

Thermoforming. Developments continue to be characterized by clever improvements to the details and new process variations. The industry is focusing on exact matching of machine technology, process and material.

New Process Variations Expand Sales Markets

MAREN BEGEMANN

The thermoforming process finds many applications in the packaging sector as well as for technical parts. It is used when thin-gauge or large area parts are to be manufactured quickly and economically from thermoplastic resins. New developments and advances in machine technology, tooling, infrared heaters and materials are presented.

Materials as the Key to Economical Production

The demand for highly automated large machines has grown worldwide in recent years. As a consequence of the increasing price of petroleum, globalization and the concentration of packaging companies in markets, producers of packaging require fully automatic solutions at justifiable prices.

After the focus on increasing machine cycles per minute through machine improvements in recent years, further increases in productivity, process stability and system availability are being achieved through use of intelligent control concepts. With its "Illig IC" (Intelligent Control Concept), Illig Maschinenbau GmbH & Co. KG, Heilbronn, Germany, expects to exploit fully the ca-

pabilities of the 3rd generation of servomotor-powered thermoformers. Use of the ThermoLineControl module permits all machined components to be displayed and programmed centrally at the thermoforming station. Dynamic process optimization responds

cuts (Fig. 1), Illig has developed the Model BF 70 forming/punching machine. It permits thermoforming of cups with pronounced undercuts in their shape, something that required injection molding or blow molding in the past. In contrast to the parts produced by

mark. This cooperation offers manufacturers of molded parts solutions for high-performance, automated parts handling. The problem is that, while thermoforming systems can produce at high speed, there are limits when it comes to subsequent processing of



Fig. 1. Food packaging with pronounced undercuts (photo: Illig)

to changes in the production process or other parameters and adjusts the machine cycles per minute to achieve maximum productivity and quality. A compensation system corrects for the effects of changes in the ambient conditions that occur in the course of production.

To thermoform food packaging with pronounced under-

means of these methods, thermoformed articles offer the same mechanical properties but are up to 40 % lighter; this conserves resources and lowers costs.

In the field of handling systems for strip steel compressed-air forming equipment, Kiefel GmbH, Freilassing, Germany, is cooperating with Kilde A/S, Skive, Den-

the molded parts. For instance, the packaging manufacturers cannot benefit fully from the high machine cycles per minute achieved by a Kiefel KMD Speedformer, since a second machine attendant that may be necessary to accept the parts would ruin the calculation. Solutions for automated handling thus become that much more important in or- →

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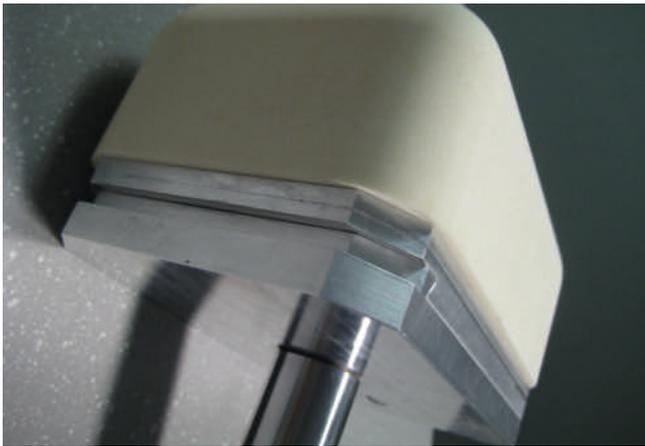


Fig. 2. Quick-mounting system for top plug (photo: Kiefer)



Fig. 3. Thermoforming of corn starch-based film through use of optimized teaching (photo: Heraeus)

der to achieve the best possible productivity during mass production. According to the manufacturer, the 6-axis robot systems from Kilde are matched perfectly to the KMD systems from Kiefer. Additional downstream equipment is also available.

At Gabler Thermoform GmbH & Co. KG, Lübeck, Germany, activities are focused not only on the high end; the product range in the tilting machine segment for small production volumes is being expanded as well. The M60 (with a mold space of 525 × 330 mm²) is a high-speed machine on which pre-stretch speeds greater than 2 m/s are being used for the first time. The machine offers benefits in terms of quality of the thermoformed cups and speed of the process. To improve product quality further, Gabler has also introduced a

variety of monitoring mechanisms. As a consequence of the continuous reduction in part weights, the importance of part handling is growing in importance. Gabler offers various handling devices such as indexing stackers with reliable vacuum part removal or plate

stackers for conveying the parts to hole punching or image monitoring systems.

Geiss AG, Sesslach, Germany, is introducing two new major innovations on its thermoforming systems. The first allows the processor to adjust the switching points for the vacuum pressure from the operator panel by means of the automatic vacuum pump circuit. In addition to saving energy, this extends the service life of the vacuum pumps. By lowering the pump operating time per shift, maintenance requirements are also reduced. The second – twin-sheet thermoformers – permit inserts to be placed between the two sheets of plastic. After the first sheet of plastic has been loaded and clamped, an insert is loaded from the other side and clamped in the twin-sheet frame. Then, the second sheet of plastic is loaded and clamped. Both sheets of plastic, including the insert, are heated and then welded. Special steel pallets with steel inserts are just one example of such an application.

