

# microrelleus



## EPIC ONLINE TECH. MEETING ON LASER MICROMACHINING

Femtosecond laser - High accuracy laser micro-processing

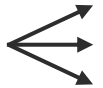


# FUNCTIONAL TEXTURING

- 1) Who we are
- 2) Femtosecond laser technology
- 3) Functional texturing
- 4) Microstructuring
- 5) Cases Study



# Who we are

- Service provider for industry  Industrial engraving  
Laser texturing  
Laser microstructuring
- Company creation: 1983 (Pantograph → Die-Sinking EDM → CNC Milling → Laser)
- Facilities in Barcelona – Spain
- 2013: nanosecond laser service in 5 axis
- **2016: femtosecond laser service in 5 axis**



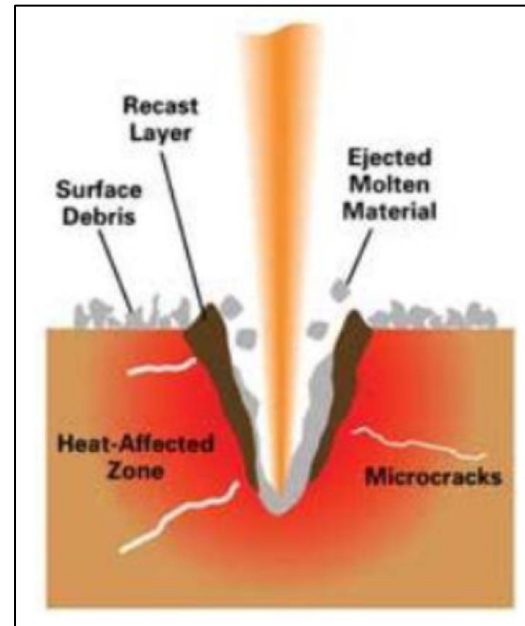
# Technology - What a femtosecond laser is?

## Characteristics:

- Ultra-short pulse duration laser
  - (almost no thermal effect over the material)
- Clean, Sharp and burr-free micro milling
- High quality surface finishing
- 5 axis
- Milling over any material
  - Plastic
  - Glass
  - Hard metal
  - Steel
  - Carbide silicium
  - Etc.
- Optimal technology for:
  - Microcavities in mold
  - Microfluidic channels
  - Micro milling for stamping tool
  - Micro structuring
  - Etc.

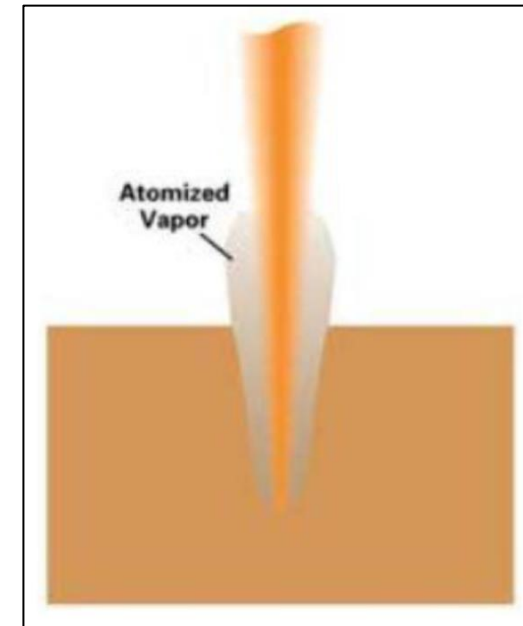
## Nanosecond laser ( $10^{-9}$ sec)

