



Engel

Processing rPET by Thin-Wall Injection Molding



Fig. 1. The thin-walled containers are injection molded from rPET. © Engel

At K 2022, Engel, with its partners Alpa Group, Brink and IPB Printing, is presenting a quantum leap for the packaging industry. Thin-wall containers can for the first time be produced from PET directly by injection molding in only one process step. At its booth, the Austrian machine manufacturer is processing a recycled material (rPET). With a wall thickness of 0.32 mm, the transparent 125 ml round containers (**Fig. 1**) are representative of many packagings, in particular in the food sector. Thanks to integrated in-mold labeling (IML), the containers leave the production cell ready for filling. Until now, it has only been possible to process PET by injection molding into thick-walled parts such as bottle preforms. The ultimate packaging form was obtained in a second process step – for example, blow molding.

By 2025, according to the European Plastics Pact, all plastic packaging should contain 30 % recycled material and be 100 % recyclable. Experts think that these aims will not be achievable with polyolefins or polystyrene. In addition, there are no positive evaluations by the European Food Safety Authority EFSA for recyclate streams yet. rPET

offers a way of avoiding fines and special taxes here. Despite the currently high price of PET, this material will thus become an economical alternative. PET has so far been the only plastic that, as a recycled material, can be processed back into food packaging in a closed loop on an industrial scale. This would significantly expand the range of applications of PET and rPET. Beyond the bottle-to-bottle cycle, it is now conceivable to establish bottle-to-cup or even cup-to-bottle recycling.

The centerpiece of the production cell is an Engel e-speed 280/50 injection molding machine with electrical clamping and hydraulic injection unit. The new high-performance injection unit reaches injection speeds of up to 1400 mm/s at maximum injection pressures of up to 2600 bar for processing small shot weights with high wall thickness/flow path ratios. For processing rPET, Engel combines the new injection unit with an in-house developed plasticizing unit targeted specifically at recyclate processing. The new e-speed permits the processing of any recyclate proportions up to 100 % rPET.

At K, the partner companies present a mold that can process different labels simultaneously. They are thus picking up on the globally different trends in in-mold labeling. For the US market, the inks on labels can be washed off, since for this market the label and application are to be sent for recycling. For Europe, a different technology is presented: a label that floats during recycling so that the inks can be easily separated from the PET along with the label.

High Recycling Quality Directly from Flakes

Engel's new process allows it to process plastic wastes on the injection molding machine immediately

after they are granulated as flakes. In a two-stage process, plasticizing and injection are subdivided into two mutually independent process steps. In the first step, the raw material is melted. The melt is transferred to a second screw to inject it

into the cavity. Between the plasticizing and injection unit, a melt filter and a degassing unit are integrated into the process – this allows high-quality products to be produced even from contaminated plastic wastes.

The collected recyclable materials, after sorting and cleaning, are shredded, compounded, filtered and pelletized and transferred to injection molding as regrind. The pelletization of the regrind is an energy-intensive process, which also generally requires logistical outlay. In the two-stage process, this step is completely eliminated. According to Engel's calculations, this reduces the energy demand for manufacturing the trade show product by about 30 %.

A focus of the new process is on large-volume molded parts, which are already widely manufactured from recycled materials such as pallets, transport boxes and refuse containers. The integrated degassing increases the range of used to applications in the packaging and automotive industries. During K, Engel will demonstrate the two-stage process at the VDMA Circular Economy Forum (open air). An Engel duo 12060H/80Z/900 injection molding machine (**Fig. 2**) will process a mixture of polyolefins from a post-industrial collection into dolly pallets (**Fig. 3**).

The systems are based on conventional injection molding machines. This, too, helps to reduce recycling costs and speed up the establishment of a circular economy. The Engel developers paid special attention to the degassing unit. Residual moisture as well as volatile substances from material degradation or printing ink residues can pass through the melt filter. If these compounds are not removed before injection of the melt, they can lead to pores in the interior and defects on the surface of the part. Another special feature of the Engel solution is that the first plasticizing unit has the task of buffering raw material. In this way, a continuous process is achieved, which permits the use of smaller screws and therefore further cost savings.

The project partners are AVK Plastics as pallet manufacturer, IPP, a specialist in logistics solutions for delivery chains, the mold manufacturer Haidlmair and Ettlinger as supplier of the melt filter. Another partner is R-Cycle. The pallets are provided with an RFID chip and a QR code, which is applied by IML. The QR



Fig. 2. Based on a conventional Engel duo injection molding machine, the systems for processing plastic flakes are modular in design with a high-performance melt filter and a degassing unit as required. © Engel



Fig. 3. The flakes are used to produce roller logistics load carriers, so-called dolly pallets.

