

NEWS

New Production Site in China

SCHOTT forma vitrum has announced the opening of a new factory in Suzhou, China. The new production site will manufacture ampoules and vials for the pharmaceutical industry in China. The company expects to begin production in July 2006 with approximately 50 new employees.

To manufacture its products, the facility will use "SCHOTT Type 1" borosilicate glass, a high quality tubing glass that complies with international standards (USP, EP, and JP). In recent years, this particular glass type has met with a strong increase in demand in China. At the new site, the complete range of ampoules and vials that the Chinese market currently demands will be manufactured. All of these products will satisfy the highest international requirements for pharmaceutical primary packaging made of glass.

The plant is being built in accordance with the standard concept that SCHOTT Pharmaceutical Packaging production sites follow on a global basis. It will be equipped with state-of-the-art production equipment



and visual inspection systems, operate in a clean room environment and comply with Good Manufacturing Practices (GMP).

SCHOTT forma vitrum is the first international manufacturer of primary pharmaceutical packaging made of glass to establish a production site in China. This move documents the interest of the company in the fast developing Chinese market for injectable

pharmaceuticals. With a production facility for world class products located at the doorstep of both current and future customers, SCHOTT hopes to bring tangible advantages, such as fast delivery times, local customer support and technical consulting without language barriers, as well as full support from SCHOTT forma vitrum's global network in meeting specific requirements.

ISO 15378 in Germany, Brazil and Switzerland

In December 2005, SCHOTT forma vitrum, Switzerland was certified according to ISO/FDIS 15378. After the plants in Germany and Brazil, it is already the third certified site of SCHOTT Business Segment Pharmaceutical Packaging. SCHOTT forma vitrum is among the first companies worldwide to be certified after this new standard.

ISO 15378 is a new international standard for primary packaging material for medicinal products which is expected to be published in the first quarter of 2006. It addresses the specific needs of the pharmaceutical industry and determines how primary packaging materials are to be produced in accordance with today's standards for process stability and quality. The new standard also includes special criteria that pertain to "Good Manufacturing Practices" (GMP) in primary packaging.

"This standard is of vital importance to the pharmaceutical industry and its suppliers of pharmaceutical primary packaging" says Dr. Jürgen Thürk, head of development glass at SCHOTT forma



vitrum, St. Gallen and convenor of the working group that developed ISO15378. "For the first time, the principles of GMP were specified as part of an ISO standard." For this reason, SCHOTT forma vitrum has not only started early with the certification of all its manufacturing sites worldwide but it also contributed to the development of the new standard by playing an active role in the working group.

EVENTS

75 years forma vitrum

75 years ago, when Heinrich Schwendener founded forma vitrum ag in St. Gallen, Switzerland, he certainly never expected the company to one day deliver its products to customers around the globe, including Asia, America, Western and Eastern Europe.

Today, forma vitrum ag is the competence center for syringes, vials, and pen cartridges of one of the leading suppliers of parenteral packaging worldwide. The most renowned pharmaceutical companies all over the world order high quality pharmaceutical packaging for injectables from St. Gallen. forma vitrum ag manufactures more than 600 million syringes, cartridges and vials made of high quality tubing glass, 95 percent of which are exported. Year after year, 350 employees process 5,000 tons of glass tubes



on 30,000 m² of production space and generate sales of approximately 48 million Euros.

Quality has always been the company's focus over the course of its 75 year history. Its products meet the highest demands for both precision and purity. In

order to achieve a consistently high level of quality, they are produced in state-of-the-art production facilities, and follow a strictly controlled manufacturing process.