- Heat affected zone
- Burr



## Femtosecond laser ( $10^{-15}$ sec)

- “Cold” ablation
- Absolutely burr-free

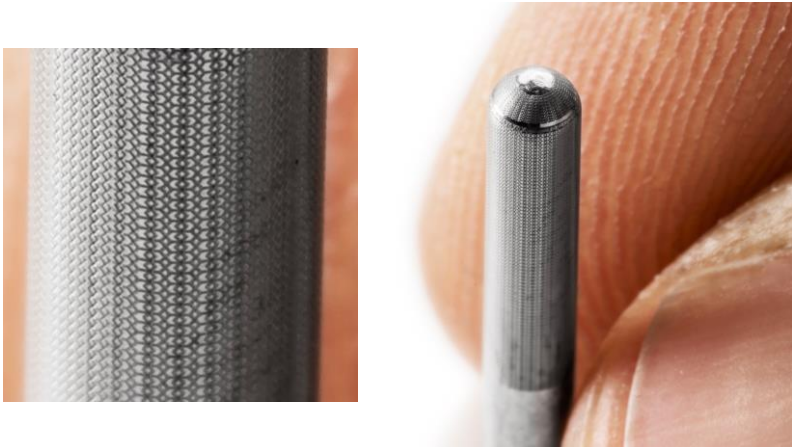


\*Femtosecond laser beam diameter:  
from  $50\mu\text{m}$  to  $10\mu\text{m}$

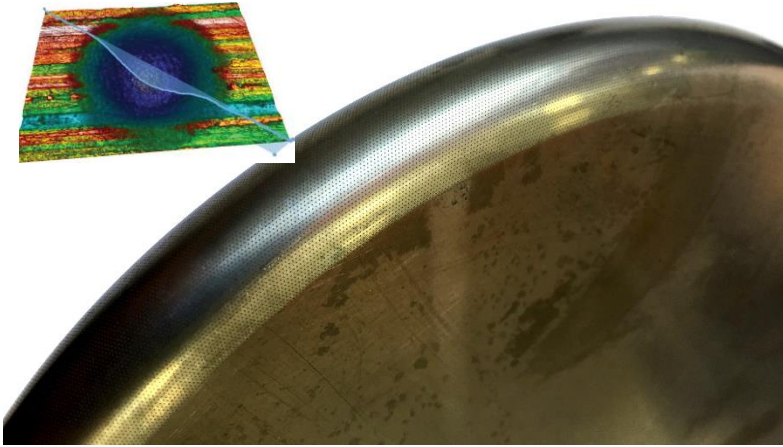


# Micromachining using femtosecond laser

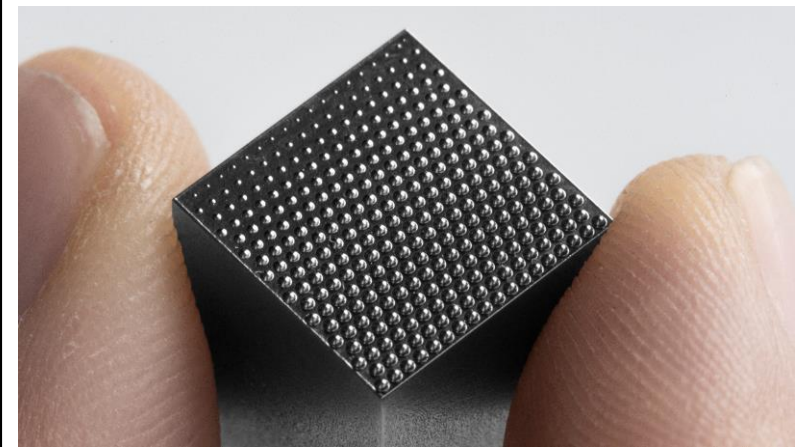
Microstructuring for a medical device



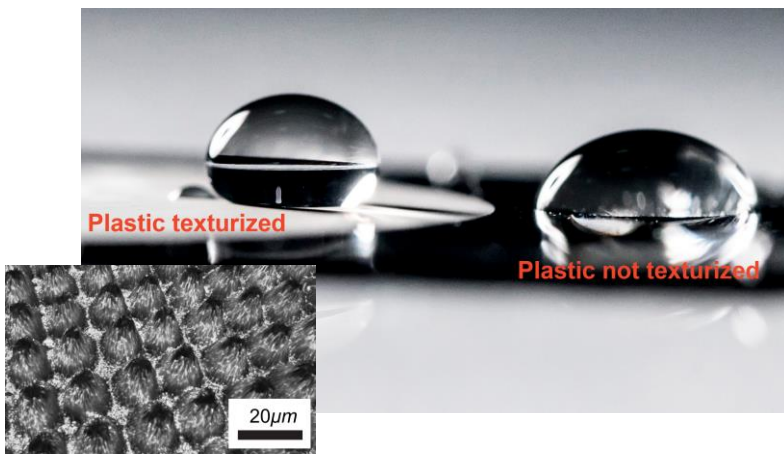
Self-lubricating microstructuring on steel tool



