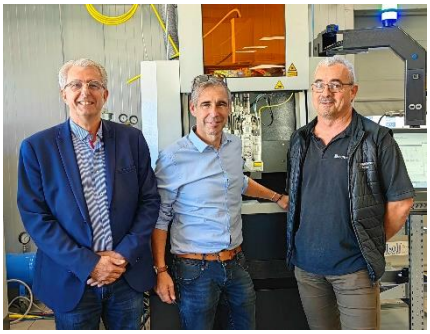
MicroJet® Laser Technology: High Precision, Cleanliness, and Material Preservation

Laser Micro-Machining for Medical Technologies and Precision Mechanics

Microweld specializes in implementing various laser technologies for cutting, welding, or marking products in the fields of medical technology, watchmaking, and precision mechanics. However, lasers tend to generate significant localized heat in the material, which can lead to degradation of the properties of sensitive materials. That's why the company acquired an innovative laser cutting system in early 2023. With the Laser MicroJet® (LMJ) process, the laser beam is confined within a water jet that cools and cleans the cutting slot.



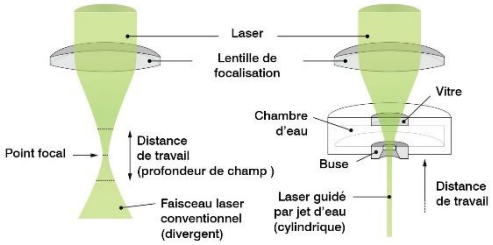
"When I founded Microweld in 1997, we primarily focused on laser welding for the automotive sector," recalls Norbert Giraud, CEO of the company based in Chavanod, France. "Our expertise in the automotive industry gradually attracted clients from other sectors. Quickly, we expanded the use of laser technologies to other areas such as cutting or marking. Then, the company began performing repair welds on worn or damaged molds for the production of injection-molded parts, which was a significant leap forward for us. Microweld was the first company to implement this technology in France. Since then, we have broadened our range of services to include other manufacturing operations, such as the assembly of sub-assemblies or fully finished products. Other important customer segments have also been added to the industries we serve. Our rapid growth has required several relocations over the years". Today, Microweld has around fifty employees with about thirty laser installations of various types and power ranges.

Moving towards precision engineering and microtechnology

"We are convinced that our future lies in microtechnologies," explains Thierry Fradet, Sales and Business Development Director at Microweld. The manufacturing of large parts in large quantities does not require as much qualification from the staff as microtechnologies, which often involve challenging tasks and the use of sometimes highly exotic materials for small production volumes. This is where Microweld excels, thanks to its experienced and highly skilled staff. The extensive know-how and experience that the company has gained over the years are essential assets. Such expertise is not easy to find in the market. While educational institutions provide good theoretical knowledge, freshly graduated students lack experience. It takes them several years of practice to gather all the required skills. Microweld's staff, on the other hand, possesses the necessary qualifications. This is reflected in the company's customer base, as nearly 80% of its revenue is now generated in the field of medical technologies. Watchmaking and micromechanics are other important market segments. For Thierry Fradet, these sectors hold the greatest potential for conquering new markets.

Joining a major group to gain fresh impetus

"In these market segments, it is necessary to rely on a solid structure, offer a wide range of expertise, and have significant financial stability," adds Norbert Giraud. That's why, in 2021, he sought to connect with potential partners. After various discussions, he decided to join the Acrotec Group to face future challenges. His choice was primarily motivated by the nature of his counterparts: leaders well-acquainted with the practical realities of a production company, rather than fund managers or financial investors. The group does not interfere in the management of the company. However, Microweld, now part of a group of around thirty companies offering a wide range of complementary specializations, can benefit from interesting synergies. The advantage for its customers is dealing with a "one-stop shop." They now have a partner with broad development potential that can provide them with complete solutions while remaining their sole point of contact. Instead of having to painstakingly order screws here and levers there, they can directly obtain the desired complete product.



A highly anticipated laser technology for achieving "clean" cuts

"Belonging to Acrotec has also facilitated our decision to embark on an entirely innovative laser cutting technology for machining demanding microcomponents," says Norbert Giraud. Compared to cutting processes like wire EDM, this technology has a crucial advantage: components are not contaminated by traces of troublesome substances such as nickel or copper. This is particularly important for medical devices, including implants. The patented Laser MicroJet® technology guided by a water jet from Synova in Switzerland also avoids the drawbacks of conventional laser cutting systems, where the material is literally melted by an ultra-hot laser beam. This results in material deterioration in the area near the surface of the cutting slot and fusion burrs below the workpiece. With Synova's LMJ® lasers, the laser beam is confined within a very thin and stable cylindrical water jet at a pressure of 100-500 bars. Due to total internal reflection at the interface with the ambient air, the laser cannot exit the water jet and remains focused over a relatively long distance. The cutting slot is constantly flushed with very pure water, so even the most sensitive materials undergo virtually no structural changes. Additionally, the obtained cutting edges are smooth and perfectly vertical.

