

Healthcare industry BW

Silicone application in medical technology

Silicone is flexible, biocompatible and heat-resistant, characteristics that make organosilicone compounds ideal for a wide range of applications in medical technology. Up until now, the broad application of such compounds has been hampered chiefly by the high surface friction of silicone. The Reutlingen-based company Silcos GmbH has developed special methods for the treatment of surfaces that considerably improve the compound's range of applications in the life sciences.



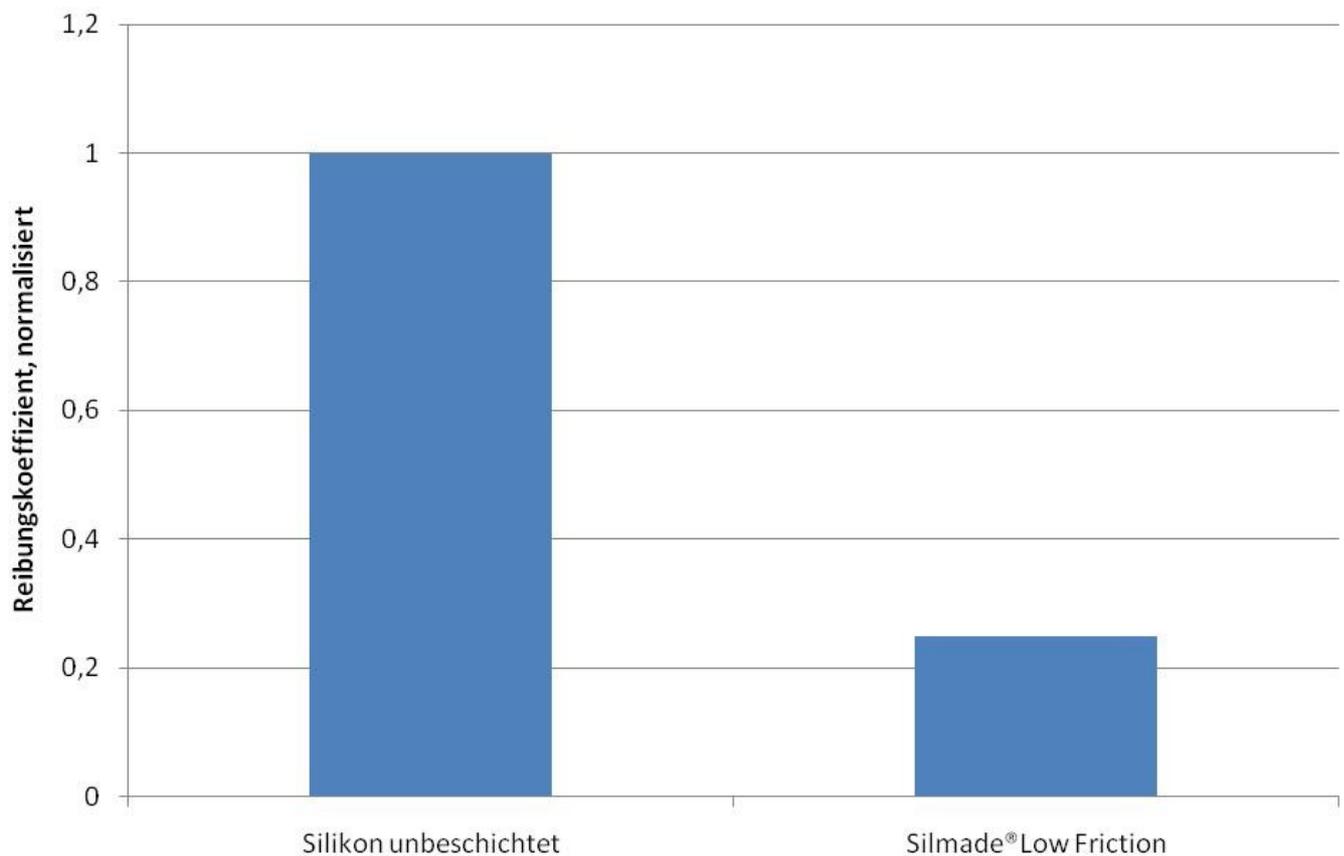
Silcos management team (from left to right): Michael Ulm is in charge of the company's New Technologies business field, Manfred Fuchs is the company's CEO and Bernhard Mitteregger is in charge of Sales and Marketing.
© Silcos GmbH

“Up until now, the application of silicone in the medical technology sector has been associated with a big “but”,” said Bernhard Mitteregger, head of the company's sales and marketing division.

This comes as something of a surprise for a material that has many inherent characteristics that make it ideal for use in devices that come into direct contact with the human body: silicone is highly elastic, has a long lifespan, excellent biological compatibility and is an excellent sealant. It is also very easy to clean. Due to its high stability to heat, silicone can also be autoclaved and sterilised using gamma or UV radiation. Silicone would appear to have got what it takes to be a perfect candidate for use in medical technology, and a perfect material for use in devices and instruments that come into direct contact with living tissue. “The negative thing about silicone, however, is that it is characterised by a high breakaway torque and that the high friction coefficient has made it quite difficult to apply in areas such as endoscopy,” said Mitteregger.