Micro-optics on mold insert



Superhydrophobic texture from mold insert



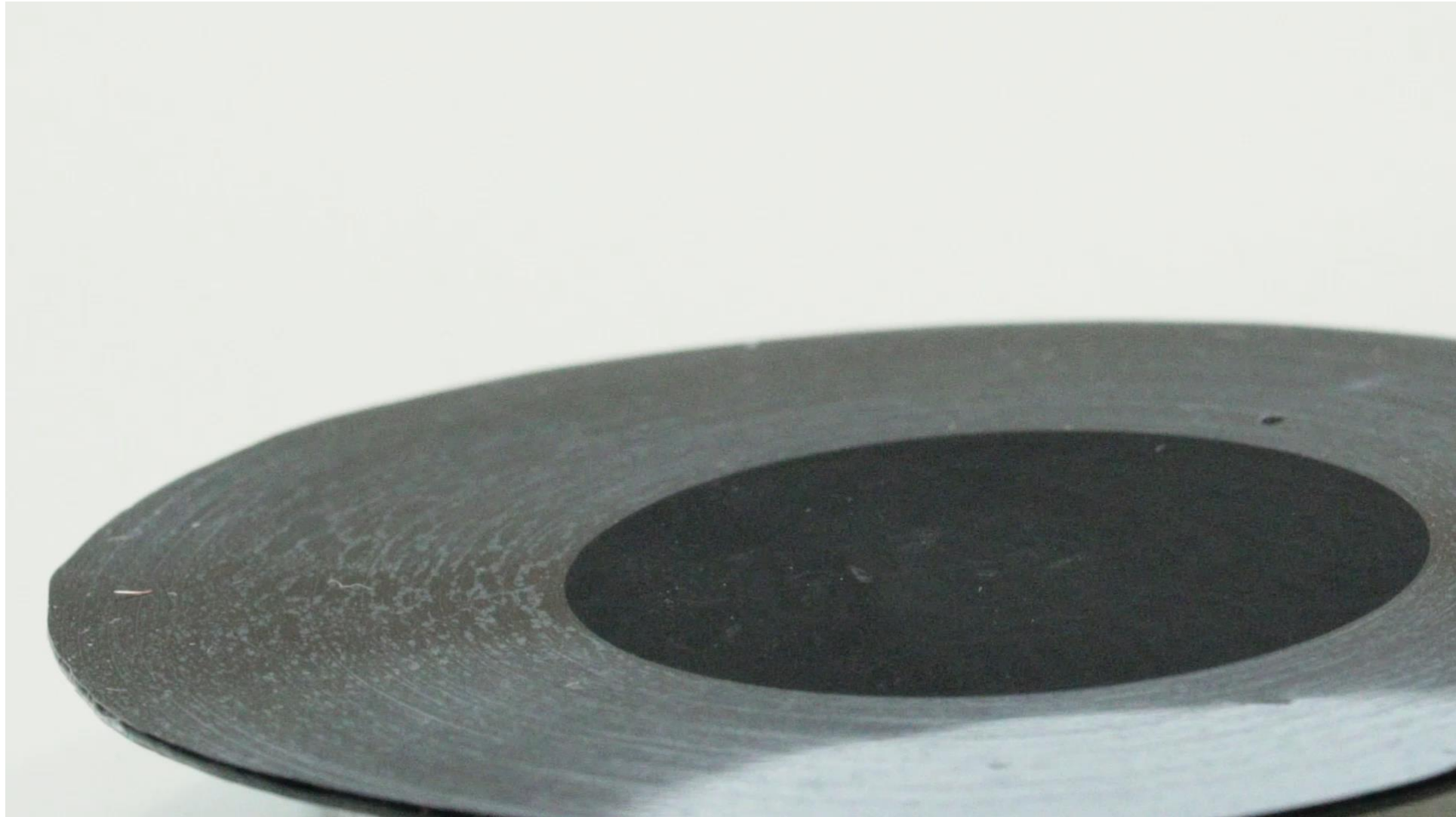
Light diffraction texture



Micro-optics on PMMA prototype parts



# Functional texturing - Hydrophobicity



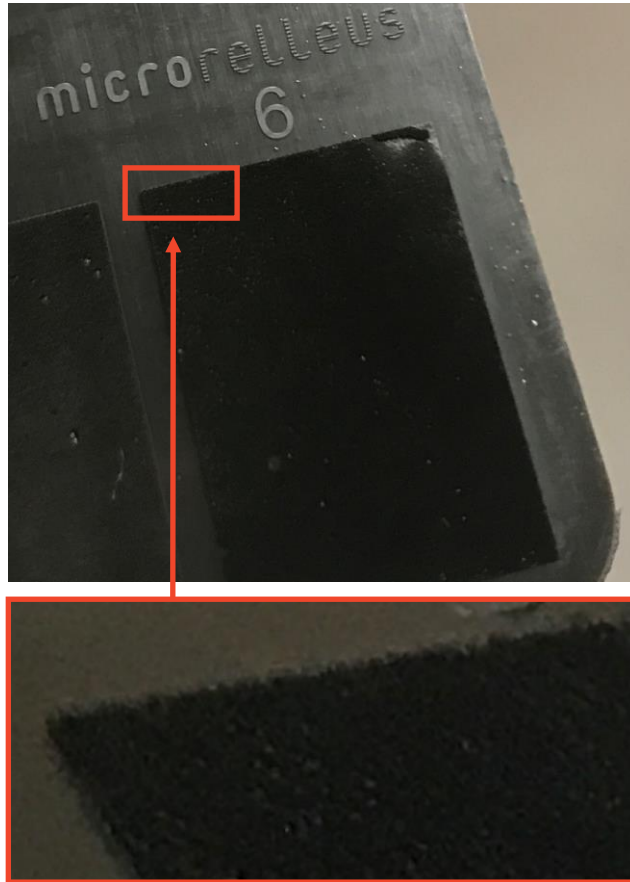