Quick-change Tooling

Thanks to clever concepts, conventional thermoforming molds are being developed further to provide maximum flexibility. With its "Flexline", Kiefer Werkzeugbau GmbH, Schwaigern, Germany, is introducing a basic mold that does

not perform the usual shaping function. With this mold concept, individual mold add-ons can be attached with little effort, lowering investment costs and shortening lead times considerably. This mold concept is complemented by the new ASM 20010 automatic clamping module for shallow molds. This permits quick mold changes. Thanks to a quick-mounting system (OSV), the top plug can be released easily from the side, eliminating the tedious task of removal and installation (Fig. 2).

Bio for Packaging

Advances in thermoforming are also being driven by the development of new materials. For instance, BASF SE, Ludwigshafen, Germany, is actively working on new product grades intended specifically for thermoforming as it expands its product line of biodegradable and bio-based plastics (trade name: ecovio). Target applications include rigid packaging. According to the manufacturer, the new grades differ from conventional film materials not only in their biodegradability: in addition to a certain stiffness, they also exhibit exceptional toughness.

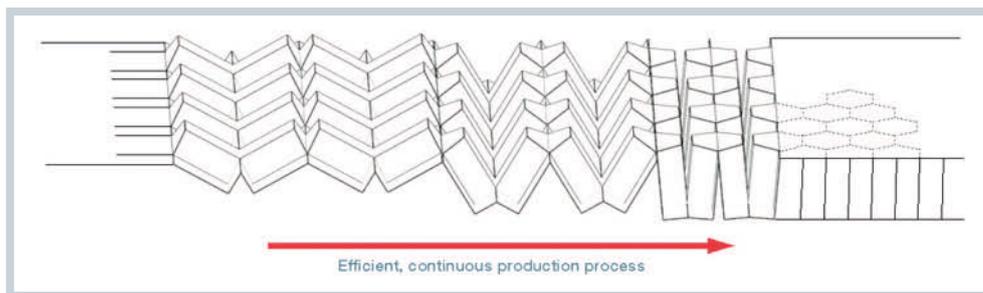
IR Heater Technology

The continuous development of new materials also drives the manufacturers of infrared heaters to adapt their products to the new materials. Plantic Technologies Ltd., Altona, Australia, for instance, has developed a bio-based plastic derived from the vegetable starch extracted from non-GM corn plants. The resultant films can be thermoformed into trays, blisters and cookie packaging (Fig. 3). Together with Heraeus Noblelight GmbH, Kleinostheim, Germany, Plantic Technologies has tested various approaches to optimize the heating process. By using short-wavelength IR heaters, it is possible to reach the forming



Fig. 4. Testing arrangement for determining the best wavelength for infrared heating (photo: Friedr. Freck)

Fig. 5. ThermHex honeycomb core production process (photo: ThermHex)



temperature in about 2 seconds, minimizing water loss from the material and improving product quality.

Friedr. Freck GmbH, Menden, Germany, supplies all of the IR heater types needed for thermoforming. To identify the right heater for the particular material, a test of the material's response is available (Fig. 4).

With its "Supermini" infrared heater, Krelus AG, Oberentfelden, Switzerland, is entering the heater market for classic thermoforming applications. Until now, these heaters were used only for thermoforming of large parts, e.g. in the automotive sector. The new models, with dimensions of 123×123 mm² and 248×61 mm², close this gap. Their energy-saving construction and fast response times make these metal-strip heaters an interesting alternative to conventional products.

Ideas for Lightweight Design

ThermHex Waben GmbH, Halle (Saale), Germany, offers

in-line production of honeycomb material made from thermoplastic film or produced by direct extrusion. The honeycomb core is created from a single web of material in a thermal forming and

find use for a variety of applications in the automotive, furniture, construction and packaging industries.

At the Shell Eco-marathon 2012, the Burg Giebichenstein Kunsthochschule Halle, Halle

from renewable resources. A ThermHex sandwich panel was manufactured from lignin for the envelope of the concept vehicle. In nature, lignin gives plants their woody structure, is a byproduct of paper production and has processing characteristics similar to those of polypropylene.

Conclusions and Outlook

Thanks to new processing variants, thermoforming is finding increasing application for products that could not be manufactured by means of classic thermoforming previously. Through innovation and targeted developments, it will be possible to develop additional markets with new products and strengthen the sector. In the same way, detail improvements are increasing the efficiency of conventional production processes. ■

THE AUTHORESS

DIPL.-ING. MAREN BEGEMANN, born in 1983, conducts research in the field of thermoforming.



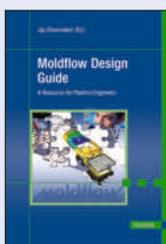
Fig. 6. Vehicle envelope made from lignin-containing ThermHex sandwich panels (photo: Burg Giebichenstein Kunsthochschule Halle)

folding process (Fig. 5). All thermoformable polymers can be converted into such honeycomb cores. The honeycomb cores can be combined with a variety of skin/cladding materials and

(Saale), received the Design Award for its entry in the "Urban Concept" category (Fig. 6). The objective was to develop a single-seat vehicle with an unusual steering system and shape that was manufactured

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