Silcos GmbH has carried out research and development aimed at considerably reducing the material’s surface friction, and has come up with something resembling a varnish to coat the surface of the silicone. The company had to overcome two major hurdles, as Mitteregger explains: “It was rather difficult to develop a varnish that adheres well to surfaces. Based on our know-how, we were finally able to reduce friction as well as preventing abrasion on the coating. “We solved this particular problem in cooperation with a varnish manufacturer,” said Mitteregger.

Varnish reduces friction



The surface coating considerably reduces the friction of silicone products, which facilitates the use of silicone in medical devices and instruments.

© Silcos GmbH

The type and shape of silicone products affects friction, which can be reduced by up to 70 per cent by coating the surface of the silicone product. However, the surface coating reduces the heat resistance of the final product. Pure silicone can be heated to over 200°C without losing its stability whereas the surface coating of a silicone device or instrument will not tolerate such high temperatures. However, it is worth noting that most life sciences applications do not involve such high temperatures. Silcos

GmbH guarantees that its coated silicone products have a temperature stability of up to 110°C, which is usually sufficient for medical applications. Endoscopes and catheters, i.e. products in which the metal components are moved through seals, are typical life sciences applications where silicone is used. "In general, coated silicone is excellently suited for all kinds of device seals. As silicone is not very permeable to gas, it can also be used as a barrier coating, for example in pumps that are moved by gasses or liquids," said Mitteregger pointing out that silicone can be used for many applications from life support machines to drug pumps.

Respiratory masks that are comfortable on the skin

Silicone is also excellent for direct use on skin. "Normal silicone usually feels slightly sticky and attracts dust particles. The coating makes the products comfortable to wear and also reduces the static charge of the silicone, thereby reducing dust adhesion," said Mitteregger. These properties mean that the coated silicone products are excellently suited for use in respiratory masks, especially when they have to be worn for an extended period of time. "The masks need to be comfortable to wear and normally prevent sweat building up between the silicone cushion and the face. The coating does both these things," said Mitteregger.

Coating is not the only way that silicone surfaces can be treated in order to broaden their range of applications. The Silcos team is increasingly focusing on adhesion. "We have found a way to activate the silicone surface in a way that enables it to adhere well to other materials," said Mitteregger.

Highly pure silicone through post-treatment



In the field of medical technology, silicone is also suitable for the manufacture of extrusion ware (e.g. tubes).

© Silcos GmbH

Silcos GmbH not only focuses on the modification of silicone surfaces, but also applies a proprietary method for the post-treatment of silicone parts that goes deeper into the silicone and for which the company holds the patent rights. Silcos acquired the technology, which is marketed as “ColdCuring” technology, and the necessary equipment from the Danish company Nanon A/S in spring 2009. As Nanon’s ColdCuring experts also moved to the Reutlingen-based company, Silcos was able to continue the further development of the technology without interruption. ColdCuring enables the post-treatment of silicone parts during which undesirable volatile silicone residues are removed. “Catalyst residues and volatile substances are removed using liquid carbon dioxide and pressure; CO_2 penetrates the silicone and dissolves compounds that are not fully cross-linked without damaging the internal structure. The method produces highly pure silicone suitable for highly specific applications,” Mitteregger explains. The resulting material has less than 0.3 per cent of free silicones, which is even less than the 0.5 per cent allowed in babies’ pacifiers.

The method is an effective alternative to hot tempering which is carried out at a temperature of 200°C . It goes without saying that such high temperatures require a lot of energy. “In addition to being environmentally friendly and saving energy, the ColdCuring process only takes around one hour and is thus considerably faster than hot tempering which requires around four hours,” said Mitteregger.

Huge market potential in the life sciences

Up until now, Silcos GmbH has only used its technologies in business-to-business (B2B) transactions. The company has traditionally had many clients in the automotive sector, but an increasing number are active in the medical technology sector. “The medical technology industry is a growing field for the application of silicone products, especially when one takes into account user and steering interfaces (e.g. keypads). Its outstanding characteristics make silicone suitable for three-dimensional geometries, which means that the parts can be completely covered with silicone. This enables the implementation of hygienic solutions in products ranging, for example, from simple blood measuring devices to complex surgical devices,” said Mitteregger.

Mitteregger believes that the company’s products have the potential to be used in many more life sciences applications. “Construction engineers, developers and designers do not often think of silicone in their search for solutions to problems. And it is here that we would like to provide more information and education. Silicone can be used for many more applications than those for which it is currently used; one of the reasons that it is not used so widely is because nobody has thought of asking us for support. We would be more than happy to answer any silicone-related questions people might have and assist in finding solutions to problems,” said Mitteregger, who welcomes all enquiries from engineers, developers and designers.

Further information:

Silcos GmbH
Bernd Mitteregger, Sales and Marketing
Hans-Böckler-Straße 28
72770 Reutlingen
Tel.: +49 (0)7121/ 93 937 - 0
E-mail: office(at)silcos.com

Article

30-Jan-2012

Leh (22.12.2011)

BioRegio STERN

© BIOPRO Baden-Württemberg GmbH

The article is part of the following dossiers



Medical technology – serving healthcare