# Functional texturing – Light diffraction (design)

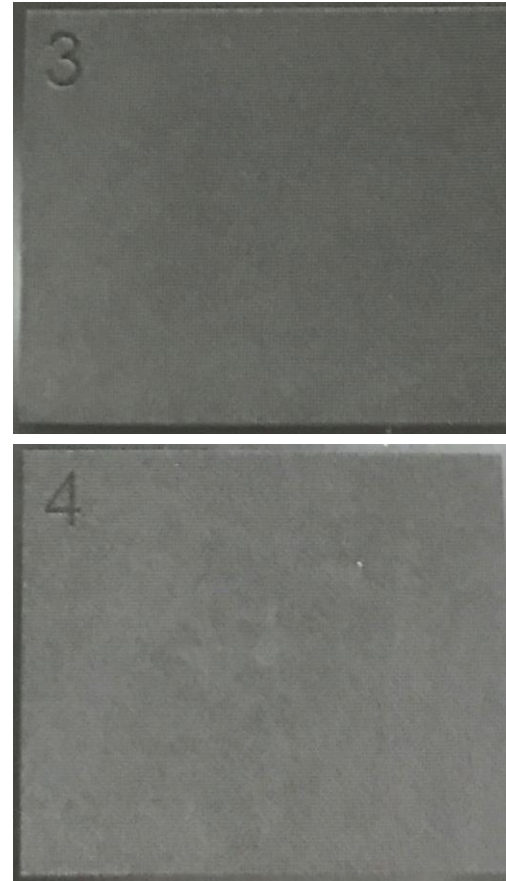


# Functional texturing – Sensitive texturing

- Peach skin effect



- Soft-touch effect

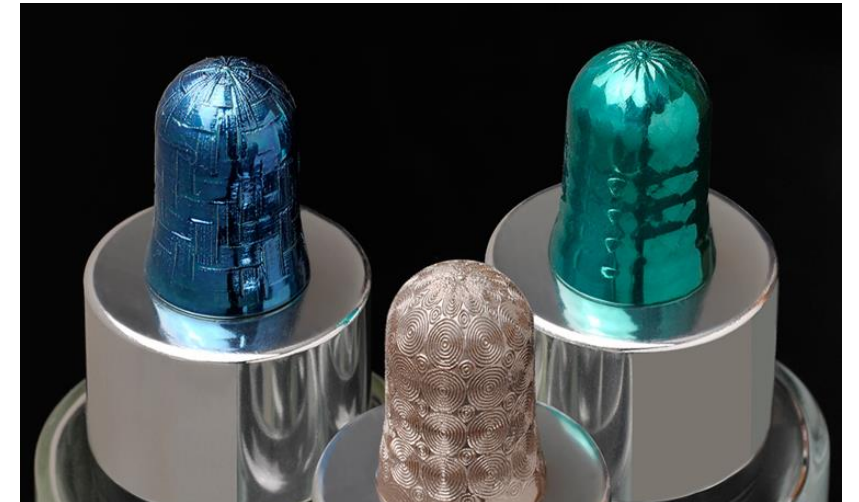


- Anti-scratch





