Tilting Technique Improves Centering and Other Features

Ring-shaped Dies. A special rubber gasket is now available to seal the parting line between head and die. First pilot projects have shown several promising benefits. The technique is suited for pipe extrusion, film blow molding and extrusion blow molding.

HEINZ GROSS

A patent [1] was recently granted for the tilting technique, originally designed for the sole purpose of improving the sealing and centering of ring-shaped dies. The method achieves this aim by applying simple elastic tilt joints between head and die. A number of pilot projects were carried out, showing that the parting line can be sealed reliably, while at the same time, improving the well-aimed and precise centering of the ring-shaped dies. What is more, the technique includes further benefits that are interesting in terms of economy. They mainly help reduce the expenses entailed in the application of ring-shaped dies to a significant extent.

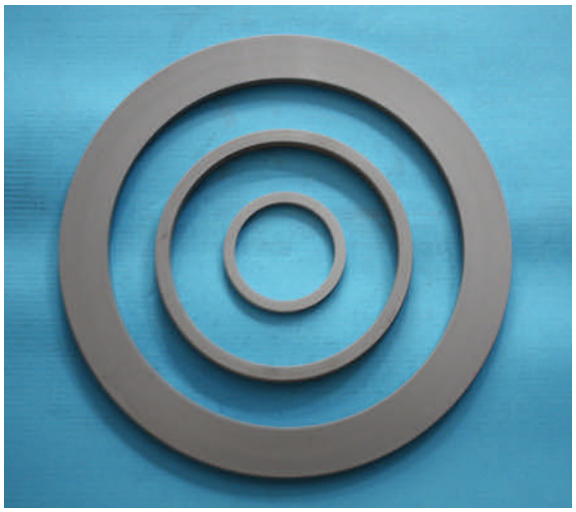

Fig. 1. Three examples of elastic tilt joints inserted into heads of different dimensions (photos: Gross Kunststoff-Verfahrenstechnik)

A Wide Variety of Applications

Ring-shaped die heads serve for the extrusion of various types of semi-finished products such as pipes, foamed films or sheets, blown films or cables. And in the extrusion of hollow bodies by blow molding, annular extrusion heads are employed, too. While these techniques are indeed very different from each other, there is one thing they all have in common, and that is the fact that the die has to be re-centered on the die head each time after cleaning. This poses requirements that apply to all processes in the same way. Other requirements differ from process to process, while some are only valid for certain techniques. Retrofitting a ring-shaped head with an elastic tilt joint **(Fig 1)** will pay off extremely fast, if dies need to be cleaned frequently, or if dimensions have to be changed at short intervals. It is, however, worthwhile considering whether to equip ring-shaped heads with a tilt joint, when processing expensive raw materials, or where narrow thickness tolerances must be adhered to.

At present, it is mainly producers of pipes for the automotive industry who have spontaneously declared their willingness to retrofit their extrusion heads with an elastic tilt joint. The benefit included in customers obtaining pipes of higher qualities, thanks to better adherence to narrow thickness tolerances, can hardly be put into concrete numbers. However, the benefit for the producer, in terms of reduction in material consumption, can easily be determined. While the costs for retrofitting are not too high, the low pipe weights achievable per length unit alone lead to interesting payback periods, in many cases. When employing a tilt joint, cost saving in dimensional changes exceeds the costs saved as a result of reduced thickness tolerances, though. →

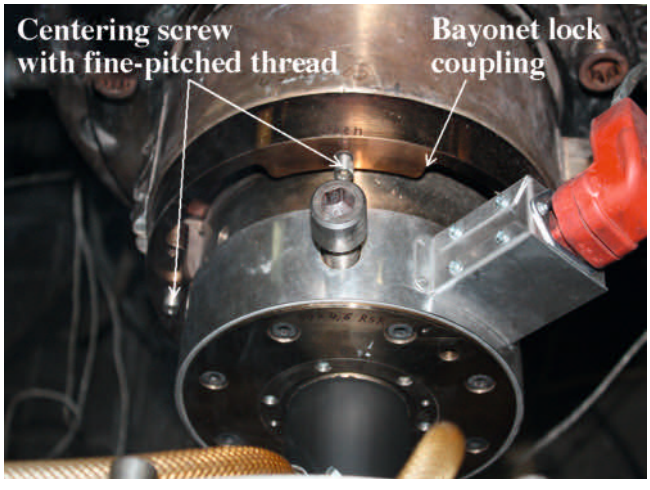

Fig. 2. Tilting die with bayonet lock coupling, with a narrow centering fit between head and die, and with fine-pitched thread screws (M6x0.5) designed for fine optimization of the relative position of die and mandrel