A highly satisfying collaboration with Synova

"The installation of the Synova LCS 150, delivered to us last March, includes a rotary axis in addition to its three linear axes," explains Thierry Fradet. According to him, the experience of delivery, commissioning, and training was entirely successful. The use of the control system proved easy to learn. The fact that Microweld's staff already had prior experience with laser systems was a plus.

As a result, the new installation was put into production in just a few weeks. Synova was responsive and efficient when Microweld had questions or encountered issues.The quality of the cutting edges and the micrometric precision of the LMJ system are particularly remarkable. While with "conventional" laser cutting processes, significant flank angles are inevitable, the new installation allows for deviations of only a few µm from the vertical, even for cut lengths on the order of a centimeter. Microweld was also able to make significant progress in cutting thin graphite films. Here, the minimum thickness that could be processed was reduced from 200 µm to only 70 µm. "We are also very satisfied with the wide variety of demanding materials we can process with this installation, including nitinol, titanium, tantalum, niobium, and tungsten," concludes Norbert Giraud.

Klaus Vollrath b2dcomm.ch

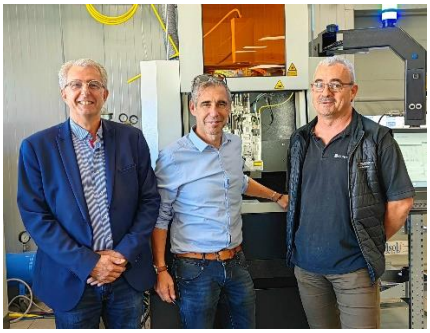
Addresses

Microweld, Parc Altaïs, 35 rue Uranus, F-74650 Chavanod, France, T.: +33-450-698485, technic@microweld.fr, www.microweld.fr

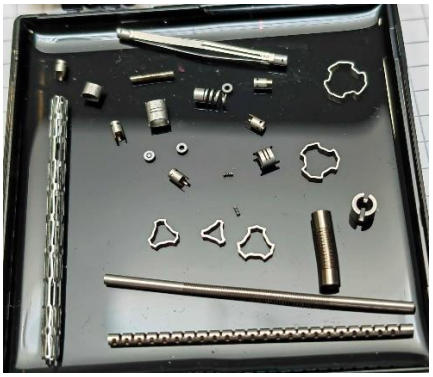
Synova S.A., Route de Genolier 13, CH-1266 Duillier (Nyon), Switzerland, T.: +41-21-5522 600, sales@synova.ch, www.synova.ch

Captions

The LCS 150 three-axis MicroJet laser equipment installed at Microweld in March 2023 is equipped with an additional rotary axis. (Photo: Klaus Vollrath)



Thierry Fradet, Sales and Business Development Director at Microweld, the CEO of the company Norbert Giraud, and laser technician Xavier Perissoud (from left to right) proudly stand before 'their' Laser MicroJet installation (photo: Klaus Vollrath).

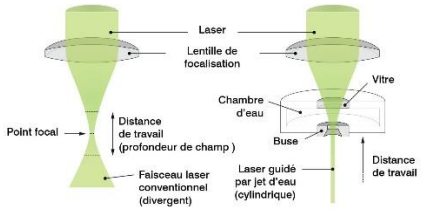


A selection of microcomponents manufactured by Microweld, including a stent for stabilising arteries and a cutting device for removing calcium deposits in blood vessels (Photo: Klaus Vollrath)

Microweld employees have access to around 30 different laser systems (photo: Klaus Vollrath)

The quality control department is well equipped (photo: Klaus Vollrath)

These sophisticated instruments for knee surgery are delivered fully assembled and sterile-packed (photo: Klaus Vollrath).



Unlike 'conventional' laser optics, where the intensity of the laser beam rapidly decreases behind the focal point (on the left), in the water-guided LMJ laser, the laser beam is guided within a well-focused water jet. This enables very deep cuts with vertical and very smooth surfaces (graphic: Synova).

Nitinol bone anchors manufactured using the LMJ process for orthopaedic interventions (Photo: Klaus Vollrath)

Microcomponents for medical devices cut using the Synova system (Photo: Klaus Vollrath)