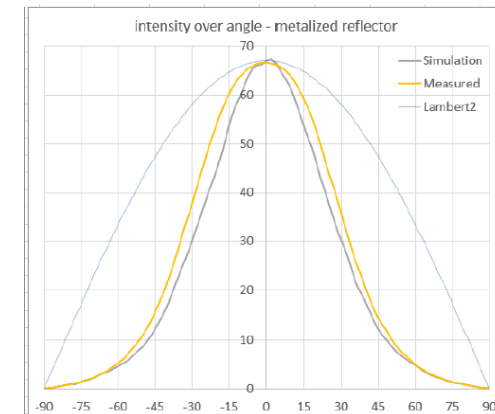
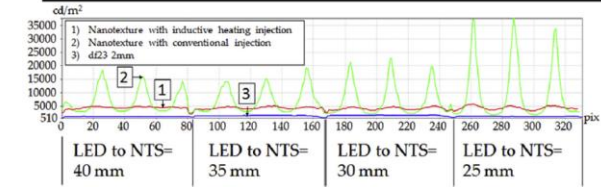
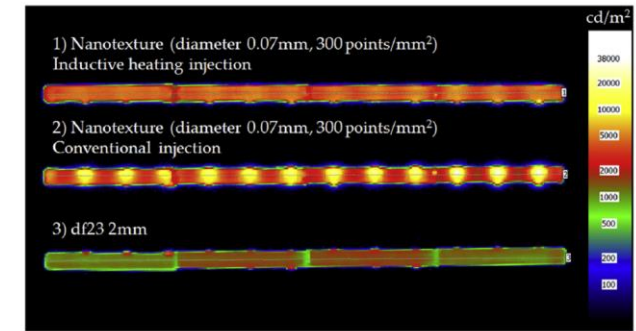
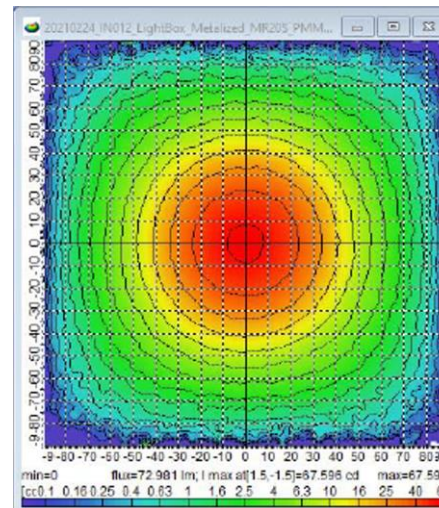
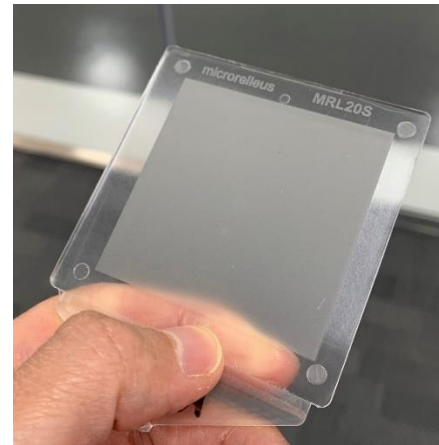
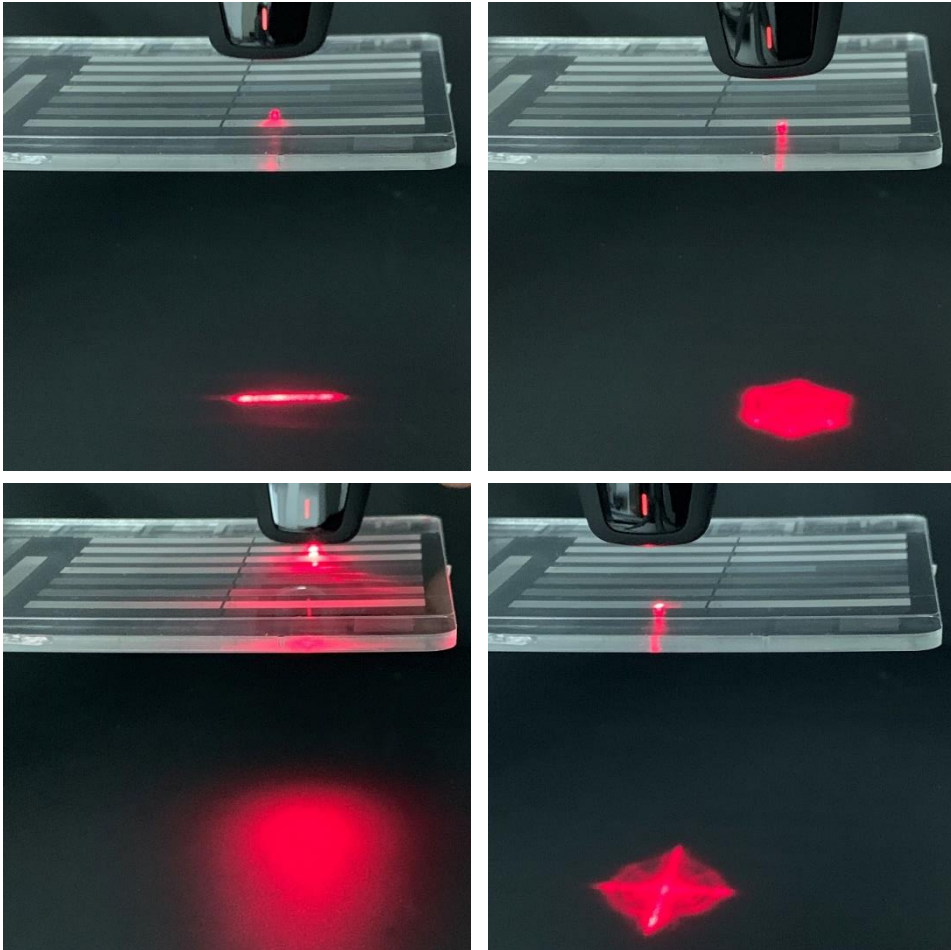
# Design texturing





