



**pro-K Fachgruppe**  
Thermoplastische Platten

Technical Information  
Injection moulding versus  
Thermoforming

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### Fachgruppe Thermoplastische Platten

Die Fachgruppe Thermoplastische Platten ist eine Fachgruppe des pro-K Industrieverbandes Halbzeuge und Konsumprodukte aus Kunststoff e.V., Städelstraße 10, D-60596 Frankfurt am Main; Tel.: 069 - 2 71 05-31; Fax 069 - 23 98 37; E-Mail: [info@pro-kunststoff.de](mailto:info@pro-kunststoff.de); [www.pro-kunststoff.de](http://www.pro-kunststoff.de)

## 1. Introduction

In recent years production technologies in thermoforming have made major progress. In many cases it can no longer be seen at first glance if it is an injection moulded or a thermoformed component. Not only permanently improvements in machine technology are responsible for this. Now the entire process chain from semi-finished material via it's processing and finishing on to completion of the customer product has meanwhile achieved the highest quality standards.

A permanently growing amount of available tooling reflects ever new application possibilities for thermoforming. Multi-layer materials, decorative films, printed semi-finished materials, electrically conductive semi-finished materials together with many specially equipped materials are mentioned here just as an example.

The whole range of thermoforming opens the most varied areas of application: from the classic processing of film material for packaging applications via the manufacture of workpiece carriers and technical formed parts from sheet material through to the manufacture of hollow parts and other special applications.

Advantages over injection moulding can often be found if one compares the total costs of both processes. But a mainly clearly shorter work-through up to product manufacture is frequently an argument for thermoforming. Additionally construction and manufacture of thermoforming tooling generally offers clear price advantages in comparison with those of injection moulding tooling. Of course with all comparisons the quantity or start size together with special technical demands must be considered.

Whilst with injection moulding almost all shapes and details can be represented, thermoforming in comparison to injection moulding is limited by the use of semi-finished materials. This supposed "disadvantage" can be turned into an advantage when the possibilities of thermoforming are known.

Both processes will play an important part in the future of plastics processing. The following comparison is intended to show a comparison in simple terms and illustrations "thermoforming versus injection moulding".

## 2. Plastic thermoforming

Plastic thermoforming belongs to the so-called thermo-shaping processes (heat shaping)

Vacuum forming of plastics is carried out in thermoforming machines which are available in various sizes. The size of the vacuum formed plastic component depends on the size of the forming machine and the required size of the plastic sheet.

Thermoforming of plastic can be done in several ways:

One method is that a plastic sheet is heated to the extent that it becomes soft and flexible. Then using pressure a form (for example a model of the shaping to be produced) is pressed into the plastic sheet until due to heating, the plastic sheet has taken on the external shape of the model. After cooling, the shaping produced has contours of the model and can be processed further.

The second possibility is to press the heated sheet on to the model until the desired shape has been reached.

What method is used depends on the type of forming machine.

A further method for thermoforming of plastic can be a combination of pressure and vacuum. With this method, the model is pressed with pressure into the heated plastic sheet. At the same time, the escaping air which was between the model and the plastic sheet is sucked out. In this way, an exact shape of the plastic component to be produced is achieved.

Some plastics which can be used in thermoforming are, for example PC (polycarbonate), PE (polyethylene), PVC (poly-vinyl-chloride) or also PS (polystyrene) and ABS (acrylonitrile – butadiene – styrene).

Important properties of plastic: the plastic must be able to take on heat properly but must not flow during the thermoforming process. Only in this way can a good and exact shaping be reproduced.

By plastic thermoforming, housings, shells and other shapes can be produced

### **3. Plastic injection moulding**

Injection moulding of plastic is a shaping process which is mainly used for plastics processing. With this method, directly useable formed parts can be economically produced in large numbers.

To achieve this, with an injection moulding machine the plastic being used is plasticised in an injection unit and then injected into an injection moulding tool. The hollow area known as the cavity determines the shape and surface structure of the finished part.

The injection moulding process is (almost only) used to produce in large series. The costs for tooling play a large part in the investment necessary. Because of this, the economic border-line is only achieved after some thousands of parts. For this, the tools can be used for manufacture of up to some millions of parts.

#### 4. A comparison : Injection moulding – Thermoforming

Injection moulding		Thermoforming
Granulate	Input	Semi-finished (sheet, blank)
Thermoplastic, elastomers, Duroplast, GfK, CfK, ceramic		Thermoplastic
	Processing	
Shaping	Process	Shaping
Thermoplastic area Homogenised melted mass	Temperature	Thermo-elastic area Possible field heating
High injection-clamping force	Pressure	Lower pressures
Mainly steel Multi-cavity tools – single tool	Tool	Frequently aluminium alloy Single tool (1 cavity mould)
Injection moulding machine	Machine	Press
Finished part	Output	Semi-finished Further process : trimming