Following the globalization of
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EDITORIAL

Dear Readers,

Anniversaries give companies the unique opportunity to escape from every day business for a short while and reflect on how well they were able to meet various challenges during the past decades and develop new solutions together with their customers. Anniversaries also offer companies a chance to look forward and critically evaluate whether they were successful in developing the right values, such as reliability, continuity and sustained partnerships. In this regard, we can definitely say that SCHOTT forma vitrum is moving in the right direction. Here, we'll need to continue to set the right accents, for example, with respect to our unique new developments in the area of coatings. Not only will we be able to provide improved packaging for biotechnology medications, we'll also be able to offer new solutions. Or simply take a look at how well



our efforts at internationalization are developing. The quick progress of ISO 15378 certification in our plants worldwide shows our commitment, and we'll also be opening a new factory in China this year. All of this was made possible, and this also comes to mind when we celebrate an anniversary, by dedicated employees who are willing to do all they can to meet our customers' challenging demands. I wish you enjoyable reading.

Dr. Peter Knaus
Vice President, Business Segment
Pharmaceutical Packaging

its customers from the pharmaceutical industry, forma vitrum built its first subsidiary abroad 15 years ago in Cordoba, Mexico. Today, more than 260 employees produce 800 million products per year at a manufacturing site 6000 m² in size. Ten years ago, another forma vitrum plant was opened in Lukásháza, Hungary. Today, the 300 employees who work at the 6000 m² site manufacture 870 million product

units. This means forma vitrum can not only look back on its successful 75 year history in St. Gallen, but is actually able to celebrate a total of 100 years of experience.

Since 1998, SCHOTT AG, the international technology group, has stood at the side of forma vitrum as a cooperation partner. In 2004, SCHOTT acquired two-thirds of the forma vitrum shares.

Milestones for the forma vitrum Group

1930	Founded on December 6
1990	Production start forma vitrum de Mexico S.A.
1995	Production start forma vitrum kft in Hungary
1998	Cooperation with SCHOTT AG, Germany
2002	Certification according to ISO 13485 for Medical Devices Market introduction of TopLine vials, the high quality product line
2004	SCHOTT AG acquires two-thirds majority
2005	Expansion of the sterile syringe business

PEOPLE

From peak to peak with persistence and a good sense of humor



recalls. Once the plant in Hungary had developed into a state-of-the-art factory according to the St. Gallen example, Hersche immediately moved to the next challenge. From Mexico and Hungary, he moved to the SCHOTT site in Müllheim, Germany, in 1999. Within a very short time frame, this company had to be brought into shape to meet SCHOTT forma vitrum's high standards and generate profits, of course. In mid 2001, it was finally time for Markus Hersche to return back to St. Gallen, following 15 years of work abroad. He became the Managing Director of forma vitrum ag and later took over also the production site of SCHOTT Schweiz in St. Gallen, two production operations with currently over 350 employees and at the same time competence center for sterile syringes, vials and pen cartridges of the SCHOTT forma vitrum group. Today, Hersche is challenged by new tasks in St. Gallen. "To meet and exceed our customers' requirements of today and tomorrow we not only optimize but develop new technologies and build new manufacturing equipment, and we even venture into new challenges in the fields of glass syringes and the COC polymer business."

Although Markus Hersche seems to be attracted by major challenges both in his career and personal life,



he never really looks for them on purpose. While Hersche loves to move forward and enjoys speed, he always respects the environment and keeps risks controlled. His good sense of humor does not leave him even in difficult situations. To relax, he often skis and he'll occasionally climb mountains close to where he lives of up to 4,000 meters high. "I guess this is something typical of us Swiss. No matter where we might be, we feel an urge to climb the highest and even the lowest mountain," Hersche says with a smile. "Being high up on a mountain in some distance to everyday life helps to restore the right proportions. It makes one see one's own limits and refreshes the view for the things that really matter."

MATERIALS

Glass or Polymer, Coated or Uncoated: Multiple Choices to Make

"A medication is always only as good as its packaging," says Walter Schiess, Product Manager for syringes at SCHOTT forma vitrum. In the past, glass ranked as the material of choice for prefilled syringes.

