

UV-Cure Silicones Enable New Design Concepts for Medical Devices

Materials | An innovative processing method to UV cure silicone with limited heat has been developed by Freudenberg Medical. This development facilitates faster processing, higher yield, and the ability to produce new combination products by eliminating the constraints of conventional heat cured silicones.



In the process of cross-linking by means of UV light, the silicone parts are only heated to temperatures ranging between 30 °C and 70 °C. Thus, even sensitive active substances or additives can be used.

vative applications such as the combination of silicone and temperature-sensitive plastic, the incorporation of heat-sensitive ingredients like pharmaceuticals, and the encapsulation of electronic parts or flexible printed circuits.

Freudenberg Medical has developed a unique processing method to cure the material at a much higher rate than traditional platinum-cured silicone. The method delivers more efficient processing at a lower price.

UV cure process: benefits for combination products

During the manufacturing process, when extruding tubing or injection molding parts, the Freudenberg Medical team uses an ultraviolet (UV) light source to cure the silicone. The resulting product temperature stays relatively cool among 30 to 70°C and provides a more complete cure at a higher cure rate. This processing method benefits pharmaceutical customers in the production of drug delivery applications or combination products where heat sensitive pharmaceutical drugs are imbedded into the silicone. It is also advantageous when injection molding thick walled parts as the light enables a faster cure at a specific point.

“We are always talking to raw material companies, seeing what’s new in the market, and talking with customers about their design and processing challenges,” said Allen Stadtmiller, Director of Engineering at Freudenberg Medical. “We try and present nontraditional options to solve customer problems.”

Freudenberg Medical has been conducting silicone molding and extrusion trials at one of the company’s silicone technology lead centers in Carpinteria, USA. The company was initially approached by one of its silicone material suppliers. “The raw material fabricator came to us because we have over 30 years

Heat curing is the traditional method for cross-linking silicones in both injection molding and extrusion processes. The time it takes to transport the heat from the outer walls throughout the entire part, either by thermal conduction or by IR radiation, limits the process output. The necessary heat to induce vulcaniz-

ation in a reasonable amount of time hinders the suitability for heat curing a combination product – which typically includes temperature sensitive components or additives. Additionally, a heat cure can result in product shrinkage or create environmental pollutants.

Applying ultraviolet light to initiate the cross-link reaction is a relatively new process for silicone medical products. It is known as UV curing and works with a high intensity ultraviolet light which can instantly cure elastomers, inks, or coatings. UV curable silicone elastomers are relatively new, higher quality silicones with unique processing characteristics.

Recent achievements in silicone raw material development have enabled inno-

YOUR KEYWORDS

- UV curing of silicone
- Combination products
- Special raw materials
- Use of UV curable silicone instead
- of redesigning a piece

Photo: Freudenberg

of experience in silicone molding and extrusion,” said Stadtmiller, “much more than traditional fabricators in our market space.” A Freudenberg Medical customer was identified who had been working with several different material manufacturers.

Based on the current part design the customer’s piece had difficulty meeting design requirements using traditional materials. Instead of redesigning the part, which is time and cost prohibitive, Freudenberg Medical presented the UV curable silicone solution that met both the design criteria and the target pricing.

The most successful applications have been conducted using a tubing extrusion process. With extrusion, the UV cure permits production of more product using existing processing equipment. The faster the machine runs, the lower the cost becomes for each tube or part. This process enables the use of a higher-end silicone base material and the better quality material delivers specific advantages in

terms of properties and characteristics. Additional benefits occur within secondary operations with less heat shrinkage and therefore more repeatable results.

UV curing is also advantageous when injection molding thick walled parts. This is beneficial for medical devices imbedded with batteries or electronics as well as devices with temperature sensitive parts. The UV light penetrates instantly and sets the cure where it’s needed. This speeds the curing process for thicker cross sections of material and results in a shorter cure cycle. UV curing silicone thus alleviates some of the constraints which exist with traditional, heat cured silicone and this opens the door for new medical device design applications as well as lower costs for customers. ■

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Company profile

Freudenberg Medical focuses on innovative medical devices as a partner for design, development, and production. With 11 manufacturing operations and more than 1,500 associates worldwide, Freudenberg Medical offers a wide range of capabilities from high precision silicone and thermoplastic components and tubing to coating technology, finished devices, and solutions for minimally invasive and catheter-based devices.

Freudenberg Medical is a part of the Freudenberg Group. This company with long tradition supplies more than 30 market segments worldwide and employs over 48,000 people.

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