

| Ultra-fast laser processing, high-performance industrial technology



Ultra-fast laser processing, a high-performance technology opportunity

Ultra-fast laser processing enables functionalization, texturing, or micro-machining through rapid treatment without material deterioration, in both 2D and 3D, on a wide range of materials.



Technical specifications of our ultra-fast laser processes:

- Suitable for all materials, from the hardest to the most fragile
- Extreme precision
- Thermal control
- No pre- or post-processing
- Reproducibility
- Wide range of surface geometries: 2D flat & complex 3D
- All part sizes from μm^2 to m^2
- Material removal without burrs or thermal impact
- Dimensional control

Operational characteristics of our ultra-fast laser processes:

- Accelerated productivity
- Cost optimization
- Enhanced performance of the final product (improves the intrinsic properties of materials)
- Low carbon footprint: limited electrical consumption, non-contact technique, additive-free, and no consumables

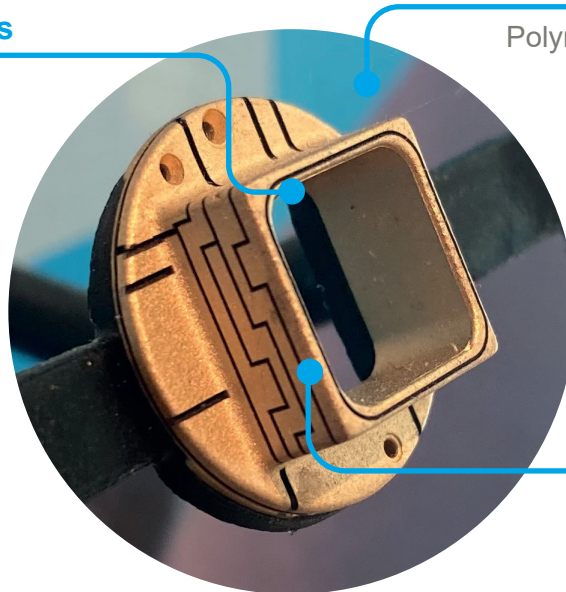


Materials

- Polymer (PET, Parylene, PTFE...)
- Metals (Aluminium, Gold, Copper, Nickel, Tungsten...)
- Composites
- Ceramics

Industrial Applications

- Cutting/Drilling/Dicing
- Ablation of thin layers
- Etching
- Micro & Nano Surface Texturation

