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Engel: New machinery and processes

Among the 11 injection moulding machines on display on the Engel stand at the K 2010 fair in Düsseldorf, Germany, aside from another nine machines running on other stands, there will be the first model on the Engel stand of a completely new range of e-cap machines, dedicated to and optimised for moulding of caps and closures, a worldwide market sector said by Engel to amount to 3 billion closures per year.

With its launch at K 2010, Engel's new e-cap caps and closures injection moulding machine will mould caps in 2.6 s cycle time in a 96-cavity mould

According to Engel's Vice President R&D Dr Georg Steinbichler, the e-cap machine is the first all-electric injection moulding machine that has been designed specifically for production of caps and closures. Steinbichler claims "no other machine in the market can produce caps and closures as economically as the e-cap".

Although a 380 t e-cap machine has been produced and a 280 t machine is planned, it is a 420 t e-cap that will be seen running at the K 2010 fair, producing 26 mm diameter x-light HDPE closures in a typical 96-cavity **Schöttli** closure mould with 2.6 s cycle time and with integration of a **Qvision** quality control system.

The e-cap has a new injection unit incorporating a high throughput plasticising unit and an improved high force ejector system. Steinbichler says that the low energy consumption makes an important contribution to cost saving, since energy amounts to the largest second share of plastic closure production cost at 7.1 %, after raw material at 67.5 %.

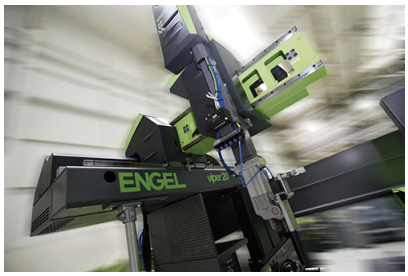
Micromoulding

A new injection unit has also been developed for optimised moulding of micro-dimensioned parts on standard Engel low tonnage injection moulding machines equipped with a 15 mm diameter screw. This arrangement enables use of standard-sized granulate to produce parts down to a weight of 0.1 g, based on shot weight of 1 g and use of multi-cavity cold runner moulds. As with micromoulding solutions from competing machinery producers, the FIFO (First-In-First-Out) process ensures low residence time and thereby minimum melt degradation.

Productive solutions

Main application development and productivity themes at Engel are focussed on optical systems, single stage processes for complex and multi-component parts, lightweight design with fibre-reinforced thermoplastics and various means of saving energy.

Optical applications range from flat panels for computer screens, through thick-walled moulded lenses using multi-layer injection moulding with Engel **combimelt** 2-K machines with one material applied in two stages in order to cut cycle time, to use of **e-victory** and **e-motion** machines for injection-compression moulding as a means of obtaining optical parts with low internal stress for optimum optical properties. At K 2010, for example, an **e-victory 200/50** will mould thick-walled architectural illumination light emitting diode (LED) lenses in PMMA with parts handling by an Engel **viper 6** robot, followed by optical quality control.



This viper 20 robot joined the first new viper 40 in March and a new viper 6 model will be among the viper models on display and in action on the Engel stand at K 2010

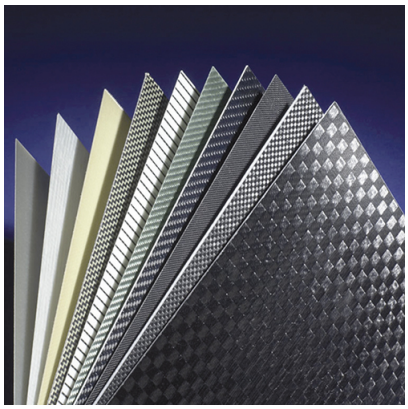
The viper linear robot series are characterised by higher maximum speed and acceleration than the established ERC range, integrated vibration control. Optimised acceleration and speed and ability for the operator to set speed to the level that is really needed at the press of a button contributes to long lifetime, with de-moulding taking place "just in time".

Engel's first viper robot was the mid-sized **viper 40** version, introduced in the market in October 2009 and followed by the **viper 20** in March 2010 and the **viper 60** in mid 2010. The range therefore expands at K 2010 with the small-sized viper 6. Steinbichler says of the viper series that vibration control results not only in improved position control and repeatability, but also shortening of mould opening and cycle times. Aside from the moulding demonstrations, the viper robots will also be on display at K 2010 in their own special exhibition.

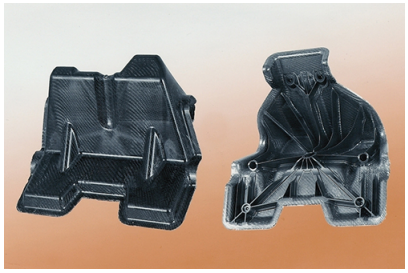
Single stage processes promoted by Engel include use of its **clearmelt** machines for moulding film backmoulded thermoplastic mouldings with overmoulding in the same mould of a scratch resistant transparent polyurethane (PU) coating provided within a production cell equipped with **Hennecke** PU equipment. This technique was first shown at Engel's 2009 symposium and is used not only as a means of surface decoration, but also for functional applications when using, e. g. flexible circuitry films to provide for sensor functions. An **e-motion 280 T** will demonstrate this type of process at K 2010 with production of a wood effect surface, using a viper 40 robot and with the application and mould having been developed by **Schöfer.**

Yet another single stage process will be demonstrated at K 2010 in the form of the Multitube in-mould assembly (IMA) system developed by French mouldmaker **Georges Pernoud,** in which a two-component part will be overmoulded with a threaded bushing by a two-component tiebarless Engel **victory 1050H/500W/220 combi** via a secondary injection unit mounted piggy-back on the machine and with a six-axis part handling robot. The **Multitube** technique eliminates conventional use of post-moulding bonding and Engel also points to the advantage of this technique in obtaining smoother interior surface of media ducts than is possible with conventional use of gas assist injection moulding.