It offers excellent characteristics, prevents water vapor or oxygen from being in contact with the medication and ensures that none of the drug ingredients inactivate. Today, the majority of all prefilled syringes produced in the world are still made of glass. Nevertheless, with some applications, glass packaging can be a disadvantage. For instance, certain components that make up the glass can interact with the drug. High performance polymers, such as COC, increasingly represent an alternative. In general, COC, a cyclic olefin copolymer, offers a number of advantages. Parenteral packaging made of polymer is easy to produce and all process steps of the value chain are consequently performed under clean room conditions. Unlike glass, TopPac syringes made of polymers need not be washed to achieve the cleanliness required for "ready to fill" packaging. They are completely free of particles and the amount of free silicone is on a very low level. The excellent design flexibility allows integrating functional parts as, for instance, a luer lock adapter, which leads to a much more robust system. Furthermore, the TopPac syringes have a much higher breakage resistance and are ideal for packing toxic products.

This reveals why SCHOTT forma vitrum – known as a glass expert by origin – has plenty of reasons to offer its customers products made of polymers as an alternative. "Especially with new applications or biotech products, polymers are

worth considering when selecting materials," says Schiess. However, SCHOTT forma vitrum not only has established excellent skills in working with glass and polymers, but also ranks as an expert in the field of surface coatings. Using the PICVD technique developed by SCHOTT, silicon dioxide layers are applied to the surface of glass to prevent metal ions contained in primary packaging from diffusing or to secure the biological stability of the medication. Initial tests have now been completed on applying coatings to the polymer COC using the PICVD technique to improve the oxygen permeation characteristics of the polymer by a factor of ten.

"Any pharmaceutical company that introduces a new medication to the market is faced with the challenge of identifying the best combination of packaging material and drug formulation. SCHOTT forma vitrum is able to help not only with the decision whether to rely on glass or polymers, but also on whether to select coated or uncoated products," comments Dr. Robert Hormes, Manager of the Competence Center Coating in the business segment Pharmaceutical Packaging.

The Plasma Impulse technology developed by SCHOTT is used for

the application of specific layers to glass and polymers. Furthermore, SCHOTT offers expertise in measuring non-specific binding of proteins onto the surfaces of packaging. "Only recently, we were able to develop a screening expertise that allows us to mark proteins and then quantify how much protein is lost from the solution due to binding to the surface," says Dr. Hormes. The advantage to pharmaceutical companies is a quick test to determine what type of packaging will be particularly well-suited for the stability of a drug formulation. Even while formulating a protein medication, the screening test can help with systematically optimizing the compounds of a formulation. Being able to select the right type of packaging or modify the formulation at an early stage in time saves both time and money. The screening method can be applied not only to coated and uncoated glass and polymer surfaces, but also to siliconized surfaces. Further testing is currently underway in this area at SCHOTT forma vitrum in order to be able to offer new coated products to the industry.

At first glance, his original career has absolutely nothing to do with the work Markus Hersche currently does as General Manager of forma vitrum in St. Gallen, Switzerland.

Hersche is actually a skilled airplane mechanic, with a degree in engineering and economics, who used to build and repair airplanes for "Swissair" and the Swiss Army back in the 1980s. When it departs, an Airbus A 310 weighs approximately 150 tons. By comparison, the products he sells for forma vitrum are close to nothing in size. "Precision, consciousness of safety and the willingness to accept responsibility were the traits that really helped me in both careers," he says. A single mistake in building an airplane can lead to the same type of fatal consequence as an impure pharmaceutical vial or a contaminated syringe.

Markus Hersche has now worked for forma vitrum for twenty years, something he himself finds difficult to believe. "Maybe this is because I've been responsible for performing so many completely different tasks at different locations," Hersche says. Back in 1989, when he had only been with forma vitrum for four years, Dr. Christoph Fässler, the Managing Director at that time and today President of the Board of Directors of the forma vitrum holding ag, sent him to Mexico to establish a completely new production site. "This was our first factory located abroad and believe me, I experienced this as nothing but an adventure," he explains. All-rounders that were capable of entrepreneurial thinking, tackling problems and improvising were in demand. "At the beginning, we stood at the foot of a huge mountain. However, at some point we were picked up a shovel and simply went to work."

