

Breathe more freely with the Respimat Soft Mist Inhaler of Boehringer Ingelheim microParts

Plan Optik AG supplies well-refined glass wafers as a cap for the high-tech centrepiece



Jets of liquid just a few micrometers thick collide with each other at the speed of a Formula One racing car to form an ultra-fine cloud of spray: the Respimat® Soft Mist Inhaler developed by Boehringer Ingelheim microParts GmbH (Dortmund) has revolutionized inhalation technology. Plan Optik AG supplies a special wafer made of borosilicate glass for the manufacture of the high-tech centre piece of the Respimat, the so-called uniblock. Both surface quality and thickness tolerance meet the highest requirements.

Glass wafer permits the inspection of the structure even after bonding

The uniblock is a unit comprising a fine filter and a twin-stream impaction nozzle that produces the spray cloud mechanically and without the need for propellant gas. It consists of a filter system and a special nozzle, which produces the fine cloud of spray. The solution containing the medication is forced through a filter system inside the uniblock. The fluid emerges from the uniblock through two nozzles. The jets of liquid collide with each other at a precisely defined angle and create a cloud of fine mist which is long-lasting. It also contains a large proportion of fine particles which can consequently enter the lungs.

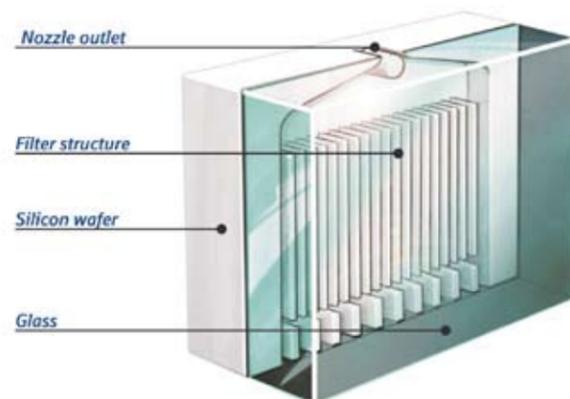
The starting point of the uniblock is a silicon wafer with an oxide coating. Boehringer Ingelheim microParts structures this wafer using a dry-etching process specially developed by the company itself. "At an earlier stage of development we thought that we would also cap this structure with a silicon wafer," explained Frank Pelzer of Team C Nozzle Production Front End. However, it was then realized that a glass wafer would be a better choice, because: "In this way the structure can also be inspected after bonding by using optical processes," added Dr. Stefan Kreuzberger, Director of Public Relations.

The nozzle has a diameter of 5 micrometers, and it functions as a filter. For this very reason each individual nozzle must be inspected after the isolation of the bonded wafer – and this is considerably easier with a glass cap that it would be with silicon, which is opaque. And so the company searched for a supplier who could supply glass wafers in sufficiently large quantities that would meet the highly exacting product specifications. "Here we found a reliable partner in Plan Optik AG, with whom we had already worked in the past," commented Pelzer.

Quality by Plan Optik permits an optimal bonding result

The glass wafers manufactured by Plan Optik have a very high quality surface and a very low thickness variation. Both of these features are equally important, because an insufficiently planar surface would weaken the atomic bond between the two wafers and possibly even prevent the necessary rigidity. The perfect bonding result is so important because the operating pressure within the nozzle amounts to 200 atmospheres, and the testing pressure is as high as 320 atmospheres – in other words, more than 100 times the pressure in a car tyre. And the nozzle must be able to withstand this pressure continuously.

A convex or concave cap, so to speak, would noticeably alter the volumes within the nozzle – with undesirable results for the spray jet and thus the resultant spray. "Plan Optik therefore employs special polishing processes like MDF polishing, some of which were specially developed, in order to be able to guarantee surface qualities which meet the requirements to the letter," emphasized Carsten Wesselkamp, sales manager of Plan Optik.