© Engel

code can be used by trade show visitors to call up information about the material and recycling process live from R-Cycle's database.

More Economy in the Production of Large Containers

Together with its development partner Haidlmair, Engel has also succeeded in reducing the cycle time for the manufac-

ture of large logistics products by 30 %. This leap in performance is the result of the Engel duo speed large machine in combination with innovative mold technology.

The centerpiece of the production cell, in which HDPE multi-use containers weighing 2000 g are produced, is a duo 8310/700 speed injection molding machine. The series, equipped with the servo-hydraulic ecodrive and a newly developed high-speed injection unit, according to Engel, combines high productivity and efficiency with a particularly small footprint in the field of large clamping forces. The twin-platen machines form are Engel thus advancing into regions that for a long time were the reserve of toggle machines.

The high-performance mold is equipped with a type FDU Midi SLS 6-cavity hot runner system of the

Haidlmair subsidiary FDU Hotrunner. The slit die can deliver large shot volumes into the cavity faster than conventional needle valve systems without a high frictional energy. In addition, hybrid inserts provide efficient cooling and very good thermal equilibrium. Multiple sensors in the mold interior – including for cavity pressure measurement, analysis of the material flow and determination of the crystallization effect – contribute to high process stability.

Kunststoffe international already reported on the growth of the iQ product family in the August edition. The new setpoint assistant iQ hold control saves a lot of time by automatically determining the optimum holding pressure time.

➤ **Hall 15, booth C58**

Netstal

Fast, Precise and Networked

At the Netstal booth, the attention of visitors will be drawn by two powerful production systems. "Processors face tough competition from the challenge to increase their productivity and minimize costs per manufactured part. Short cycle times, maximum precision and high reliability of the machines are the principal levers. But the efficient use of resources is also relevant, for example minimized energy consumption or lower wall thicknesses," says Renzo Davatz, CEO of Netstal and member of the executive committee of Krauss-Maffei. The appropriate solutions are at hand.

An Elion 1200 all-electric machine will produce pipette tips in 64 cavities. The system solution includes a precision mold from Otto Männer and a high-speed handling system from MA micro automation. It processes an electrically conductive compound from Pre-mix, specially developed for manufacturing pipette tips for in vitro diagnostics. The pace is set by the energy-saving injection molding machine equipped for medical production, which achieves a cycle time of about 5.3 s, which is particularly fast for this application. The machine is equipped with the "Smart Operation" 4-key control unit (Fig.). This option allows users to achieve additional productivity increases by automation, standardization and shortening of recurring process steps in shift operation. For customers from medical technology, the regular calibration of the injection molding machines acc. to ISO 17025 is also interesting – Netstal has been an accredited calibration lab since the end of 2021.

The enhanced Elios 4500 is celebrating its trade show premiere. By conversion to an all-electric positive connection, the dry cycle could be accelerated by 0.1 s. Users not only benefit from increased productivity, but also from the optimized energy efficiency: with respect to the dry cycle, the average power consumption falls by 7 kW. Another bonus is provided by the 450 mm shorter machine length. The machine will manufacture thin-walled 150 ml yogurt

cups by in-mold labeling (IML) from a certified renewable PP from Sabic. The material is based on tall oil, a waste product of paper manufacturing. One cup weighs only 6.5 g. The 12-cavity mold, like the handling system, is from IML Solutions. The cycle time is about 5 s. The in-mold labels from Verstraete are provided with digital watermarks of the HolyGrail 2.0 initiative. Codes invisible to the human eye are printed on the entire surface of the label. The machine-readable codes contain information about the contents, packaging material and origin and thus permit homogeneous separation of different types of plastic.

As a member of the OPC Foundation, Netstal is advancing the development of the OPC UA interface standards for plastic machinery. At the tradeshow booth, Netstal will present the complete ancillary integration of a manufacturing execution system from bfa solutions, temperature-control equipment from HB-Therm and Gammaflux hot runner control equipment. In addition, Netstal participates in the OPC US showcase from VDMA. All the Netstal machines exhibited at K, including those at partner booths, are integrated in the umati demonstrator. The show visitors can scan the QR codes applied to the machines with their smartphones and thus obtain information about machine, status, the current job as well as process values in real time in the umati app.

➤ **Hall 15, booth D24**



aXos control unit with "Smart Operation:" the guided machine operation enables users to achieve additional productivity increases. © Netstal