As soon as the factory was operating smoothly, he was given his next job. Some 8,500 kilometers to the northwest of Mexico, yet another production site was waiting to be established in Hungary, Eastern Europe, in 1994. "At that time, forma vitrum was one of the first investors in this area," Hersche

ON TOUR

State-of-the-Art Site in Brazil

Brazil represents a very special country for SCHOTT. Even back in 1954, the SCHOTT Group invested funds there to establish the company's first factory located outside Germany, a tubing facility in which SCHOTT acquired two-thirds of the shares. Initially, ampoules and vials were manufactured from glass tubes at two different locations.

In 1989, SCHOTT finally acquired 100 percent of the shares in the Brazilian pharmaceutical packaging businesses that were at the time operating under the name Vitronac in Rio de Janeiro and Vitrosul near Sao Paulo. In

2000, the SCHOTT Group decided to consolidate the two factories.

Because neither of the sites offered the type of expansion options required, a new lot was purchased in Itupeva, 50 kilometers northwest of Sao Paulo. It was here that "SCHOTT Brazil – Embalagens," one of the world's most modern production sites for pharmaceutical packaging, opened.

"We decided to involve our customers in our planning efforts from the very beginning," explains Managing Director Jurgen Buhr. In this way, a plant with production in a clean room environment literally dedicated to meeting customer



demands was established. The strategic location, excellent infrastructure, reliable power supply and telecommunication all became important criteria for selecting this site.

The site consists of more than 150,000 m² of space; however the existing manufacturing facilities and administrative building currently take up less than half of this total area. "This means we have plenty of room to grow," says Buhr.

"SCHOTT Brazil – Embalagens" generates sales of 21 million Euros per year. Here, the majority of the business is made with pharmaceutical packaging such as vials and ampoules. Along the way, other products are manufactured and sold

for use in cosmetics and the diagnostic industry.

The manufacturing facilities consist of more than 70 production lines and have a total capacity of 900 million pieces per year. They operate in a fully-continuous manner, 24 hours per day, seven days a week. "On the

one hand, this underscores our ability to supply products. On the other, it helps ensure the stability of our production processes," Buhr adds. Its 390 employees supply mainly to Brazil and other South American countries.

Site at a glance

SCHOTT Brazil – Embalagens

Location:	Itupeva, 50 kilometers northwest of Sao Paulo
Employees:	390
Products:	ampoules and vials
Capacity:	900 million units per year
Building:	14,500 m ²
Quality certification:	ISO 9001, ISO 14001, OHSAS 18001, ISO/DIS 15378

PRODUCTS

Dental Cartridges: historic quality by SCHOTT

Who among us has not suffered the agonies of an aching tooth? Lucky for us all was the discovery of dental anesthesia, made even more effective with the invention of the dental cartridge – as manufactured today to the exacting standards of SCHOTT forma vitrum.

It was memory of a painful extraction that prompted young Dr. Horace Wells of Connecticut to pursue and promote anesthesia in the dental arena – demonstrating its effectiveness by pulling his own tooth while under its effects. That was in the mid-1800s. Half a century later, Johns Hopkins surgeon Dr. William Stewart became the first to demonstrate the injection of a pain-blocking agent – cocaine – into a sensory nerve trunk in the jaw. The euphoria experienced while under its effects was nothing compared with the collective relief felt by dental patients to come.



Today, it is estimated that the average dentist administers between 1,500 and 2,000 injections of anesthesia each year. Most of these are through the more modern innovation of the pre-filled glass cartridge – the result of an idea of Dr. Harvey Cook during World War I, who took his inspiration from the rifle cartridges he encountered during that conflict. Lacking a supplier, Dr. Cook fashioned his own.

