come the market for packaging films will continue to grow. Compound films with or without barrier functions had particularly remarkable growth rates between 2001–2004. The majority of this applied to thermoforming films however films with or without Aluminium barrier layers also enjoyed strong growth. In general, compound films are printable and can be laminated with a very wide range of market available films (table 1).

Film types and growth potentials

Within the context of lamination films the types indicate the raw materials used for production. It is

therefore necessary to distinguish between materials like PET (Polyethylene Terephthalate); PP (Polypropylene); or PE (Polyethylene). Lamination films are materials which are intended to be laminated through a further finishing process; available in either unprinted or printed qualities; and manufactured in different types and blends. In view of the many different available variations in the market and due to the demand for stable runnability with the many different laminating and printing processes such film materials must offer extreme robustness.

How will the consumption of synthetics for the manufacturing of films for laminating and printing used for the production of flexible packaging develop within the next few years? The British market research company *PCI Films Consulting* compiled a study for the period of 2006–2010, those results are shown in table 2.

Based on these numbers it is clear to see, that Polyolefins (PE and PP) have a significantly large share. Furthermore, there is a differentiation between PP-C (PP cast film) and PP-BO (PP biaxial oriented). With regard to the growth rate PP-BO films are of certain interest. However, there is no doubt that the growth rates of materials for the manufacturing of flexible packag-

ing are of considerable importance for future product development (table 3).

The strongest growth rates can be found in the »other films« category. This includes film compounds consisting of different materials and non specified film types with the latter having the highest predicted growth rates. Strong growth rates can also be expected for the PET-BO type of films. Due to such growth expectations an increasing number of companies start to concentrate on film laminating.

The nomenclature of films

The drawing up of the international DIN EN ISO 1043-1 standard also served the intention, to transfer naming rules from other fields of the synthetics and chemical industries onto the film industries. However, this 2001 issued standard is mostly unknown and therefore rarely used, although it has an undeniable potential to clear the above mentioned confusion.

Based on this standard there is a return to the traditional manner, of writing material specific name affixes in capital letters. Some examples of this are:

- PVC = Polyvinyl Chloride,
- PE = Polyethylene,
- PP = Polypropylene,
- PS = Polystyrene,
- PLA = Polylactic Acid.

If the characteristics of materials are determined by certain processing steps, they are post-positioned to the material name in capital letters and connected with a hyphen. For example, the biaxial orientation is a process which significantly modifies the characteristics of the respective materials.

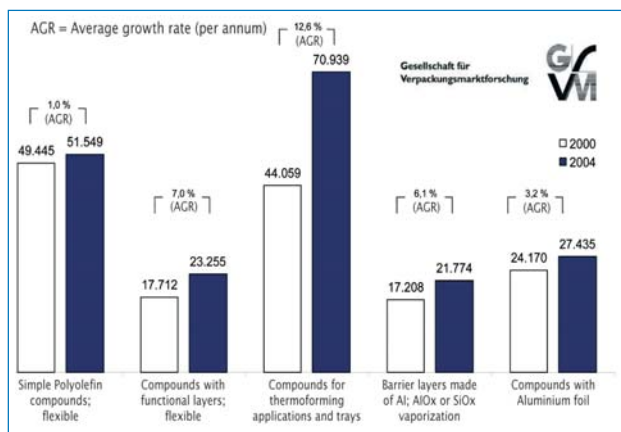
- PP-BO = biaxially oriented Polypropylene,

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Table 1:
The consumption of flexible film compounds in Germany 2001–2004 (in tons).

