A **Smooth** Cut

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SCHOTT Advanced Processing has become the market leader **laser cutting systems** for glass through new technology – and its integration into customer-friendly mass production of displays throughout the world.

SCHOTT/Thomas Bauer

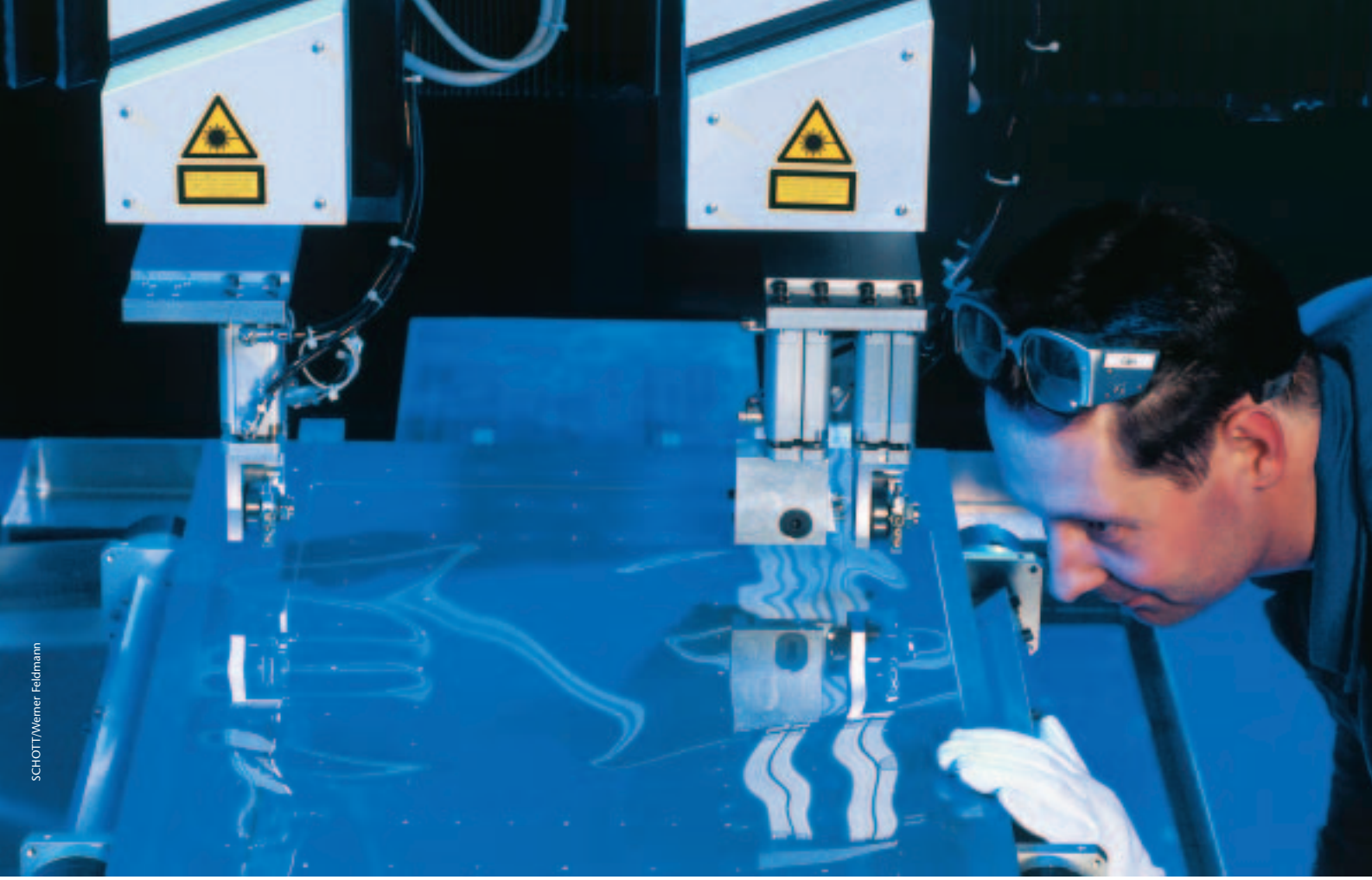
These laser devices for cutting display glass meet the requirements for integrated mass production in clean room conditions.