Some 75 years later, acknowledged for quality in syringes, vials and ampoules, SCHOTT forma vitrum entered the market for dental cartridges. Today, manufacturing takes place in either Schott's Lebanon, Pennsylvania or Brazilian state-of-the-art facilities that have the potential to produce approximately 400 million dental cartridges on an annual basis. Covering an area of 16,000 square meters (around 173,000 square feet), the Lebanon facility features the most advanced technology and practices, including automated camera inspection and a clean room for final packing to minimize particle contamination. Certified to ISO 9001:2000 standards, the plant also meets current Good Manufacturing Practice (cGMP) standards required by the US Food and Drug Administration (FDA). The facility operates two lines devoted to dental cartridges on third generation machines to support the demands of SCHOTT's global customers. Currently, the facility runs three shifts on the two lines on a five-days schedule, with the ability to move to a six or seven day schedule if required.

The cartridges themselves are crafted from SCHOTT Fiolax glass which is manufactured – untouched by human hands – in one of three SCHOTT tubing facilities: Mitterteich, Germany; Barcelona, Spain; and Rio de



Janeiro, Brazil. "SCHOTT has been producing special glass tubing for pharmaceutical packaging for more than 90 years," says Gary Waller, Director of Marketing and Sales, North America. "We set the standard." SCHOTT Fiolax is a Type 1 borosilicate glass of the highest quality that is used for syringes, vials, ampoules and cartridges. It is known for its excellent hydrolytic resistance, neutrality, impermeability and strength. SCHOTT produces two sizes of dental cartridges: 2.2 cc and the industry standard of 1.8 cc, each with an 8 mm aluminum seal finish (either US or DIN). Cartridges are packed to the specific configuration required by each customer to minimize excess handling within their washing system, and ready for filling and terminal or aseptic sterilization by the customer. Cocaine, of course, is no longer the anesthetic of choice; it has been replaced first by synthetic versions such as procaine, and such

recent successors as primocaine and tetracaine at four and ten times its strength, respectively.

"Over a hundred years after its discovery, anesthetic for dental care continues to be a stable market within North America, with tremendous growth opportunity outside North America," says Waller. "Current manufacturers are pursuing licenses on a global basis to support their expansion investments and consolidations."

"As in the pharmaceutical sector, we have seen a consolidation in anesthetic filling in North America," says Waller. "Only a few years ago, there existed four fillers for the dental industry, but recently, through contract agreements of acquisition, we have two remaining in the US. With the recent consolidation, SCHOTT has had the opportunity to secure growth through outstanding service and continuing quality improvement in both process and delivery."

Masthead

SCHOTT forma vitrum
NEWSFLASH

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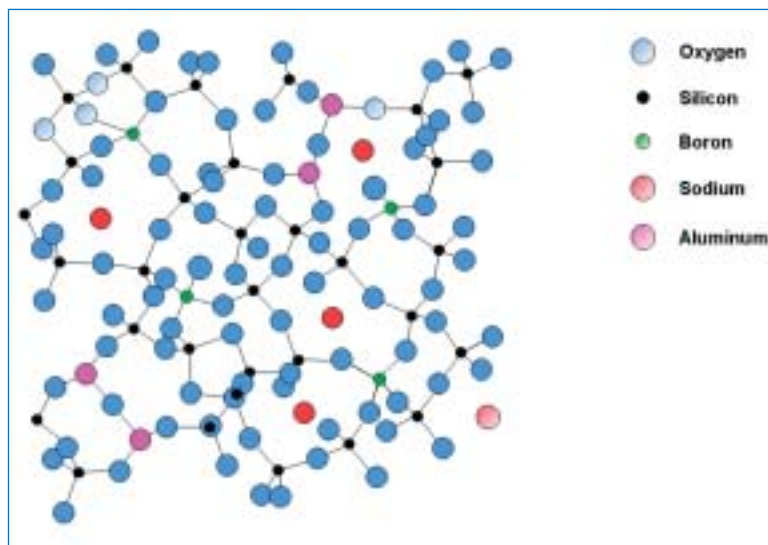
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QUALITY

