Mould Design and Manufacture: REVIEW

Better Undercut Release for Luer Fittings

Al Hickok from Roehr Tool Corporation and Glenn Starkey of Progressive Components have produced a case study which examines the benefits of expandable cavities for moulding luer fittings. Roehr Tool and Progressive Components are sister companies which engineer and distribte mould components around the world.

The writers argue that by using expandable cavities, mould builders can enjoy—fewer moving parts, reduced design time, having cooling lines concentric with the part, using a smaller mould base, and grease-free operations. Extracts of the case study are as follows.

A typical luer fitting is used by the medical industry to make secure, leak-proof connections with tubing in medical devices. Many of these fittings have external undercuts, which makes the mould more costly and complicated and increases the risk for quality defects in production. More cost effective and simpler solutions are always of interest when working with medical OEMs.

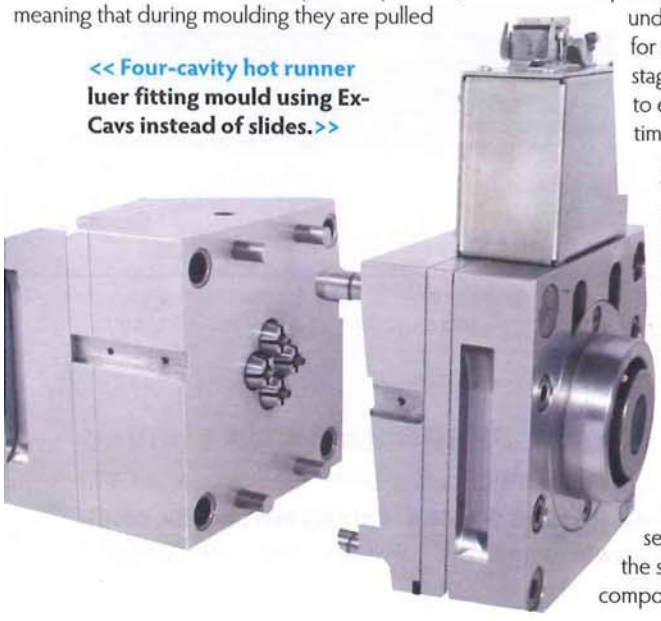
Small undercut details have traditionally been formed from large side actions on two to four faces of the part, resulting in the need to build a much larger size mould than if the undercuts were not present. In addition, side actions carry with them costs for construction, and they introduce their own risks and considerations for maintenance over the life of the tooling programme.

However, practices are evolving and tooling engineers now recognise the advantages of utilising a single, expanding cavity component as an alternative to the usual "slide mould" designs.

Often referred to as "ex-cavs", expandable cavities are constructed in an expanded position, meaning that during moulding they are pulled back against a striker ring and collapsed inward. For ejection, the component is staged forward, which allows the segments of the Ex-Cav to expand outward. This releases the undercut and the part is then ready for ejection. They are commonly staged forward during mould open to enable the fastest possible cycle time.

<< Expandable cavities allow for very tight cavity spacing compared to slides, allowing for more cavities per mould or a smaller mould and press. >>

<< Four-cavity hot runner luer fitting mould using Ex-Cavs instead of slides.>>



One mould builder in New York recommended the use of Ex-Cavs for a project and then verified the simplicity and cost savings, saying: "It was much simpler to machine features into the mould core insert and the pin plates to accommodate the expandable cavities versus having to spend significantly more time and costs doing all the tool work required for slide sets. We were able to eliminate the slides and also the related components."

Expandable cavities have been proven to improve cycle times, as a Massachusetts-based mould builder related that fewer moving parts added up to more efficient cooling and therefore lower cycle times and more manufactured parts. Easier maintenance was also reported to be a benefit of a simplified tool design.

Moulding Cycle Monitor in New Languages, Alignment Lock Tested to 2 mn Cycles

AST Technology, another sister company, is promoting that its cycle monitor system, CVe, is available in six new languages— French, Italian, Japanese, Korean, Portuguese and Thai. The new languages complement the existing range of English, German, Mandarin and Spanish. The product helps to produce comprehensive mould performance reports by monitoring and collecting information like cycle counts and maintenance actions.