"Gaining our first display customer back in 1999 was not at all easy," recalls Dr. Christoph Hermanns, Managing Director of SCHOTT Advanced Processing (AP). "We spent at least one week per month in Japan". Japan is where some of world's major suppliers of display applications are based. Supported by selected local representatives and colleagues from his then five-strong team, Dr. Hermanns knocked on many a door in Japan.

Today, the SCHOTT subsidiary, established in 1997, can claim to be the market leader with a total of 30 laser-cutting systems that the young company now supplies to customers throughout the world as well as to its parent company. This success is not due solely to the company's advanced and patented technology for the cutting of flat glass ("SCHOTT Info" 85/1998). Another factor is the cost-effective automation of this technology to mass-production scale and, above all, the way these machines can be installed on the other side of the world, if the customer requires. "The key to our success is that we are always willingness to meet very different requirements and the conviction that ours is the technology of the future," says Dr. Hermanns.

Huge market created by displays

The new technology opens up great market opportunities because, for the first time, it permits efficient laser cutting of so-called flat panel displays (FPDs), which are displays for flat screens or other flat electronic devices in a variety of formats. There are plasma display panels (PDPs) for TVs and big screens – for both consumer and public use – with screen dimensions from about 40 to 60 inches. Then there are liquid crystal displays (LCDs) and thin film transistor displays (TFTs), which is one of the LCD-based technologies for computers and laptops. Com-



SCHOTT/Werner Feldmann

A development engineer makes a fine adjustment to a sheet of thin glass prior to a test run in the laser cutter.

ing soon are LCD-TV applications with screen dimensions of up to about 40 inches, which are somewhat smaller than those of PDPs. Other FPDs range from super twisted nematic displays (STN) for black and white displays and innovative microdisplays for digital cameras to organic light emitting diodes (OLEDs) made with organic lighting surfaces for – among other things – cell phone applications.

The upper estimate of the worldwide FPD market is currently US$28.3 billion, with an annual growth rate of some 18 percent. At some 73 percent, TFT accounts for the lion's share of the entire FDP market. Because the quality of TFT displays includes higher definition and low energy consumption, TFT displays are expected to achieve an average growth rate of more than 20 percent per year. The advantage of SCHOTT AP's laser cutting technology over conventional ones lies in the highly precise cutting of the displays, thus causing no microcracks. This results in hardly any material losses and higher productivity. In addition, the clear trend towards ever thinner glass makes the use of laser cutting even more attractive.

Further advantages are that process chains and tact time can be reduced. With diamond cutting, for instance, the material has to be scribed, then broken, ground and washed, whereas with laser cutting, or precisely laser scribing, the need for grinding and washing, along with the accompanying process costs, is eliminated. With laser scribing the glass is initially scribed, then cut with a laser and separated. The process operates with a precision of some 25 µm tolerance and is suitable for material with a thickness of 200 µm to 10 millimeters. In certain cases a cutting speed of up to 1,500 millimeters per second can be achieved.

Microdisplays are trendsetters

The rapidly growing future market for displays makes it extremely important to exploit these advantages for competitive reasons. This is a major reason why SCHOTT AP's client list already includes the leading Japanese display manufacturers, and now the first Taiwanese customer has been added: the display manufacturer Wintek in Taichung, which is mainly involved in production for LCD applications. Customers in Europe include the electronics group Philips, which has adopted laser cutting for OLED cutting applications in their end products, such as for charging indicators for electric shavers.