Alkalinity – Only the Best Packaging for Injectable Medications



Borosilicate glass structure

The properties of glass are mainly influenced by the glass components. The work of Dr. Otto Schott (1851-1935) resulted in many different special glasses for various technical applications. The borosilicate glass brands "FIOLAX" O.C., BORO 8330™ and "DURAN" still rank among the best known and proven glass types for pharmaceutical packaging and for glass apparatus used in pharmaceutical and chemical laboratories.

The main component of glass is a network of silicon oxide. However, pure silicon oxide or "quartz glass" would not be suitable to manufacture pharmaceutical containers with automatic converting machines because of its high melting temperature.

Therefore, alkali and alkaline earth metal oxides are added to the glass composition in order to lower the working point to a temperature where automatic converting is easier (around 1000 °C). But such a glass consisting only of silica and alkaline earth metal oxides ("soda lime glass") must not be used for primary packaging of aqueous injectable drugs because the alkali and alkaline

earth ions are not strongly enough fixed to the silica structure. During prolonged contact with water, these ions can be leached out of the glass surface comparatively easily. This problem is solved by adding boron oxide and aluminum oxide as additional glass components. Thus the glass structure is stabilized, chemical and physical properties are improved, and the alkali release is reduced to a very low level. This borosilicate glass is now particularly suitable for pharmaceutical applications such as ampoules, vials, syringes and cartridges.

"FIOLAX" O.C.-amber borosilicate glass for light sensitive drugs additionally contains ferric and titanium oxide to achieve the brown colour.

The composition of "FIOLAX" O.C. borosilicate glass is a compromise between a good working temperature and high hydrolytic resistance. However, in contact with water, some traces of alkaline compounds (mainly sodium ions) are still leached out of the glass surface and may finally influence the stability of a sensitive drug. This is the reason why the sodium release of borosilicate

glass containers has to be measured according to different pharmacopoea and international standards.

The hydrolytic resistance of a "FIOLAX" O.C. borosilicate glass container is mainly influenced by two things:

- 1) the glass composition, and
- 2) the converting of the glass tubing into containers.

Measuring the hydrolytic resistance, these two influences are taken into account with two different test methods, the glass grain test and the alkali release test.

The glass grain test gives information about the material glass itself and indicates if the glass has the correct composition. There are different methods with only slightly different test conditions (ISO 719, ISO 729, Ph. Eur., USP, JP). The basic principle is the same: A glass sample (e. g. a vial) is crushed to powder, a certain amount of this glass powder (grain) is treated with boiling water, and the amount of alkali ions which has been released from the glass powder is measured. According to the result and the test method, the glass is classified into the first, second or third hydrolytic class.

The result for "FIOLAX" O.C. is always approximately one third of the limit value of the first hydrolytic class (e. g. Type 1 according to Ph. Eur. and USP; HGB 1 according to ISO 719; HGA 1 according to ISO 720). It is not influenced by the converting process, so it is the same for tubing and containers.

The result of the glass grain test is directly related to the glass composition.

It is fully controlled by the glass tubing manufacturer who needs to keep the glass composition constant. This is only one of several chemical and physical properties that are guaranteed by the glass manufacturer

SCHOTT (e. g. in the "FIOLAX" O.C. certificates, data sheets or TLB 2004).