Progressive Components has reported that its new Z series of alignment locks have been independently tested to show no wear after 2 mn cycles. They are now Progressive's standard alignment locks.

New Release of Moldex3D Predicts Effectiveness of Core Shift in Multi-Component Insert Moulding Processes

Simpatec, a European distributor of injection moulding simulation software Moldex3D, has written about how the software can help product designers and mould builders with insert moulded multi-component metal and plastic parts.

During insert moulding, it is often difficult for engineers to observe the deformation of part inserts without any analytical tools. Moldex3D advanced forecast techniques are said to find out the stress and displacement distributions of part inserts in the filling process through coupling calculation of the insert parts and melt flow. Furthermore, designs can be optimised via visualising the part inserts displacement results.

The new release R12 Moldex3D Advanced reportedly provides a two-way FSI (fluid-structure coupling) algorithm technical application. The feature simulates entire dynamic flow interactions with core deflection and mesh deformation. It examines the change of core under the influence of fluid to optimise injection pressure. The behaviour of the products and part inserts are displayed synchronised with the melting flow. The result is able to accurately show the part insert deformation in every filling percentage of the cavity. Furthermore, a number of features support the part designer to avoid core deformation. These include the prediction of thermal degradation caused by hot melt flow reheating, temperature variation of the part insert during the moulding process, and results like the flow pressure, stress distribution and displacement around the part insert or the final part shape.

"Moldex3D provides the latest multi-component and insert injection moulding prediction technologies," stated Cristoph Hinse, managing director of SimpaTec, Moldex's exclusive reseller in German-speaking countries. "A part designer can predict the effectiveness of the core shift by fluid-structure coupling analysis. This method assists them to control product quality more precisely and to predict potential moulding problems before mould manufacturing.

Twin Shot Tamper Evident Luer Lock Closure

German mould maker Braunform has written about a recent project to build a mould for the manufacture of two-component, or twin-shot, tamper evident luer lock closures (TELC) for German pharmaceutical packaging company Gerresheimer Bünde, formerly Bünder Glas. The mould is for use in a class 5 cleanroom, among the most stringent used in the medical plastics industry.

A technical innovation of the mould, according to the press release, is "the nozzle side, low particle unscrewing of the luer lock adapter, as well as low-particle shearing off of the sprue after the injection process".

The release goes on to say: "very skinny, freestanding cores go into action due to the filigree contour for the originality tabs, which display the first-time opening of the closure". It adds: "There's also implemented a special needle seal hot runner system for the cap, which is operated by an inclined ramp.

Other technical challenges are the cap's thick walls, which must be openable with a defined torque, as well as the clean contour separation of the two components.

The mould manages a large temperature gradient with polycarbonate at a mould temperature of about 100°C and a TPE at 40°C (see image overleaf).

Besides the temperature difference and the high pressure, the challenge lies in processing in the hard/soft combination, which does not chemically bond to itself and furthermore is sterilisable. To avoid burning and black spots in the polycarbonate components, the manufacturer's instructions must be strictly followed.

Due to the critical material selection, the TELC is injected in an own production cell and

each cavity is intercepted individually by a Braunform patented handling system. Afterwards, customer-specific rubber seals are inserted during the assembly process.

Toolcraft Installs €1.5 mn Automated Machining Centre

At the start of 2013 the tool making division at German specialist moulder of small plastic parts, including ones for the medical sector, Toolcraft put a new automated machining centre into operation. The centre features automated management of all tool parts and electrodes in a UPC pallet system based on Certa automation software.

The fully air conditioned centre is equipped with the following machinery: an Exeron HSC 600 5-axis milling machine with Awex 50/5 alternator, an Exeron HSC 300 3-axis milling machine with Awex 50/5 alternator and an Exeron EDM 313 electric discharge machine with Awex 50/5 alternator, two Exeron EDM 312 electric discharge machines with Erowa ERM robots and an Exeron EDM 310 electric discharge machine.

