

Application Note No. 129

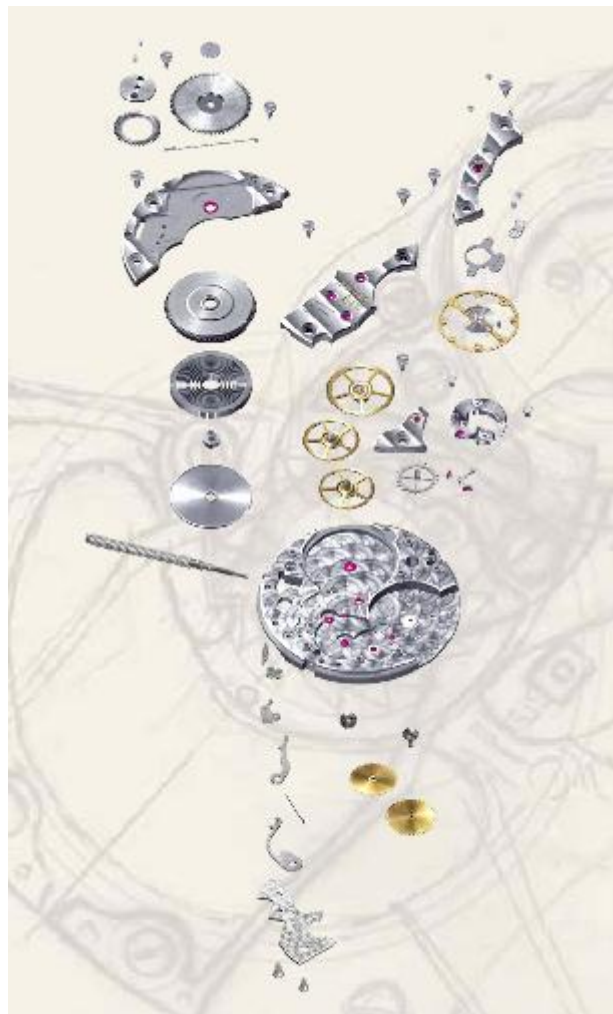
Synova Laser-Microjet: a major advantage for Watch Industry

The Synova technology can be used to improve the cutting processes presently in place in the watch industry. Typical cutting methods are dry laser, EDM (Electrical Discharge Machining), stamping or Micro-machining. But all these technologies have technical limitations.

The water jet guided laser provides a suitable technique for the cutting of thin metal such as brass, stainless steel or copper alloy as CuBe. It enables excellent cutting quality free of mechanical stress, thermal damages, contamination, and chipping.

Description of Product

A watch is composed of a lot of parts. Some of them are decorative like hands, dial or appliques and some others are functional like gears or springs. But in both cases the Synova Laser-Microjet® is the suitable technology to cut all this kind of pieces.



Description of Material

The most common materials are brass, CuBe and certain grade of stainless steel cut mainly from metal stripe (0.15 to 0.3 mm thick). But for some applications like dials it could be thicker (up to 1.5 mm).



Description of Manufacturing Task

Actually 3 different technologies are used to process watch pieces: stamping, EDM (Electrical discharge Machining), micro-machining and dry laser cutting.

They all have their limitations: the flexibility for stamping, process time for EDM and shape limitation for micro-machining.

It is also difficult to process brass with high quality by dry laser because of the heat damage.

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 pressurized water chamber. The geometry of the chamber and nozzle are decisive to couple the energy-rich laser beam in the water jet.

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 fibers. *Cutting with water jet guided laser.*

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

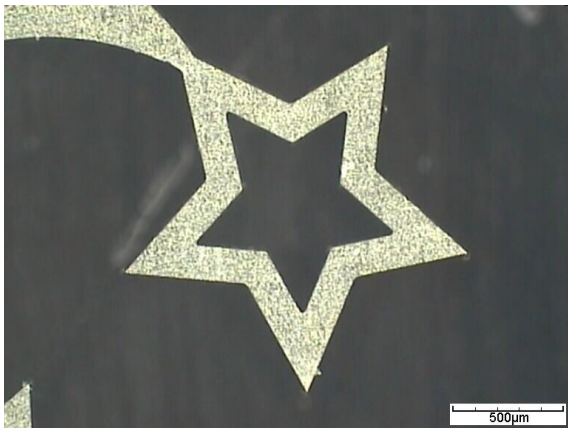
The Laser-Microjet, or water jet guided laser, provides a suitable technique for the cutting of metal. It enables excellent cutting quality free of mechanical and heat damages. Generally to achieve a high level of quality, pieces are cut in one pass with a cutting speed ranging from 0.5 mm/s to few mm/s depending on the thickness.

The Synova laser cuts in any direction and thus any contour of edges are possible even very sharp edges. Shapes can be designed on a CAD computer and the process is very flexible.

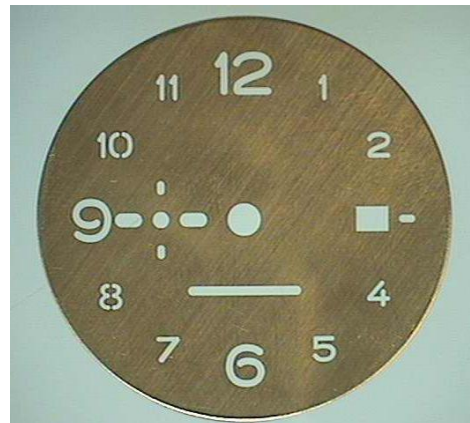
Synova Laser Microjet cut

The water jet guided laser provides a suitable technique for metal cutting with high quality as needed for the watch industry. It enables excellent cutting quality free of mechanical stress, thermal damages, contamination, and chipping.