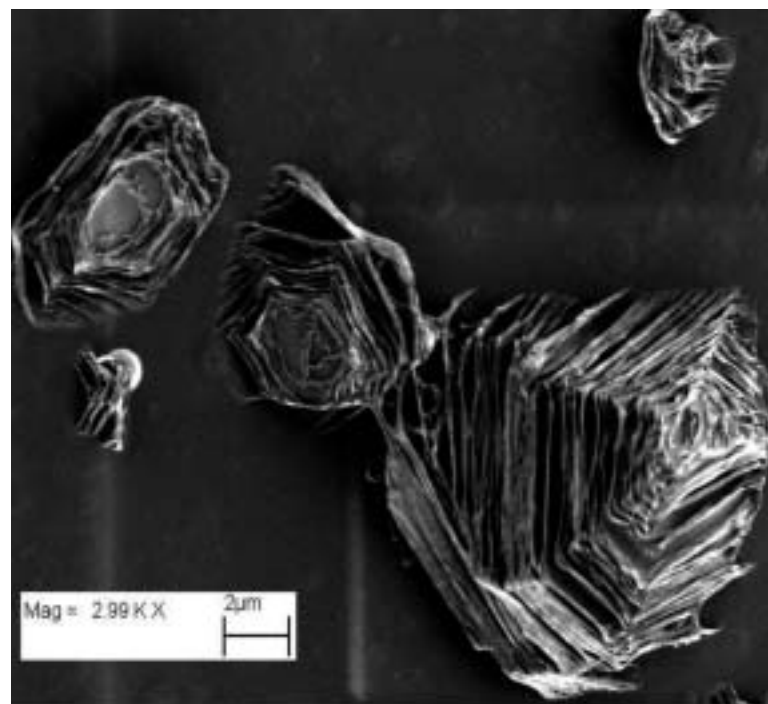
The test of the alkali release of the container surface is very important because it shows the quality (alkali release) of the internal container surface that is intended to be in direct contact with the drug. Test procedures are described in Ph. Eur. and in ISO 4802. Contrary to the glass grain test, here the container is not destroyed. The main steps include washing the container, filling it with water, heating it up, maintaining a temperature of 121 °C for one hour (autoclav), finally, measuring the extracted alkali in the water and classifying the container into Type I, II or III. EP, USP and JP standards allow only Type I containers for storage of injectables.

The tubing converter can keep the alkalinity of the container surface low in order to maintain a good

stability of the drug. During hot forming, volatile glass components like sodium borate are more or less enriched on the container surface. This sodium also contributes to the alkalinity of the container, depending on the processing parameters.

Special expertise in production of high quality "FIOLAX" borosilicate glass tubing and containers makes SCHOTT / SCHOTT forma vitrum a reliable partner for the pharmaceutical industry. As one of the world's leading suppliers of parenteral packaging, SCHOTT forma vitrum follows strictly controlled processes to ensure keeping well within the limits given by EP, USP and JP.

For a more detailed description of borosilicate glass composition, alkali release and test methods please refer to the SCHOTT-Rohr-glas Pharma Newsletters # 1-3.



Crystalline sodium borate on a borosilicate glass surface

EVENTS

Customer Event in Hungary

Under the theme "Discover SCHOTT forma vitrum," a customer event was held from October 25-28, 2005 in Hungary and Germany to celebrate the 10th anniversary of SCHOTT forma vitrum's manufacturing site in Lukácsháza, Hungary.

Forty participants from Poland, Hungary, Romania, Lithuania, Slovakia, Bulgaria, Serbia, Croatia and Russia made use of this opportunity to learn more about the challenges of parenteral packaging. In addition to a tour of the pharmaceutical packaging plant, the guests received an overview of market and development trends, future challenges facing the pharmaceutical industry and SCHOTT forma vitrum's philosophy on quality. On the second day, the



participants traveled to Germany to visit the impressive SCHOTT tubing production facilities in Mitterteich. They also received detailed information on borosilicate glass for use in primary pharmaceutical packaging. "This was truly an excellent opportunity

to show our customers the broad level of expertise that we've obtained not only in the area of pharmaceutical packaging, but also glass tubing," says Eric L'Heureux, General Manager of forma vitrum kft., Lukácsháza.