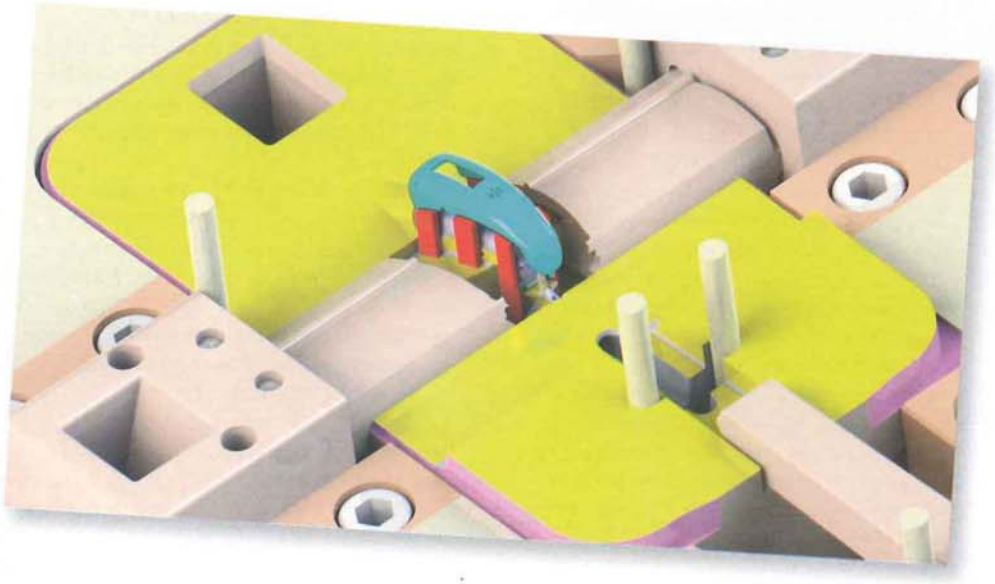
Two Zeiss Contura 3D coordinate measuring machines are also used in the measuring department, which obtain measured data directly from the design department. Pallet cleaning is carried out by an Erowa robot system.

With the new centre, Toolcraft can produce moulds around the clock when needed, with high throughput and fast delivery times. The new system means that not only can a timely flow of parts be achieved, but tool design can also be included in production: tool designers can send measuring points and tolerances directly to the Zeiss measuring equipment. Linking design and production results in continuous quality monitoring. A high technical level with high flow rates and a significant reduction of manual work is achieved with this kind of industrialised tool making.

<< This Braunform two component (twin shot) mould manages a temperature gradient between a polycarbonate shot of 100°C and that of a TPE at 40°C. >>

The mould making and injection moulding division at Toolcraft has its roots in model railway making. At the time, miniatures in this field already set high standards in attention to detail and manufacturing knowledge. After this industry 'migrated' out of Germany, Toolcraft turned to hearing aid manufacturers to supply them with complete assemblies. All major manufacturers in Europe, America and Asia are now customers. Standards in this sector are very high, says Klaus Dörr: "The tiny components make very high demands on tool making, but also on production and assembly. The required clearances and accuracy of fit of the parts are at a level which is much easier to achieve in other industries." Small parts for hearing aids range from a 0.01-5 g charge weight. In order to be able to offer complete solutions as part of their precision strategy, Toolcraft has a small parts department with 20 injection moulding machines and 30 staff in addition to their mould making department with a total of 18 machines and 70 staff. Furthermore, machines for running-in and series start are available separately.

Hearing aid requirements are many and varied: in addition to the high precision required for these miniatures, accuracy of fit is also highly prized. Customers require small clearances from, 10-20 µm, a value which is nowhere near as low in many other industries. In terms of injection technology, warping is a particular issue. In order to keep this as low as possible, Toolcraft relies on conformal cooling in tools: on this front, conformal cooling provides 'easing' at relevant points on the tool. "A very effective method", says Klaus Dörr, "in which the strengths of classic tool making production and the generative production of laser melting with metals provide combined solutions, making for impressive production technology. It's also clear that parts like these demand precision rather than the lowest possible cycle speeds."



<< CAD image of a hearing aid injection mould from Toolcraft. >>