# Laser texturing – functional texturing

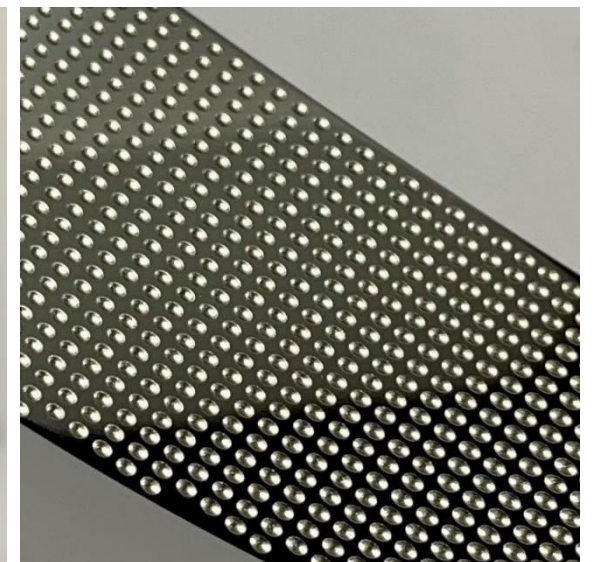
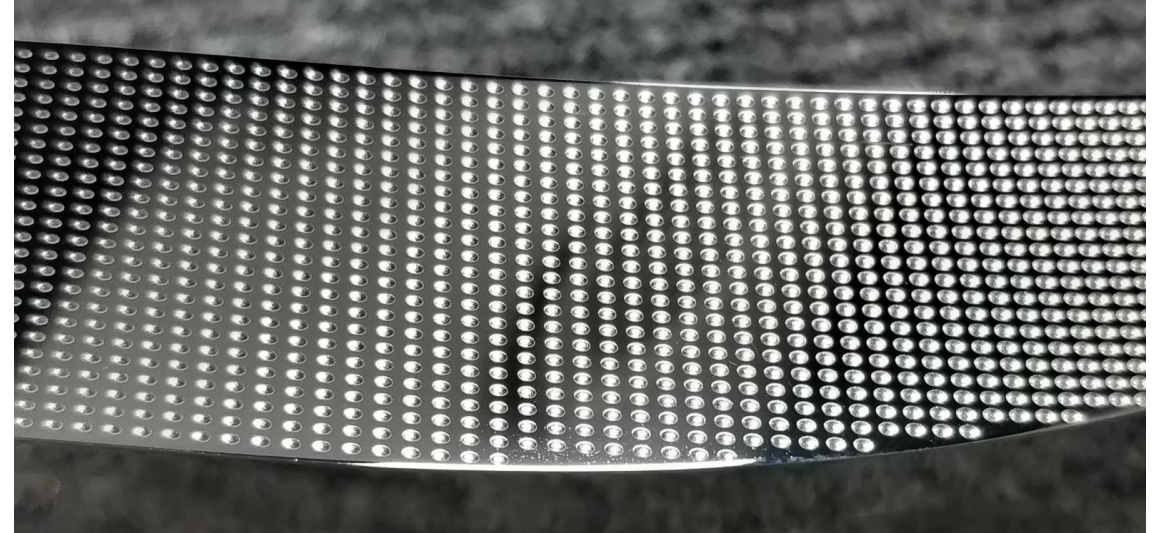
