

Mixing beads for insulin cylinder ampoules are one of the special products manufactured by Sigmund Lindner (SiLi) GmbH. The beads are manufactured from special glass rods made by Schott Rohrglas.

Work, where others go on vacation. This could be the motto for the approximately 50 employees at Sigmund Lindner GmbH in Warmensteinach. Wooded hills and clear streams surround the small community located in northeastern Bavaria, where Sigmund Lindner founded his company in 1854. At first, his company produced beads for costume jewelry. Today, with the fifth generation in charge of operations at family-owned SiLi, the company has become one of the leading manufacturers for technical glass beads and decorative glitter in international markets. The highly specialized products are made in accordance with manufacturing processes developed in-house and are exported to 75 countries through a world-wide sales network.

Completely Perfect

The top product among technical glass beads is named "SiLi beads" Type P. They are used in numerous applications such as in special ball bearings for conveyor belts and material-handling technologies, or in level indicators for the flow instruments employed by the chemical industry, as well as for valve balls for pumping technology and in the sealing of ink cartridges.

"Our expertise is particularly in demand for the manufacturing of mixing beads for pharmaceuticals", emphasizes Managing Director Stefan Trassl. These precision beads are produced from corrosion-resistant "Duran" borosilicate glass 3.3 made by Schott Rohrglas.

First, tube beads with a diameter of 2.8 to 3.0 millimeters are formed from the glass rods. "The physical and chemical properties of the glass remain unchanged up to the final stage of the process," explains SiLi Technical Director, Dr. Ralf-Peter Hitzschke. "It is a proven fact."

Grinding with the Utmost Precision

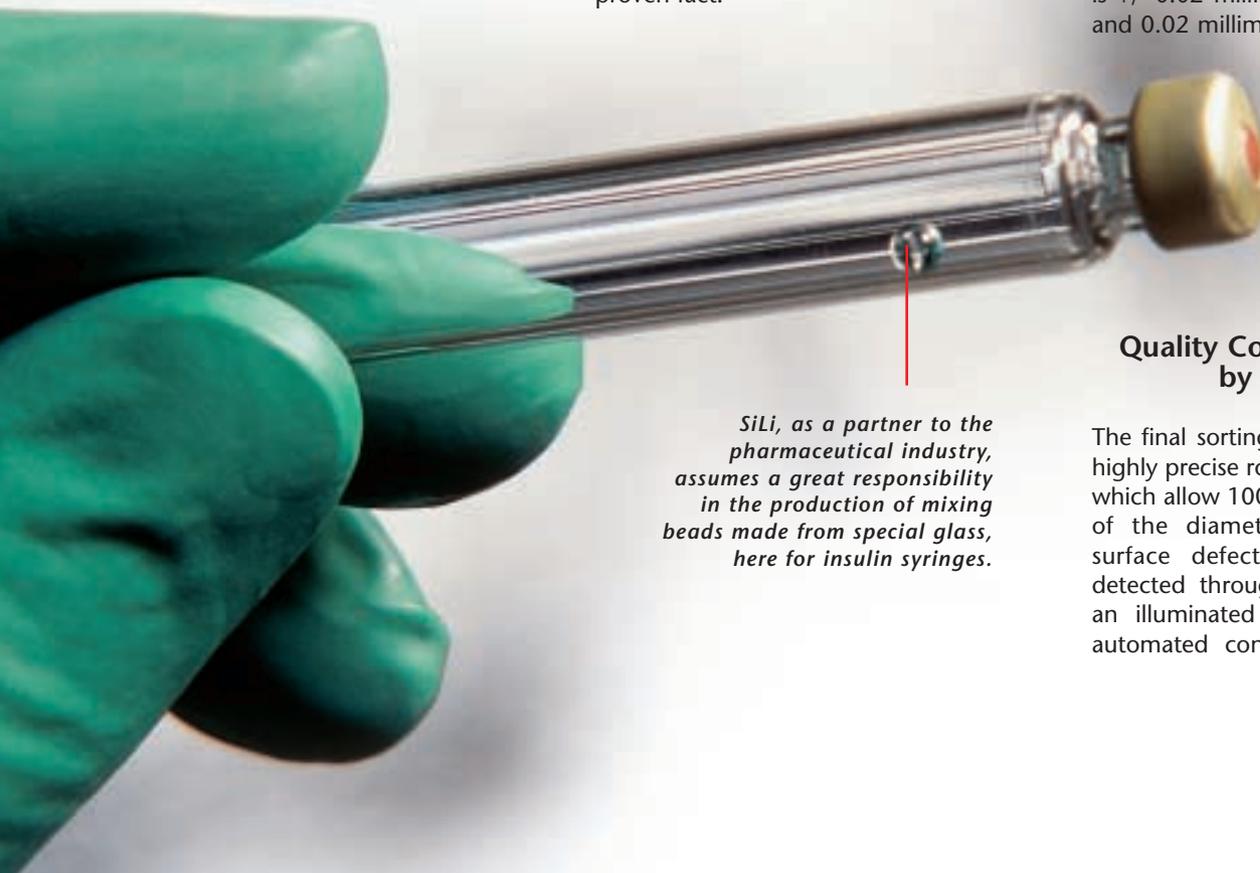
At this stage, the tube glass beads are not perfectly round, deviating by up to 0.2 millimeters. They are subsequently ground in glass bead grinding machines to achieve precision roundness. The mechanical surface removal process also helps maintain purity standards. The next step, a polishing process carried out with the utmost care in order to protect the product, gives the valuable beads a unique surface quality. The surface roughness is smaller than or equal to 0.0005 millimeters.