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Functionality in Pipe, Tube and Capillary Production

In order to seal the parting line reliably, the tilting joint must only be compressed by a precisely defined measure. An ideal way of doing this is by using a simple bayonet lock coupling. **Figure 2** represents a pipe head with an elastic tilt joint and a bayonet lock coupling, thus featuring no conventional centering screws. The bayonet lock coupling reliably generates the forces required for fixing the die. This way, the operator can easily flange or remove the die by a spinning motion. The geometry of the bayonet lock coupling automatically makes sure the elastic tilting joint is compressed just as far as is required to seal the parting line between head and die. This also prevents the gasket from being compressed too hard or too little. Additionally, no greasing of flange screws is required and the danger of screw tearing as a result of thread seizing is eliminated. **Figure 3** shows the bayonet lock coupling of a small head designed as a tilting die right from the start. This head served to produce capillaries from PLA for medical applications, at a mere 0.2 mm diameter. Optimizing the relative position of die and mandrel by means of conventional radial centering screws would certainly be impossible to achieve, considering the wall thickness below 0.1 mm.

What is more, it is not necessary any more to pre-center the die in a time-consuming process, after fixing it. Tilting dies have narrow fits between head and die, thus merely allowing for the dies to be fixed to the head center. The great benefit here is the fact that the die exactly sits in the same central position each time the process starts, which used to be different with the conventional techniques. The die used to take on a new position then, each time the process was started, and this was mainly determined by the patience and skill of the respective operator. Until today, there have been limitations to the application of the tilting technique with temperatures up to 300 °C, and with abrasive fillers. Extensions are currently being investigated, though, aimed at eliminating these restrictions too. Starting from the good results obtained up to now, one may assume that any thermoplastic and any extrudable thermoplastic compound available at the market will allow for processing with a tilting die in the future.

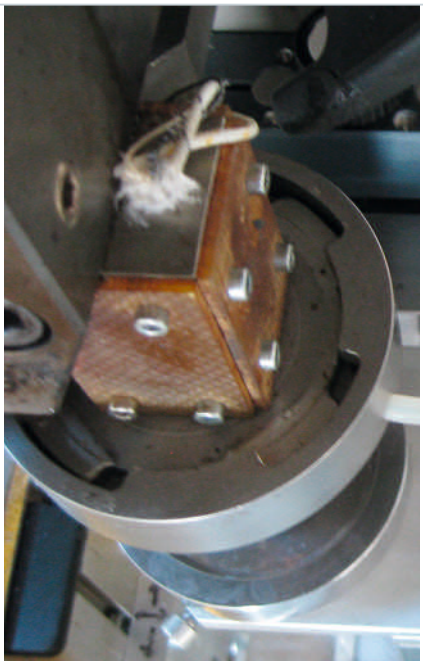

Fig. 3. Bayonet lock coupling of a capillary die with tilting technique

For the individual process, optimization of the relative position of die and mandrel can most easily be done by special centering screws, as can be seen in **Figure 2**. While compressing the elastic joint takes only little power, small screws with little thread pitches can be used for tilting the die. In case extraordinarily fine tuning is required, the operator may employ special screws with fine-pitched threads.

If desired, the user may of course make tuning even more precise by applying special adjusting units to further gear down the travel of the adjusting screw. To see an example of this, refer to **Figure 4**, which shows a head for a PE pressure pipe. As can be seen in the picture, it is generally sufficient to apply two such adjusting systems positioned at a 90° angle to one another. Within the maximum adjustment range, any desired position can thus be set relative to the mandrel.