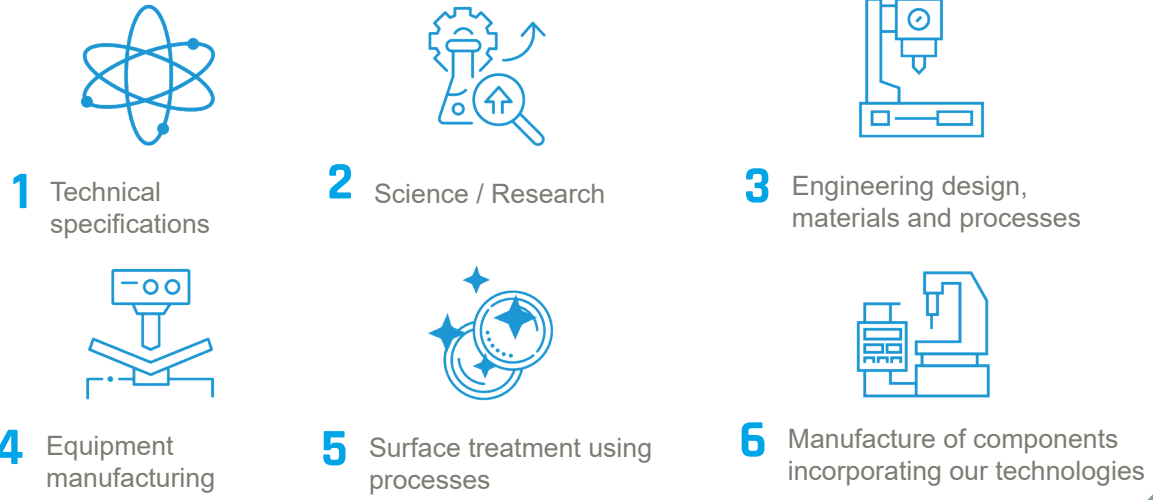


Functionalization of your surfaces

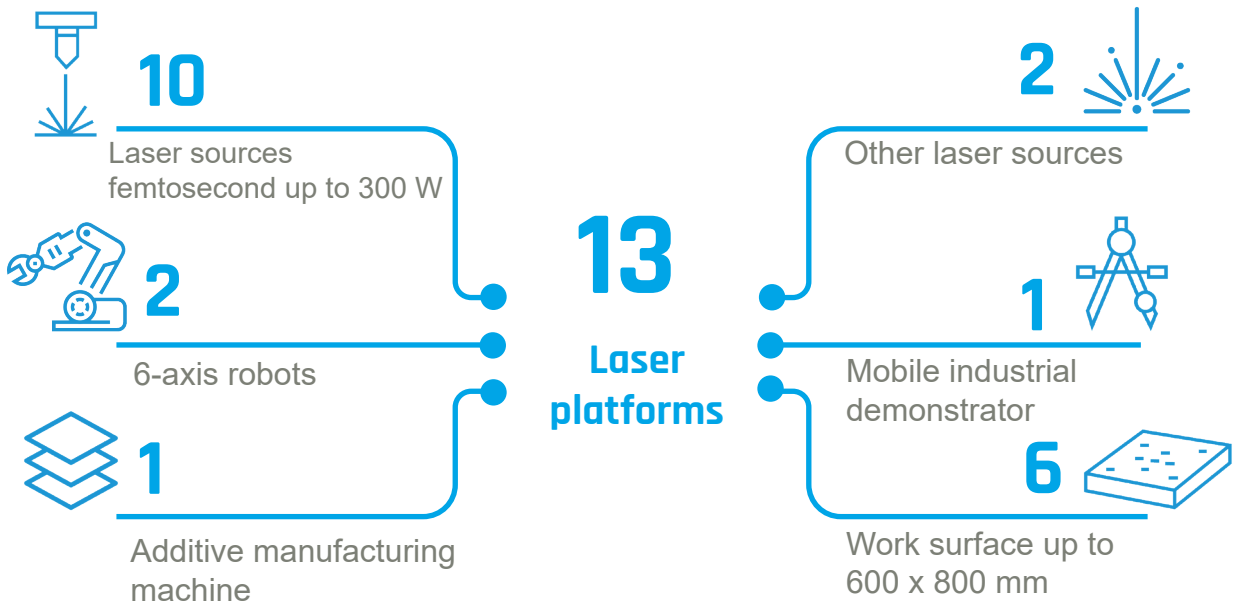
- Hydrophilic / Hydrophobic
- Anti-icing
- Sealing
- Enhancement
- Absolute black, anti-reflective
- Roughness modification
- Wettability (adhesion, surface preparation)
- Tribology (reduce friction and wear)

HEF value chain

Vertical Integration: From Science (R&D) to Industry (Production)



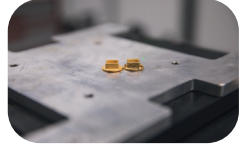
Capabilities



Applications

LASER ETCHING

Ultra-fast technology enables precision engraving with rapid machining (mm³/s) and a roughness of less than a micron, without material degradation in both 2D and 3D. The laser allows for engraving with thermal control and preservation of material integrity, suitable for the creation of microchannels, tribology, sealing, or aesthetics...



MICRO AND NANO TEXTURATION

Surface texturing using ultra-fast laser technology allows for the modification of a material's structural properties, providing technical functionalization to the piece.

Laser technology enables high-speed ablation texturing (mm^3/s) with very high resolution (μm) without damaging the materials in both 2D and 3D.

The laser can also create nanometric surfaces for various functionalities, such as:

- Wettability (hydrophobic, hydrophilic, etc.)
- Sealing
- Anti-icing
- Tribology (friction, adhesion, wear, etc.)
- Conductivity
- Coloration (absolute black, iridescence effects, etc.)

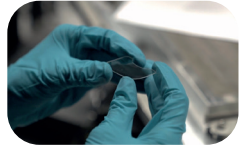


CUTTING AND DRILLING

Laser drilling allows for the creation of small holes (down to $5 \mu\text{m}$ in diameter) with varied geometries, suitable for applications on glass, metals, and plastics.

Laser technology enables through-cutting of various materials (thickness $\leq 5 \text{ mm}$) at high speed ($\geq 1 \text{ m/s}$ in a straight line and $\geq 0.2 \text{ m/s}$ for more complex geometries).

The laser preserves the substrate by controlling thermal effects and ensuring clean, burr-free cut edges.



SELECTIVE ABLATION OF THIN FILMS

Laser ablation of thin films (or «decoating») enables selective engraving without delamination, burrs, or microcracks on a layer of its substrate.



LASER MARKING

Laser marking involves permanently altering the contrast of a piece. This process is flexible, clean (additive-free), non-contact (no wear), and maintenance-free. It can also be used for engraving serial numbers or as an anti-counterfeiting measure.

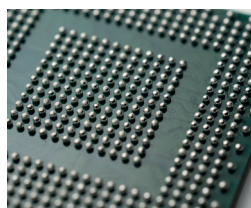


Markets

Laser technology serving all industries:



Transport



Electronics



Mechanical engineering



Defense



Energy



Contact

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«Biomimicry serves as an inspiration for this technology. For example, we can replicate the structure of a shark's skin to enhance hydrodynamics, that of a lotus leaf to make surfaces hydrophobic, or even that of a gecko's feet for adhesion»