Lightweight design with fibre-reinforced plastics will be represented on the Engel K 2010 stand by use of a **duo pico** ("powerful inside compact outside") **2050/500** machine and three robots to produce an automotive steering column part reinforced with organic sheet plastic (so-called "Organoblech") instead of sheet steel.



To be demonstrated at K 2010 by Engel, overmoulding of long fibre-reinforced organic sheets (left) with short fibre-reinforced PA to form a selectively reinforced steering column part (right, front and rear views) in the IMF process.



This IMF In-Mould-Forming technique has been developed by the **LKT** plastics processing chair at Erlangen-Nuremberg university, with the steering wheel part receiving an **AVK** federation of reinforced plastics innovation award in 2007 for the university and its partners mouldmaker **Siebenwurst** and automotive system supplier **DST Dräxlmaier,** who are also the partners for Engel's demonstration.

The part was awarded in 2007 on the basis of use of compression forming of a preform made in **Bond Laminate's Tepex** long glass/polypropylene filament sheet that was placed in a mould for overmoulding by **Sabic's Stamax** 30 % short glass fibre-reinforced polypropylene (PP). Although either polyamide (PA) or PP has been used to produce such parts, Engel has chosen to use PA for its K 2010 demonstration.

So-called "FIT hybrid" fluid injection technique structures are another form of lightweight design favoured by Engel and involves in one version heating and compression moulding of organic long fibre-reinforced sheets, pre-moulding with coining and finally reshaping and moulding of a tubular reinforcement structure via fluid assist structural foam injection moulding. Researchers at LKT received a Brose 2009 processing award within the 2009 WAK scientific circle for plastics technology award scheme for the FIT hybrid technique.

The other so-called "pull-and-foam" version to produce such parts, also favoured by Engel, involves injection moulding of a melt containing gas and selective opening of the mould cavity to create the hollow tubular foamed core reinforcing structure. The process has been developed at Paderborn University and has also been the subject of recent studies at the **IWS** materials institute at Kassel University.

Energy efficiency

Aside from cost effective solutions through these advanced processes, Engel is adopting measures on its moulding machines to improve energy efficiency beyond the level already achieved through electric drives. Here Steinbichler says that although induction heating enables faster heating, as the company had established already 25 years ago, it offers no additional saving beyond the 20 – 30 % saving level achieved through barrel insulation with thermoplastics moulding. But Steinbichler admitted that this approach has not yet been evaluated by Engel in elastomer or thermosetting plastics processing.

An **e-insert** electric drive version of the Engel insert machinery makes use of a servoelectric rotary table and an all-electric injection unit, with the new **ecodrive** servohydraulic clamping and ejection functions making an additional contribution to energy saving. An **e-insert 310V/100** machine, equipped with a viper 20 robot, will produce a glass fibre-reinforced PA sensor housing at K 2010 with precise overmoulding of metal inserts in a four-cavity mould, the accuracy and speed of the rotary table movement ensuring fast cycle time and high energy saving.

A new water flow regulator designed with new compact sensors is now available from Engel as a means of measuring and setting

flow rates so precisely that the temperature can be kept down to 20 °C and quality improved. The equipment saves energy through reduction of the amount of water and optimisation of water temperature differences and will be shown at K 2010 for the first time.

A new piece of equipment from Engel to be seen in action at K 2010, the roto feeder rotary conveyor ensures maximum process stability by feeding material continuously to the plasticising cylinder.

Another piece of new Engel equipment at K 2010 will be a rotary conveyor that ensures maximum process stability by feeding material continuously to the plasticising cylinder with benefits claimed of avoidance of inclusions and maintenance of constant pressure. The new **roto feeder** will be mounted on a **victory 330/90 tech** that will mould solid silicone into 6 mm diameter gaskets in a 64-cavity mould. Although not foreseen for Engel's own K 2010 stand demonstrations, the company is involved in post-moulding robotically applied Formed-In-Place Foam Gasket (FIPFG) with **Ceracon** for single-component PU versions and **Sonderhoff** for two-component PU seals as an alternative to multi-component moulding.

Packaging

Aside from the e-cap machine, packaging will be represented at K 2010 by an **e-motion 740H/440M/280 WP** moulding a tube with a PP cap in a four-cavity mould using a rotary "cube" mould and a second moving unit on the moving mould fixing platen and including in-mould labelling.

Medical

And finally, medical cleanroom moulding with laminar airflow will also be demonstrated with an Engel **victory 330H/120 combi,** producing a two-component valve in an 8+8-cavity mould and with part removal by a six-axis **Stäubli** robot that uses a camera to inspect parts before placing them down sorted by cavity. The other medial application will involve an **e-motion 1340/280 T** producing polystyrene Petri dishes in an 8+8-cavity **Plastisud** mould with a cycle time below 4.5 s and **Hekuma** automation that handles the parts, corona treatment in the gripper, stacking and foil wrapping.

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