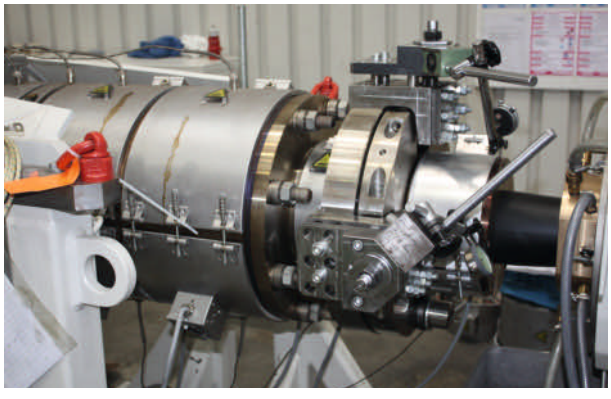

Fig. 4. Pipe head with a retrofitted tilting die. For tilting it has only two adjusting units sitting at a 90° angle to one another. Though operated via large adjusting screws, the screws' adjustment travel is very finely tuned, thanks to downstream mechanical gear reduction

Motor-driven Centering of Ring-shaped Dies

In the long run, however, it is recommended to use inexpensive stepper motors, because once an optimum processing position is found, this position can be stored in the machine control unit, and can always be reproduced exactly at start-up, for the same pipe geometry. A motor drive for the tilting die can even allow for eccentric differences in thicknesses to be minimized during extrusion by means of a control unit. **Figure 5** shows a flexring pipe die head designed for the production of core-foamed PVC pipes. It is equipped with two large stepper motors for tilting the die, as well as another twelve small stepper motors to locally adjust the flow channel gap at the circumference of the flexring bushing. This die was made in order to control the wall thicknesses of extruded pipes via the circumference, which has long been state of the art in the area of blown film extrusion. The operator must, however, center the die manually here, unless the blow head features an elastic tilt joint.

Tilting Die Technique for Extrusion Blow Molding

Integrating elastic tilt joints into blow molding heads will open up entirely new ways of processing. When retrofitting a blow molding head, two low-cost stepper motors, which sit in a 90° angle, can be employed to tilt the die. This way, the die can easily and dynamically be tilted into various positions, during discharge. Consequently, the die can be centered from the control panel at close to any desired fineness and precision, and the process parameters can even be stored at the end of the production cycle. The tilting technique thus represents the first method ever to enable production at exactly the same relative position of die and mandrel, each time the machine is started up.

Moreover, the relative position of die and mandrel can certainly be changed during discharge of the preform, too. This way, the operator can improve, e. g. the wall thickness distribution in crooked curves or in parts with a degree of

stretching that varies over the circumference. If additionally connecting the tilting technique to the 3-D technique, which is just as novel, and is currently in the stage of development and testing, it will be possible to include in any usual blow molding machine a dynamic tilting function, and a well-aimed dynamic axial as well as radial closed-loop control of wall thicknesses. No special die areas will have to be deformed any more by actuators, in order to conduct axial and radial closed-loop control of the wall thickness. Neither will special software have to be included into the control unit. At present, this is done by very expensive and sophisticated PWDS (partial wall thickness distribution systems) or flexring tools. There are in fact certain limitations to the PWDS system in particular, and to the flexring system too, and that is when the degree of deformation in the part does not change gradually, but rather significantly over a very restricted area. In these cases, the 3-D technique can achieve a more homogeneous wall thickness distribution in the part, than PWDS or flexring systems can do.

Conclusion

Even though the tilting technique is very young, i. e. a good year, an increasing number of users are showing their interest, especially from the areas of pipe extrusion and extrusion blow molding. And that is mainly because it solves the hitherto unsolved

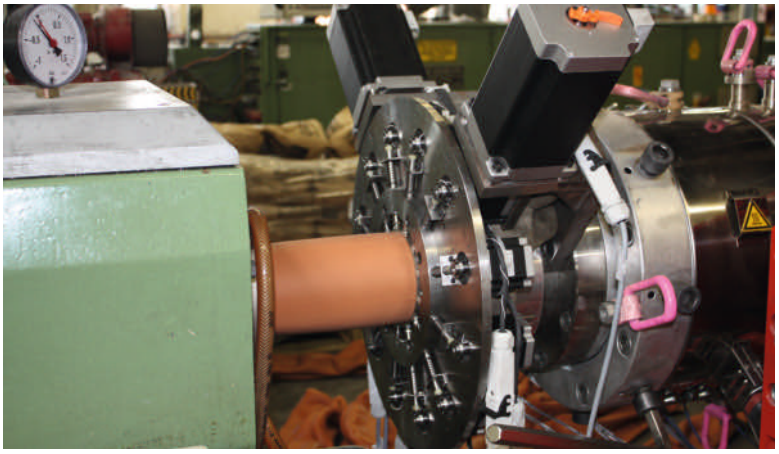

Fig. 5. Flexring tool used for the tilting technique – for the first time, it is thus possible to conduct closed-loop control of eccentric, as well as asymmetric variations in thicknesses

