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Assessing Reliability

When the reliability of glass products has to be assessed or improved, the Analysis and Measurement Department at Schott is an indispensable asset.

Schott's Analysis and Measurement Service has undergone a transformation over the past few years. In the past, a high throughput of samples used to be an indication of good work. Today the top priority is to provide the customer with specialized advice. "Although we still issue measured data," said Dr. Volker Rupertus, Head of Analysis and Measurement, "we increasingly assist our internal and external customers with the interpretation of the data and provide them with specific recommendations." The transition from a measuring service to a comprehensive consultation service is also reflected in the staffing structure of the department. Of the 95 analysis staff at the modern Mainz Research Center, about half are scientists and engineers.

Dr. Rupertus and his staff achieve their best results when they are involved in R&D work as early as possible. For instance, material strength experts like Dr. Kurt Nattermann can assess during development which product and process properties will meet the requirements set, often speeding up the development process and in many cases leading to more cost-effective manufacturing. "Customers who involve us right from the beginning appreciate the benefits and keep coming back to consult us," says Dr. Rupertus with a smile. "And of course we prefer to prevent things from going wrong later through early consultation."

Quality and Safety

One of the most important tasks of the Technical Physics Department is to assess and improve the reliability of products in collaboration with customers. "By reliability we mean that glass articles are not only of the required quality at the time of delivery but also work properly for a long time to come," explains Dr. Nattermann.

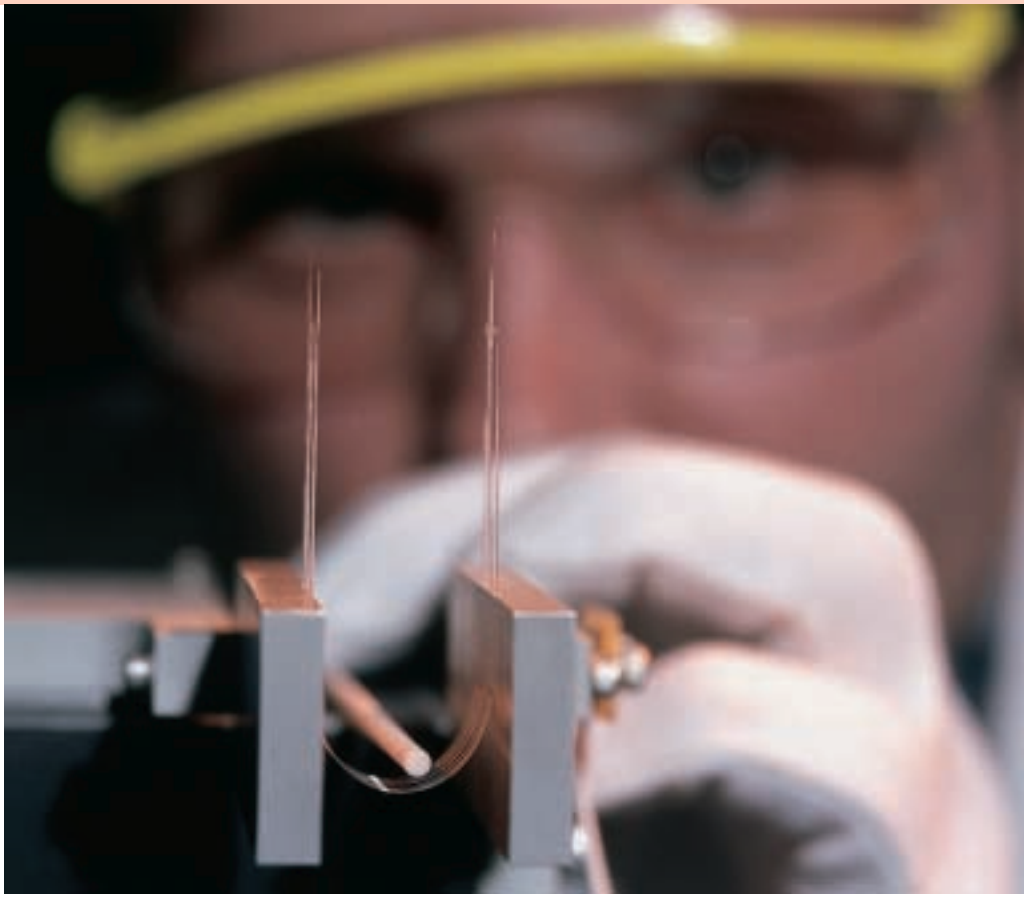
With a special apparatus it is possible to investigate crack propagation, as seen here in glass for flat-panel displays.

