Precision Shape-Shifting Silicone Tubing Is a Reality

Paul Mazelin

The ability to manipulate tubing into different forms and with multiple lumens is a benefit to medical device designers. A newer technology, however, enables this metamorphosis to occur "on the fly" during the extrusion process. This article highlights the capabilities of the Geo-Trans technology.

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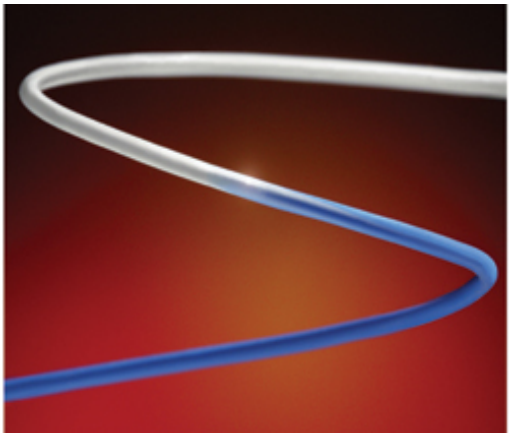
Geo-Trans is a patented process that enables the cross-sectional profile of a silicone tube to change "on the fly" during extrusion. The process was invented and patented by Specialty Silicone Fabricators (SSF) in 1996. The technology was originally developed to improve closed-wound drainage products. Today, the far-reaching medical, mechanical, and manufacturing advantages of transitional extrusion are well known. The process eliminates any secondary bonding operations to mate different tube profiles, thus significantly reducing costs. Also, because the process produces a single continuous tube, there is no need for leak testing, further reducing cost. Product quality and performance is vastly improved by eliminating any seams where CFU's (colony forming units) can gain a foothold and create potential infections.

Photo of Sylvester Fabricators Sylvester Fabricators using Geo-Trans.

The ability to produce parts with changing geometries requires tooling that can change "on the fly." For example, a die might need to slide open so a circular OD can transform to an oval, or it might need to close down from a circle to a square. SSF President Kevin Meyer states, "Specialty Silicone Fabricators' in-house tooling department has deep expertise in the development of these complex variable dies."

There have been many advances in the use of the Geo-Trans process since its first introduction. Some of these include:

The ability to extrude balloons of any length–This is accomplished by a moving mandrel that maintains a constant OD while thinning the wall by varying the ID. This eliminates typical secondary bonding requirements and attendant costs while increasing production speed. The result is reduced labor and no potential worker injury from removing balloons off of cores.

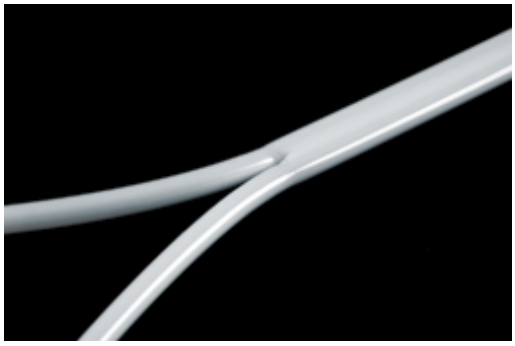


Blue and white Geo-Trans material changes "on the fly" for a tubing segment.

Variable stiffness/flexibility in a continuous tube–This is achieved with double extruder configurations that allow a very wide range of stiffness/flexibility ratios on the fly. For example, a flexible catheter that is easy to insert into the body speeds up the surgical procedure. The amount of flexibility can be controlled by thinning out the extrusion wall or by switching to a softer or stiffer material anywhere along the extruded profile.

Multi-lumen continuous extrusions–The Geo-Trans process can easily split two or more lumens off a center lumen or merge two lumens into a single lumen–all in a single continuous extruded tube. For example, the "peelable Y" configuration (as seen in the image) allows users to split the multi-lumen section as needed. The multi-lumen process is achieved by employing both moving dies and moving mandrels in concert. Once again, product cost is improved by eliminating secondary molding operations. Quality is improved by eliminating any possibility of cross contamination of fluids in the separate lumens.

The Future of Geo-Trans



Concepts of a Tube such as the Peelable Y can be made without a dual-tube configuration with the joints, intersecting or unsolidifying operations.

All of the product features discussed so far are available today. Concepts for tomorrow's Geo-Trans include spiral tubing configurations and extrusions where integral lumens stop and start. The future potential for unique extruded designs employing the Geo-Trans technology is exciting for medical device designers.

Online

For additional information on the technologies and products discussed in this article, see *MDT* online at www.mdtmag.com [2] or Specialty Silicone Fabricators at www.ssfab.com [3].

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