problem of centering in a way that is stunningly simple, while at the same time reducing the number of elements required to make the head. Operation and maintenance of the head are simplified. Additionally, the time required to switch from one dimension to another is reduced. And the risk of disturbances occurring during adjustment or operation is diminished. In the area of extrusion blow molding, the tilting technique opens up new ways of production that can help cut the cost of production. What is more, the technique can also improve the qualities of the hollow bodies produced. ■

REFERENCES

1 Deutsche Patentschrift (German patent) DE 10 2009 058 361 B3, published on 01.06.2010

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Matt and Scratch Resistant

PMMA. Attractive surfaces with extremely low levels of gloss in combination with the main properties of polymethylmethacrylate (PMMA), such as weather and scratch resistance, are increasingly in demand. Altuglas HFI-10 Super Matt from Altuglas International, La Garenne, France, has the lowest gloss levels of all currently available grades of PMMA. Its good impact resistance and the unique matt effect of the extruded product is retained even after thermoforming. Additional advantages are very good scratch resistance and a pleasant haptic. Its excellent flow properties make the product particularly suitable for injection molding, extrusion and coextrusion.

Altuglas HFI-10 Super Matt can for example be used for the manufacture of glazing, film and profiles. For applications requiring sterilization there is also a gamma ray resistant grade of HFI-10 Super Matt.

→ www.altuglas.com

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Daytime running lamp covers made out of matt, scratch resistant PMMA (photo: Mitras)

PlasticsOnline – Intelligent Networked Knowledge Platform

What is the new knowledge platform plasticsonline.info?

Sponsored by the German Federal Ministry of Economics and Technology the Carl Hanser Verlag, the Faculty of Plastics Technology at the University of Erlangen-Nuremberg and the M-Base Engineering + Software GmbH are currently working on an intelligent networked online knowledge platform for plastics technology. A first prototype is planned for the fall of 2012.

The aim of the project is to make comprehensive knowledge efficiently available to the plastics industry.

Thanks to its indexing of finely structured contents, the platform offers new search possibilities for graphic information, formulae and tables. Intelligent networking makes identification of the required information very simple and allows an effective and selective search.

Apart from basic plastics technology knowledge, the project is initially focused specifically on contents relating to the "injection molding of thermoplastics in medical technology". This "living" platform should then grow and expand the range of information available. The system will cover all available media and be available partly free of charge and partly through a subscription.

Associated partners of the project are: Professor Thomas Seul from the Laboratory for Applied Plastics Technology (AKT, FH Schmalkalden), Professor Tim A. Osswald from the Polymer Engineering Center (University of Madison, USA), BASF SE and Gerresheimer Regensburg GmbH.

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The new online knowledge platform for plastics technology

More Rugged, More Stable

Water Filters. Mann + Hummel GmbH, Ludwigsburg, Germany, is expanding its product portfolio for water treatment by using hollow fibers of polyether sulfone (PES). The PES membranes are designed to tap into new applications that impose higher requirements on temperature and chemical resistance. According to the manufacturer, the possibility of steam sterilization opens up scope for use in the food, beverages and biotechnology industries.

The walls of the PES hollow fibers are semi-permeable, acting as a membrane for microfiltration and ultrafiltration. This gives rise to a mechanical separation process. Microscopic contaminants flow with the water into the pores of the PES fibers. Key parameters are therefore the pore size of the fibers and the size of the molecules to be separated. PES membranes for microfiltration offer pore sizes of 100 to 200 nm while those for ultrafiltration have pore sizes of 10 to 20 nm.

In the field of beverages and biotechnology, fouling by the filtered substances is common. This is counteracted by the flow geometry in the hollow PES fibers. This is designed to generate high-speed cross-flow along the membrane so that the deposited material is reliably entrained. The PES membrane, in combination with an optimized flow geometry and a new module design, offers a longer life time under conventional and extreme operating conditions.

→ www.mann-hummel.com

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Hollow fibers of polyester are expanding the scope of applications