The manufacturing process allows diameters from 1.0 to 12.0 millimeters. The mixing beads for the insulin syringe cylinders, for example, are made from borosilicate glass and have a diameter of 2.5 millimeters. The standard tolerance is ± 0.02 millimeters for the diameter and 0.02 millimeters for the roundness.

Nevertheless, according to Dr. Hitzschke, one should not forget that in order to reach these values, up to 40 percent of the bead volume must be removed.

Quality Control Supervised by a Camera

The final sorting process takes place in highly precise roller sorting installations, which allow 100 percent quality control of the diameter tolerance. Possible surface defects and impurities are detected through a visual check with an illuminated magnifying glass and automated controls equipped with a



SiLi, as a partner to the pharmaceutical industry, assumes a great responsibility in the production of mixing beads made from special glass, here for insulin syringes.

SiLi Managing Director Stefan Trassl (right) and Technical Director Dr. Ralf Peter Hitzschke. Innovation is one of the company's great strengths.



The glass beads are polished to a high degree of exactness and roundness. The mechanical removal process is advantageous for the purity of the beads.

machine vision system running at a continuous speed of 10 beads per second.

Every part of the glass surface is photographed, the photos are evaluated and if necessary, beads are removed from the line.

The inspected beads are then packaged as batches and shipped. From every batch, both SiLi and the customer take a sample bead, check it, approve it and store it. Stefan Trassl: "The strict observance of our quality standards has made us a reliable partner for the pharmaceutical industry" ■



All beads are inspected with an illuminated magnifying glass.



"Duran"

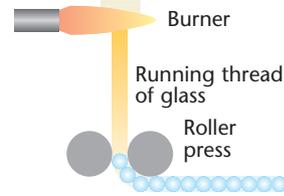
– a Highly Resistant Borosilicate Glass

"Duran" products are resistant to corrosion. They do not react with even the most aggressive of chemicals in almost all chemical branches. Borosilicate glass resists the action of water, acids, saline solutions, organic substances and even halogens. In addition, "Duran" glass tubes, capillaries and rods show a good resistance to caustic solutions.

The main area of application is the laboratory supply and chemical sector, from the simple test tube to large, complex technical plants for building chemical equipment. In environmental technology, flue gas desulfurization plants as well as solar collectors are areas of application with a promising future.

The invention of borosilicate glass in 1887–1893 is one of the greatest achievements of company founder Otto Schott.

"Duran" rod



In the transformation process from glass rod to glass bead, no impurities can be allowed to occur.