

UV-CURE SILICONES ENABLE NEW MEDICAL DEVICE DESIGN CONCEPTS AND INCREASE CUSTOMER VALUE

Freudenberg Medical has developed an innovative processing method to UV cure silicone with limited heat. Medical device customers benefit from faster processing, higher yield, and the ability to produce new combination products by eliminating the constraints of conventional heat cured silicones.

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 vulcanization 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 known as UV curing. Within this process a high intensity ultraviolet light is used to instantly cure elastomers, inks, or coatings. UV curable silicone elastomers are relatively new, higher quality silicones with unique processing characteristics.

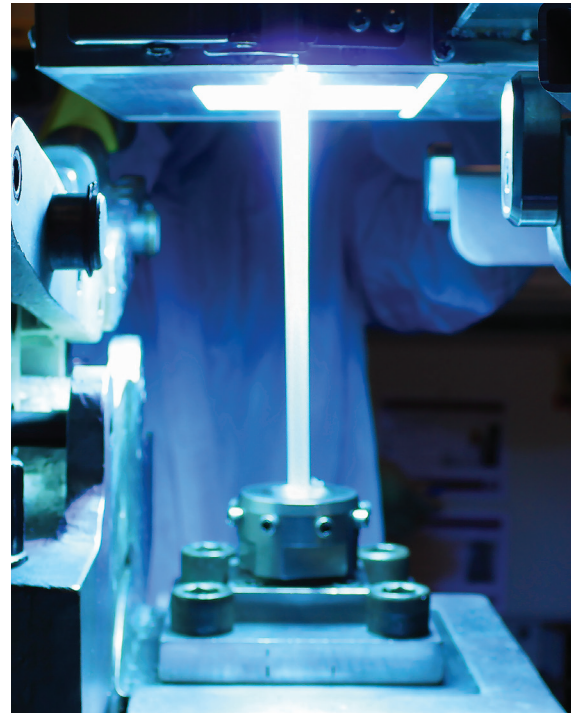
New Designs and Combination Products

Recent achievements in silicone raw material development have enabled innovative 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 will cure which delivers more efficient processing at a lower price.

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 (30-70°C), thus providing 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.”

Stadtmiller has been conducting silicone molding and extrusion trials at the company’s silicone technology lead center in Carpinteria, California (USA). Freudenberg Medical was initially approached by silicone material fabricator, Momentive. “Momentive came to us because we have over 30 years 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 3 different material manufacturers and based on the current part design the 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.



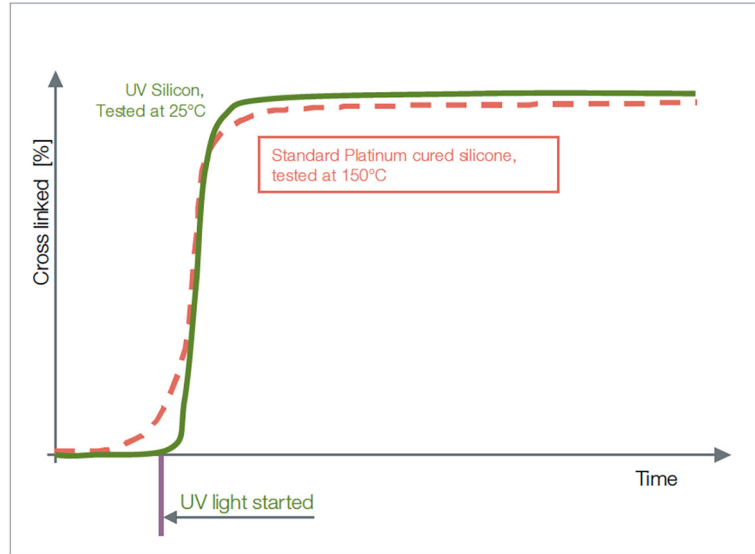
Positive Applications

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 as the light enables a cure at a specific point and delivers a faster cure than traditional methods. 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.

What Does the Future Hold

UV curing silicone alleviates some of the constraints that exists with traditional, heat cured silicone and this opens the door for new medical device design applications as well as lower costs for customers. With these new processing solutions Freudenberg Medical customers are given more flexibility to design a device with the features they want and a faster cure cycle will deliver more product at a cost-effective price.



This graph compares the curing behavior of heat cured silicone rubber to UV cured silicone rubber

Note: Momentive test data, actual results may vary

For more information on UV-cure silicone solutions at Freudenberg Medical, please contact Allen Stadtmiller, Director of Engineering: allen.stadtmiller@freudenbergmedical.com