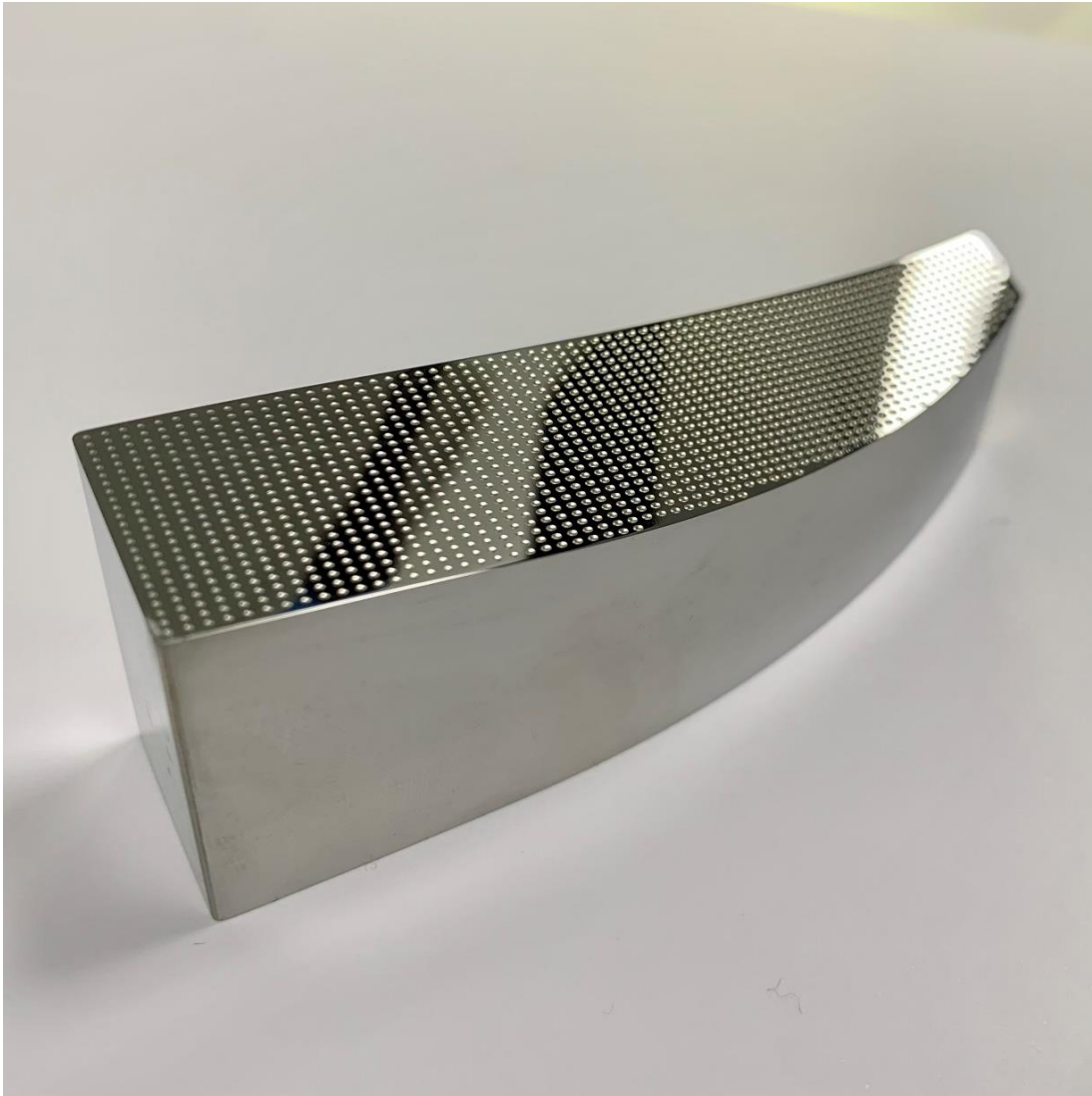
Homogeneous light diffusion and light direction 1D and 2D