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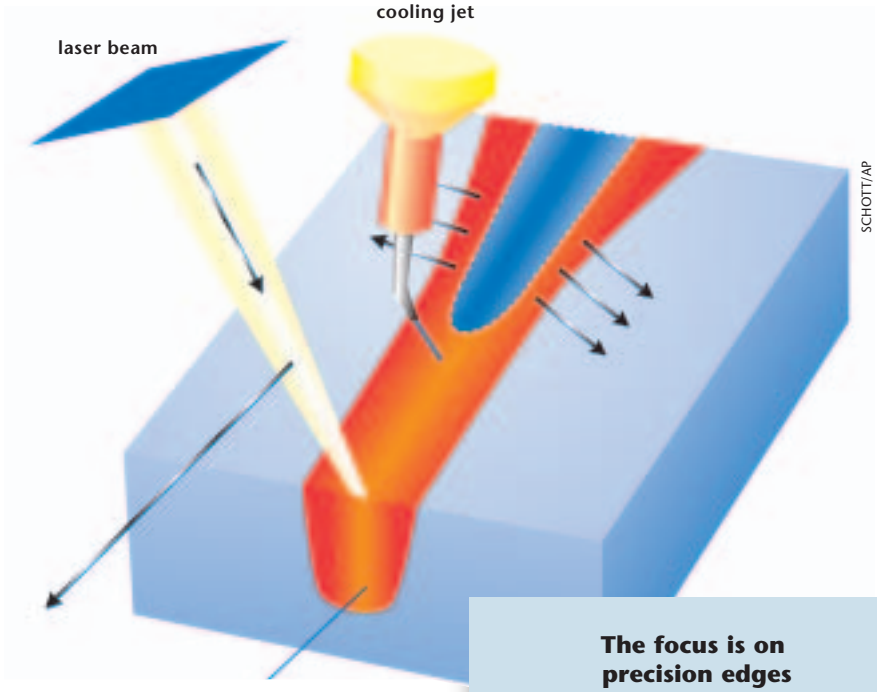
SCHOTT AP is also represented in the United Stated. The most recent plant installation was completed at the end of March 2003 at Kopin Corporation. Kopin is an innovative company based in Westborough, Massachusetts, and is the first microdisplay customer. Because Kopin produces microdisplays with edges 10 millimeters long or less, absolutely precise cutting quality without microcracks to the edges is a prime requirement. Wen-Foo Chern, Director, Display Manufacturing Engineering at Kopin, says: "SCHOTT's technology enables us to develop our next generation of products and also to meet our own customers' requirements for the very lowest tolerances in measurement." Examples of end products using microdisplays are camcorders, digital cameras and up-coming TV applications using LCD back projection technology.

In order to fully meet the needs of companies supplying these growing markets of the future, SCHOTT AP has developed several types of systems for different applications and material dimensions. The range extends to a complete inline system with laser cutter, breaker and robot to transport the material to and along a conveyor belt or cassettes. Such a system has already been supplied to a well-known Japanese customer. "This was a major success for us in light of our ambition to establish ourselves as the leading supplier of customer-oriented complete systems", says Dr. Hermanns.

New applications for laser cutting

Display applications are not, however, the only ones with good business prospects. The laser-cutting machines are already being used in the processing of glass tubes and hollow glass. They have also found their place in various applications in the biotechnology and pharmaceutical industries, such as coated substrates (bioslides) for DNA research. Further applications are in the telecommunications and automotive industries.

SCHOTT AP still sees close working relationships with customers as another key to the future. The company now has 20 Germany-based employees working on a worldwide basis with further staff operating in the main target markets.



One overriding principle in all these endeavors is the willingness to adapt to different business and local cultures and technical circumstances. "This is how we acquired our first Japanese display customer," says Heinz-Georg Geissler, Senior Manager of Sales and Marketing of SCHOTT AP. He recalls how the initial project was set up. After the contract was signed, it was crucial to keep to a tight time schedule. The delivery date could not be moved, and everything had to be organized down to the smallest detail. "On the due day countless trucks arrived for the still unfinished production building to be fitted out," says Geissler. "In the end there were more than 100 machines on the production line. Only one of them did not come from Japan." ◂

The focus is on precision edges

Conventional methods of cutting flat glass involve first using a diamond or small metal wheel to scribe a line along which the glass will be broken. This can cause tiny splinters or irregularities that in turn can lead to microcracks and ultimately to a higher risk of breakage.

In the past the edges of the glass were mainly melted or steamed using carbon dioxide (CO_2) lasers, a process that is, however, only possible with certain types of glass.

In contrast, with SCHOTT AP's new technology the CO_2 laser beam only serves to heat up the glass material along a precisely drawn line. A stream of cold compressed air applied immediately afterwards generates such extremes of tension in the glass that it snaps to give a smooth edge. The specific temperature profile between the arms of the laser beam's focal point, brought optically into a V-shape, enables the scribing to be controlled precisely. The resultant edges show no microcracks and the material is twice as break-resistant as a glass pane separated conventionally.