Source: *Innoform; GVM Gesellschaft für Verpackungsmarktforschung.*



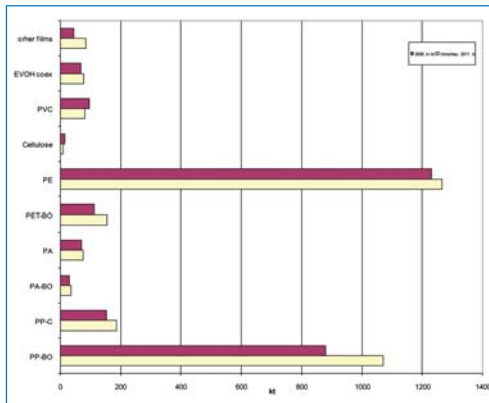
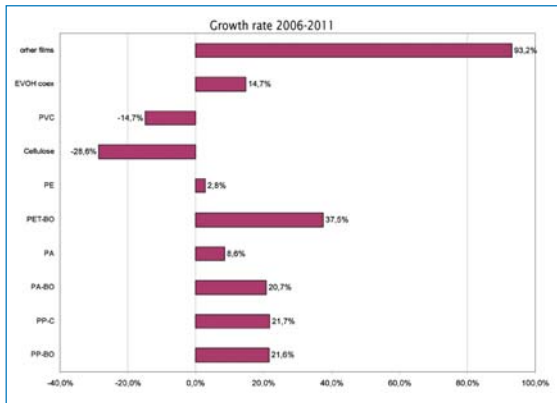


Table 2 (left):
Estimated film consumption for flexible packaging in Europe (2006-2011).
Source: PCI Films Consulting.

Table 3 (right):
Estimated growth rate for film consumption for flexible packaging in Europe (2006-2011).
Source: PCI Films Consulting.

- PET-BO = biaxially oriented Polyethylene Terephthalate,
- PP-BO = biaxially oriented Polypropylene,
- PA-BO = biaxially oriented Polyamide.

If there would be such a thing as monoaxially oriented Polyethylene Terephthalate film, this might have been called PET-MO.

Further material characteristics to be named are for example PE-LLD (Polyethylene linear low density). If such a material would be biaxially oriented, it might be named PE-LLD-BO according to the aforementioned norm.

For the following film types there is still no established standard regulation:

- PET-BO met. = biaxially oriented and metallised Polyethylene Terephthalate,
- PET-BO AlO_x = biaxially oriented Polyethylene Terephthalate coated with transparent Aluminium Oxide,
- PET-BO SiO_x = biaxially oriented Polyethylene Terephthalate coated with transparent Silicon Oxide,
- PET-BO x or x PET-BO = biaxially oriented Polyethylene Terephthalate coated with PVDC.

This applies accordingly to other substrates/polymers like

- PP-BO expanded,
- PP-BO varnished with Acryl,
- PP-BO varnished with PVOH.

Attached figures specify the number of carbon atoms of a monomer unit of each monomer or comonomer. Therefore, PA 6 means a monomer unit with six carbon atoms (NH-(CH₂)₅-CO), whereas PA 66 means two monomer units with different structures but with six carbon atoms each (NH-(CH₂)₆-NH-CO-(CH₂)₄-CO). The latter material is manufactured using HMD (Hexa-



Left:
The DSC thermo analysis determines the melting behaviour of synthetic films.

Upon:
Peelable ham package.

Below:
Leak test for a film package using a creep medium.

methylamide) and Adipic Acid and is a result of polycondensation with dehydration.

Several film types

● **Monofilms.** Films made of solely one material layer are commonly named monofilms. This term has become widely accepted and has already been successfully used against the also used term Solofilm.

● **Compound films.**

- Co-extruded compound films. These are films manufactured with a one-step process through the suitable combination of several material layers which offer predestined characteristics due to the respective materials used. A classic in this field is the Coex laminating film made of black and white PE-LD and PE-LLD for the manufacturing of packaging for rough applications like peat packaging.

- Laminated compound films. These are films whose single layers are connected with adhesive and

with considerably different characteristics than coex films materials. Therefore, the authors suggest an according linguistic differentiation: laminated compound films; solvent-less laminated compound films; or extrusion compound films.
(to be continued)

Service around films

Innoform consists of the companies *Innoform GmbH* (Test services and consulting), Oldenburg/D; and *Innoform Coaching GbR*, Hasbergen/D.

Innoform Consulting is engaged with the issue of film technology with a focus on food packaging. The aim is to give customers substantial answers with regard to food law requirements; technological production problems; and film development. In this context, the compiling of expertises and declarations of conformity concerning food law requirement – paired with specifications – serve as an essential instrument.

The business activities of *Innoform* test service comprise the origination of packaging solutions; film analysis; failure analysis; and quality assurance measures (e.g. through inspections). Since May 2007 the test service has been accredited according to DIN EN ISO/IEC 17025.

Innoform Coaching specialises in the organization of public workshops; conferences; as well as the annual »Inno-Meeting«.