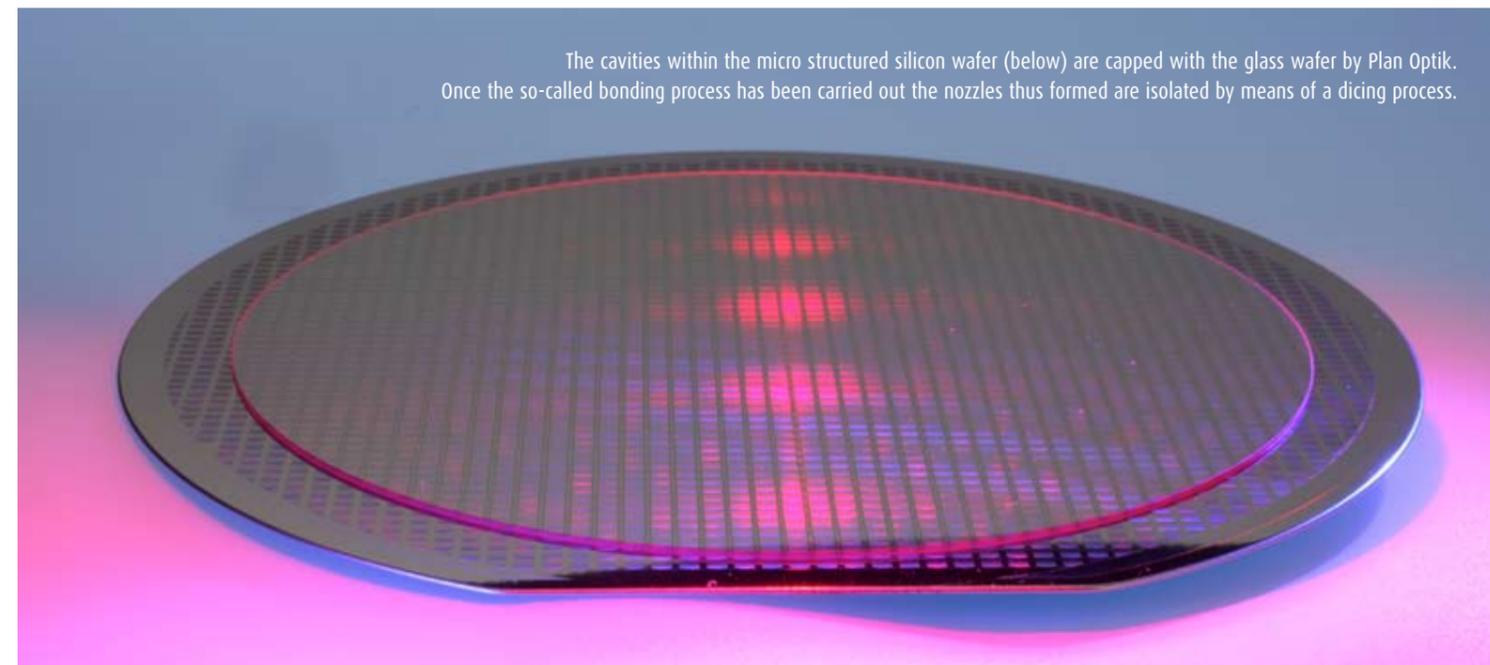
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The production process also requires the atomic fusion of the structured silicon wafer with the glass wafer as far as possible, since the nozzles – several hundred of them per wafer pair – are isolated by a sawing process. "Here it is absolutely essential to avoid eruption processes," explained Pelzer, pointing out that it is important to insist on the highest standards as regards both homogeneity and stability.

It is therefore essential to work with experienced and capable partners. "We have found Plan Optik to be a flexible partner, whose ability to deliver the product in consistently high quality are crucial for us," remarked Pelzer. This is even more important because the laws governing the testing and documentation of medicines and drugs are very wide-ranging and must always be complied with. This can only be achieved in a partnership based on mutual trust and with committed partner companies.

Up to 20 million Respimat® Soft Mist Inhalers can now be delivered worldwide. This means that thanks to the unique micro-technology, inhalation therapy is more efficient than at any time in the past: the gentle, long-lasting spray cloud lasts for approx. 1.5 seconds, which is up to seven times longer than the aerosol production in other dosage aerosols on the market. This means that patients have longer for the inhalation procedure on the one hand, and on the other that the co-ordination between triggering the release of the medication and breathing in is considerably easier. The result: the amount of the medication which reaches its target destination, the lungs – the so-called lung deposit – is up to three times higher than with a dosage aerosol, so that less of the effective substance remains in the mouth and throat.

The cavities within the micro structured silicon wafer (below) are capped with the glass wafer by Plan Optik. Once the so-called bonding process has been carried out the nozzles thus formed are isolated by means of a dicing process.



About Boehringer Ingelheim microParts GmbH

Boehringer Ingelheim microParts GmbH develops and manufactures MEMS (Micro-Electro-Mechanical-Systems) technology products for the life science industry and is one of the worldwide leaders in the technology in this field.

The company's activities focus on the exact reproduction of tiny structures in the microscopic range through the use of sophisticated injection moulding processes. In addition to systems for the production of aerosols without the use of propellant gas, the important developments by Boehringer Ingelheim microParts include micro structured channel plates for medical diagnostics and analytics (bio-chips, lab-on-a-chip systems) and micro spectrometers. The micro systems section for medical diagnostics is a competent partner for companies in the life science and in-vitro diagnostics sector. Here customer-specific diagnostic tests and test systems (e.g. lab-on-a-chip) are developed and manufactured using the latest designs from the fields of micro optics and micro fluidics.

The most important product in the competence centre for innovative drug delivery systems is the innovative Respimat® Soft Mist Inhaler. In order to fulfill the market demand, Boehringer Ingelheim microParts has expanded its production capacity on the company's site in the Technology Park in Dortmund. The result is a doubling of the production capacity for the Respimat® Soft Mist Inhaler from 10 to 20 million inhalers per year. The plant in which the inhaler for the world market is produced occupies 12,000 square meters, of which 4,000 square meters are clean room space.

About Plan Optik AG

Plan Optik AG is the leading supplier when it comes to the technology for the manufacture of structured wafers which serve as the active elements for numerous applications of MEMS technology in a variety of sectors. The wafers are made of glass, silicon-glass or quartz and are available in diameters up to 300 mm. Innovative solutions are based on micro structured components by Plan Optik, in particular in the fields of health care (micro dosage systems, lab-on-chips), automotive (sensors for driver-assistance systems and engine control, LED headlamps), aerospace (positioning and location sensors) as well as consumer electronics (CMOS chips). The fields of application in which wafers are used as carriers in the semiconductor industry as well as conductive via wafer solutions are continuously being expanded. As a manufacturer of glass micro lenses on the wafer level Plan Optik has become an important supplier for micro-optics manufacturers.

Plan Optik works together with customers including Infineon, Motorola, Boehringer, Samsung, Honeywell, Osram, Zeiss and Bosch and thus targets markets in Asia, Europe and North America. The company is listed in the Open Market (Entry Standard) of the Frankfurt Stock Exchange.



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