Frequently used films for printing and laminating

Part 2: Properties and applications of different types of film

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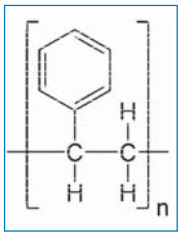
Part two of this series deals with commercially available synthetic films for printing and laminating used for food packaging and outlines the properties and fields of application of different films.

Polyvinyl chloride (PVC)

PVC is very popular among material experts as it is not only available as hard PVC (PVC-U) and soft PVC (PVC-P) but is also not as closely linked to the raw oil prices like most other synthetics are. This is because PVC's second base material Ethylene chloride is a reaction product of Ethylene and common salt (Sodium chloride – NaCl). Therefore it is available in sufficient quantities and is not affected by huge price fluctuations as is the case with oil-based products (*figure 1*).

As far as packaging films are concerned, PVC is controversial in some European countries like Germany and Switzerland. The main cause for this are the softeners it contains. As the name suggests, the major task of softeners is to make plastic products soft and smooth. One of the most frequent used softeners is Di(2-ethylhexyl)phthalate (DEHP), a colourless viscous liquid with good plasticizing properties. However, due to its physical properties DEHP may dissolve or outgas from plastics if they come in contact with liquids or fat and therefore come in contact with consumers. In this context it must be indicated, that DEHP is considered »well examined« in terms of its noxious effects which are classified as low and non-mutagenic.



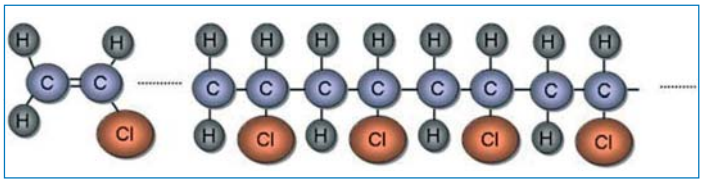
On an international scale production quantities are increasing, whereas for food packaging hard PVC is most important. This is due to the boom of thermoformed packaging (also called deep drawn packaging) used for modified atmosphere packaging (MAP) of fresh products like sausages and cheese.

Due to the above mentioned controversy on softeners the use of soft PVC in Central Europe is declining. However, in some areas like bags for blood preservation this material is still in use, but the search for alternatives is on.

High transparent stiff/brittle PVC-U is most suitable for thermoforming applications as mentioned previously. Properties like deformability; high stiffness; transparency; sealability and lamination ability guarantee the continued use of hard PVC in this field.

Polystyrene (PS)

Related to primary food packaging, Polystyrene seems to lose ground. This is because the physiological compatibility of PS is also controversial and the properties are inferior to those of PVC, PET or PP. Moreover, other significant factors include the purchase price and barrier properties, which are not very outstanding. PS is derived through the polymerisation of monomer Styrene, which may not migrate into the packed food (*figure 2*). Best known food applications for PS include yoghurt cups and thermoformed packaging for fresh products.



Polystyrene is often laminated and printed. In this context, the material's ability to absorb solvents from either ink or adhesive is another obstacle for its use in food packaging, as questionable amounts of residual solvent may remain which could migrate into the food. However, PS is generally licensed for food applications and has been successfully used for years. In the field of sleeve labels the material actually enjoys a downright boom.

Polyethylene terephthalate (PET)

Polyethylene terephthalate is a hard polymer resin of the polyester family. In the food packaging sector it is used in thermoforming applications (*figure 5*). PET is a thermoplastic synthetic of the Polyester family and made through polycondensation. It can be used in many ways especially for the manufacturing of bottles and films.

Depending on the degree of crystallinity which means the regular configuration of the polymer chains PET offers the most different properties:

- PET-C: crystalline Polyester;
- PET-A: amorphous Polyester

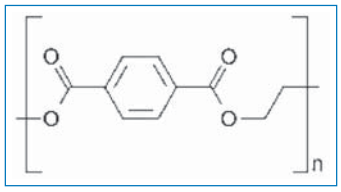


Figure 1 (above): Vinyl chloride reacts to Polyvinyl chloride.

Figure 2 (right): Structural formula of (Poly)Styrol.

Figure 5 (far right): Structural formula of Polyethylene terephthalate.

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Figure 3 (left): Yoghurt cup without lid.

Figure 4 (centre): Examples for thermo-formed PS packaging.

with non-regular configuration of the polymer chains;

- PET-G: Glycol modified Polyester, whose crystallisation has been impeded.

These three variations can be used individually, as mixtures or in co-extruded layers.

PET-A is crystal clear, thermoformable, and sealable to a limited extent. The more it crystallizes the more cloudy it becomes and more thermally stable. Therefore, crystalline PET is the only synthetic material currently used for the crisping of convenience foods. Co-extruded PET-C materials supplied with thin PET-A layers are used for the sealing of such food trays.

Contrary to the hard film types mentioned above, Polyethylene terephthalate can also be produced as a thin film down to 8 micron (standard thickness: 12 micron). To achieve constant outer layers and also being able to use recycled material for the medium layer, such films consist mostly of three layers. They can be printed and laminated and due to the subsequent stretch forming they offer extremely low thickness tolerances.

PET films have a melting point above 250 °C (482 °F) which makes them suitable to serve as outer layers for compound materials as they can be treated with very hot sealing tools. Examples of such applications are lid films for thermo formed MAP. (*to be continued*)

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Part 3: Characteristics and applications of thin facestock films and embossing layers

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