For reasons of product safety and product liability, it is important to ensure that glass articles withstand further processing at the customer's plant without suffering damage to the material. This applies, for example, to fiber optic image and light guides that are being used increasingly in IT networks. The long-term strength of optical fibers is a key factor determining the reliability of data communication and data processing systems. Even minute flaws can reduce the strength of optical fibers and even flawless fibers can break in time due to unfavorable environmental influences. The Analysis and Measurement Department developed an enhanced test procedure to determine the strength of glass fibers.

Time Accelerated Aging Processes

"By systematically subjecting glass in static and dynamic tests to loads that are well beyond realistic stress levels, we can observe typical signs of fatigue in a time accelerated mode," explains Dr. Nattermann. Due to this sophisticated method he managed to demonstrate that the strength of glass fibers could be improved significantly by optimizing the drawing process.

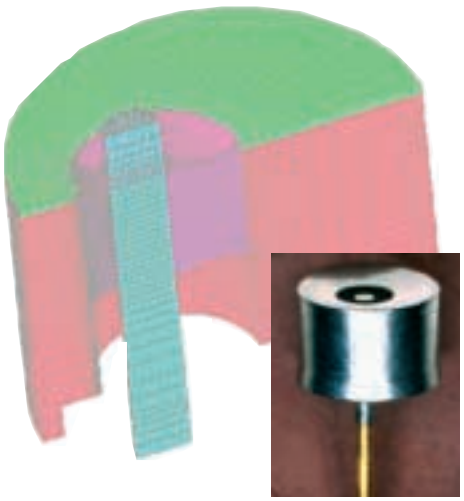
Time accelerated experiments also provide valuable information about flat glass. For example, knowledge of crack propagation is important for characterizing the reliability of glass components in flat-panel displays. In mobile phones and other flat-panel displays microscopic cracks can become longer under load or due to unfavorable ambient conditions, causing the glass to break. To be able to assess the reliability of glass components, samples of glass are intentionally damaged and systematically exposed to a defined atmosphere in a specially developed test apparatus. A camera monitors how the initial damage slowly increases. Applying the derived knowledge of the laws of crack propagation, the methods of mathematical simulation can then be used to design glass components in such a way, that their life expectancy substantially exceeds the service life of the complete products.



Two-point bending test for examining the resistance of fibers to breakage.

Computerized Product Optimization

Reliability estimates are of particular importance when it comes to personal safety. This applies, for instance, to airbag igniters, which are expected to last the entire life of the car. To insure that such an igniter operates reliably there must be a guarantee that the glass-metal seals remain tight for many years.



For product optimization of airbag igniters help is provided by so-called finite-element simulation.

In this case the task of the Analysis and Measurement Service was to optimize the product. An important aid in doing this is computer simulation, e.g. using the finite-element method with which the behavior of the airbag igniter can be calculated under strain. Since changes in geometry or material properties can be reproduced instantly by the computer, such a simulation thus points the way for further optimization stages. When these have then been implemented in practice, the outcome has to be monitored in a third stage by conducting strength tests. In this way the strength of the airbag igniter was doubled. So once again Kurt Nattermann had successfully applied his department's motto: "We don't really accept that glass is breakable" ■