SYNOVA S.A
Chemin de la Dent d'Oche
CH-1024 Ecublens
Tel: + 41 21 694 35 00
Fax: + 41 21 694 35 01
info@synova.ch
www.synova.ch

Application Note No. 118

Mask Cutting for the Manufacturing of FPD with SYNOVA Laser-Microjet®

Description of Product

Flat panel display (FPD) includes a growing number of technologies such as Organic Light-Emitting Diode Display (OLED). OLEDs have the potential to replace other display technologies due to greater efficiency, easier production, more physical flexibility and lower cost. The manufacturing of OLED displays requires mask pattern for the evaporation of organic luminescent material on glass substrate.

Description of Material

Masks are typically made of stainless steel, nickel, and Invar. Their thickness varies from 30 to 50 µm and their size tends to become larger due to current market trends especially in home television as well as due to higher production efficiency.

Description of Manufacturing Task

A large amount of very small apertures are drilled in the metal sheet. The apertures have a typical size of between 300 x 100 microns and 120 x 40 microns; the corner radius shall be as small as possible. Precision, quality and speed are critical.

Description of Conventional Manufacturing Process (Status of the Art) and Problem

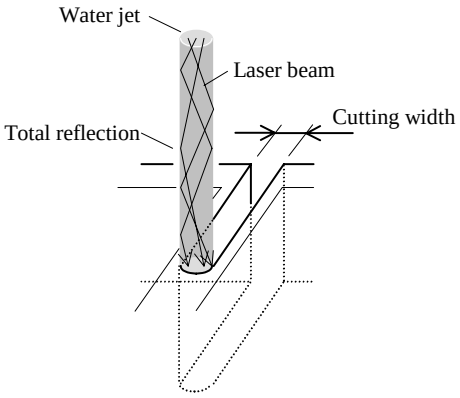
Mask cutting is usually performed by chemical etching. Although the technology is simple and mature, the method is not ideal. Important problems remain such as: significant problems in accuracy, feature size limitations, low flexibility and volimnous installation footprints.

Conventional lasers are not able to meet the industry cutting requirments and therefore are not applied here.

SYNOVA S.A
Chemin de la Dent d'Oche
CH-1024 Ecublens
Tel: + 41 21 694 35 00
Fax: + 41 21 694 35 01
info@synova.ch
www.synova.ch

Water Jet Guided Laser Technique

In 1993, scientists at the Institute for Applied Optics at the Swiss Federal Institute of Technology Lausanne succeeded in creating a water jet guided laser, called by its inventors Laser-Microjet®.



The laser beam is focused in a nozzle while passing through a pressurised water chamber. The geometry of the chamber and nozzle are decisive to coupling the energy-rich laser beam in the water jet.

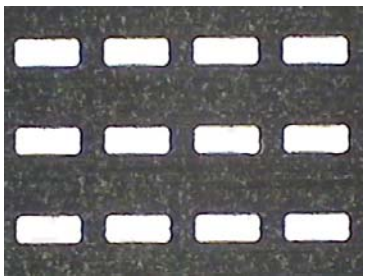
The low-pressure water jet emitted from the nozzle guides the laser beam by means of total reflection at the transition zone between water and air, in a manner similar to conventional glass fibres. The water jet can thus be referred to as a fluid optical wave-guide of variable length. Because a pulsed laser is used, the continuous water jet is able to immediately re-cool the cut, resulting in only a very slight depth of thermal penetration. The result is a very narrow, parallel, burr-free, clean cut, without any thermal damage.

Solution with Laser-Microjet® Process

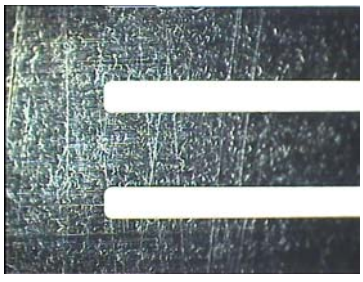
As a "cold laser", the Laser-Microjet is perfectly adapted for the high-precision cutting of metal mask used in the FPD industry. Accuracy is combined to speed; up to 20 apertures per second can be drilled. The cutting is entirely free of heat damage and the post treatment is negligible.

Any cutting form is possible. The opposite picture shows 300 x 100 µm rectangular holes in a 50-micron tick Invar mask.

The cutting speed is 4-5 holes per second.



Those lines (46 mm x 66 microns) are perfectly cut with the water jet guided laser. This 50-micron tick Invar mask was cut at the speed of 17 seconds per line.



SYNOVA S.A
Chemin de la Dent d'Oche
CH-1024 Ecublens
Tel: + 41 21 694 35 00
Fax: + 41 21 694 35 01
info@synova.ch
www.synova.ch

Benefit for the customer

The customer obtains now the following advantages:

- High speed cutting
- Excellent cutting quality
- Burr free, no oxidation
- Simplified post-treatment
- Very small beam radius on only 14 µm, sharp corners of apertures
- No scratching on back side due to absence of debris
- No heating of the sheet; neither warping nor thermal deformation
- No mechanical damages, no scratching
- Machine laser class1, completely closed, clean room compatible
- Very compact machine due to gantry axes (fixed mask – moved laser head)
- No cutting gas
- More ecologically conscientious process, because particles are absorbed in the water for filtering

Consequence of the benefits

Because of the important improvement in quality compared to chemical etching, the Laser-Microjet® process is proving itself to be the best choice for mask cutting in the future.

Machine for Laser-Microjet®[1] Cutting of Masks

Synova offers a state-of-the-art machine, especially adapted for the cutting of Masks. Optimum cutting parameters are preloaded. The machine designation is LSS 800. Due to the gantry axes system, the machine size is very small, the stencil does not move. Water jet diameter can be from 30 to 75 microns

The machine has a precision of +/- 5 microns, large processing areas (630 x 850 mm, 800 x 1000 mm, or even 1000 x 1200 mm) a maximum axis velocity of 1000 mm/s. The system is equipped with a CCD camera and fast image treatment software, allowing automatic alignment and inspection.

The operation interface is a 15-inch flat colour screen with touch panel, the machine software is based on MS Windows NT®[2]. The machine can be connected to a LAN network for data transmission. The integrated modem allows remote diagnostic service. Adapted CAM software can convert all DXF and Gerber data, fast and easy without any special programming.

A complete list of options is available such as chiller, alternative laser sources, water treatment system, reference scales, and transformers.

Synova machines have been repeatedly field proven and are used for 24h industrial production.

[1] Laser-Microjet® is an international protected trademark of Synova S.A, Switzerland.
[2] Windows NT® is a trademark of Microsoft Corp.