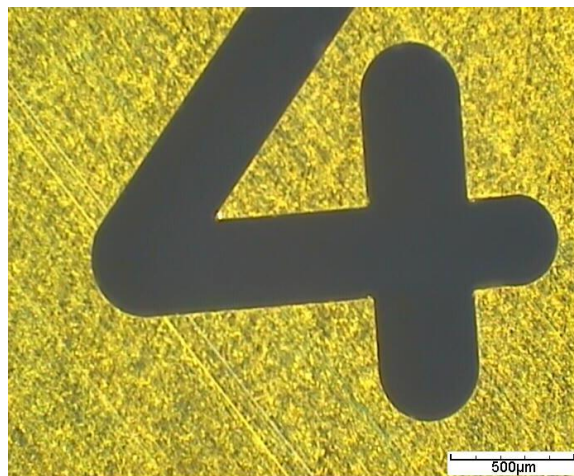
Some examples of pieces obtained by Synova Laser Microjet® cutting are presented below. The first ones concern decorative parts in brass and in stainless steel.



Picture 1: Detail of a cut in stainless steel, thickness 0.15 mm.

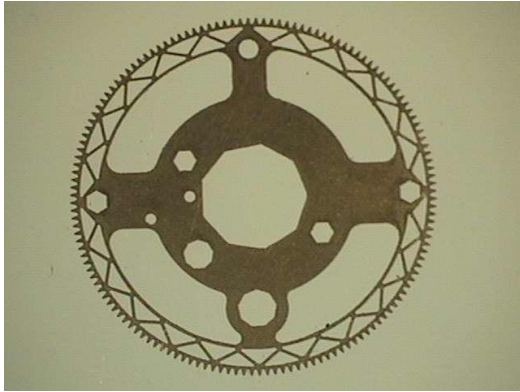


Picture 2: Overall view of a dial in brass cut by Laser Microjet®.

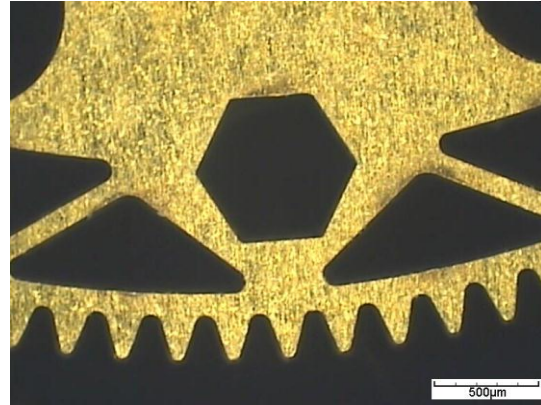


Picture 3: Detail view of the cut.

The last pictures illustrate the flexibility and the possibility to obtained sharp angle by Synova Laser Microjet®.



Picture 4: Overall view of a gear in brass cut by Laser Microjet® .



Picture 5: Detail of a cut in brass, thickness 0.15 mm.

For the functional parts the major advantage of the Laser Microjet® Technology is the very low roughness of the cutting wall obtained for brass and CuBe.

Benefit for the Customer

The customer now obtains the following advantages:

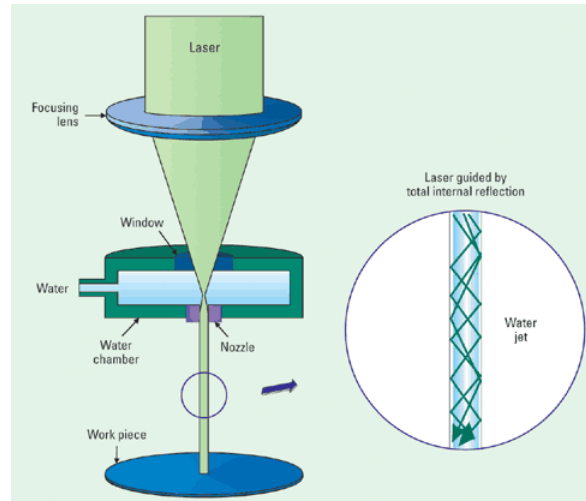
- *Very flexible process*
- *Low roughness of the cutting wall*
- *No heat damage*
- *Ideal for thin metals*
- *Suitable to cut very small hole or shape (~ 30µm)*
- *Metal thickness from 0.15 mm to 5 mm*
- *No tool-wear*
- *Very few consumables, low running costs*
- *Important cost saving*

Consequence of the Benefits

Because of the vast improvement in costs, quality, flexibility and productivity compared to conventional process, the Laser-Microjet process will be the future choice for cutting of metal sheet.

Machine for Laser-Microjet[®] metal cutting : LCS

The Laser Cutting System (LCS) is the most suitable for these applications. This machine is based on the Laser Microjet[®] technology and combines the advantages of the high energy pulsed laser with a hair-thin water jet. While the laser is used for material ablation, the water jet is used for guiding the laser light, cooling the edges and preventing the sample from particle contamination, advantages that are essential for machining of metal like steel with high quality.



The LCS is a versatile machine presenting many options such as Z or R-axis. Various laser sources are available allowing up to 200 W.