Pina-Estany, J., García-Granada, A. A., & Corull-Massana, E. (2018). Injection moulding of plastic parts with laser textured surfaces with optical applications. *Optical Materials*, 79, 372-380.  
Textures: Microrelleus

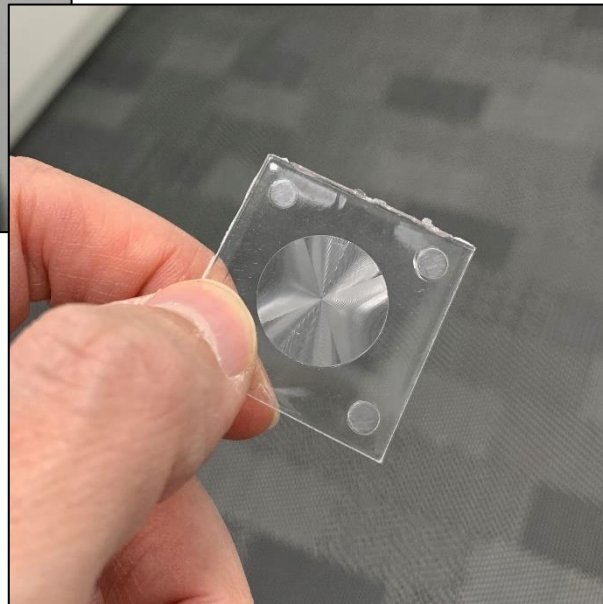
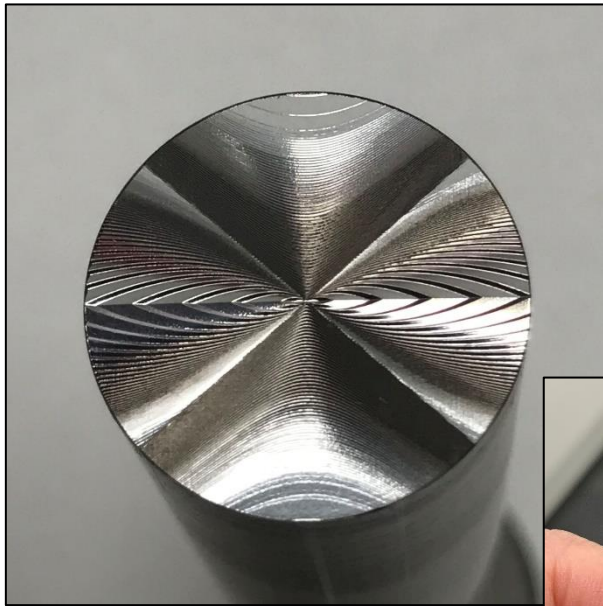


# Mould microstructuring for lighting

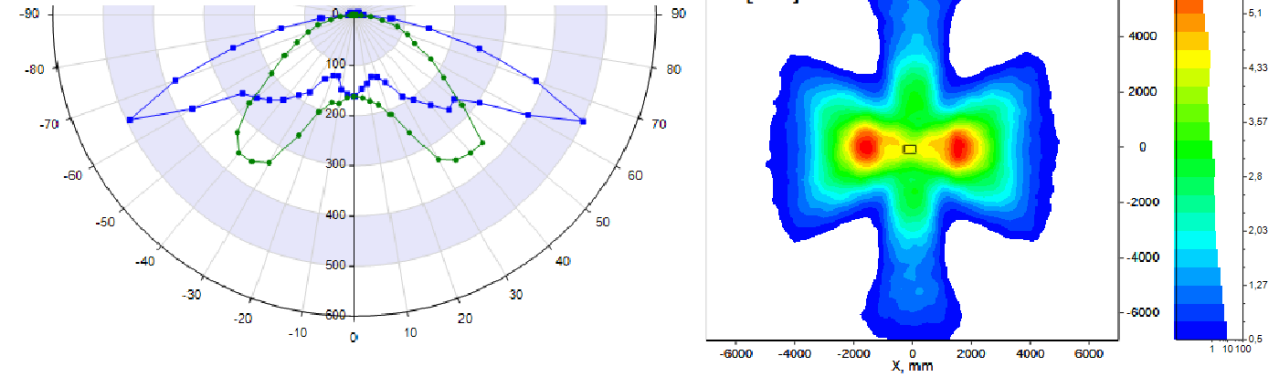


# Micro-optics on mould

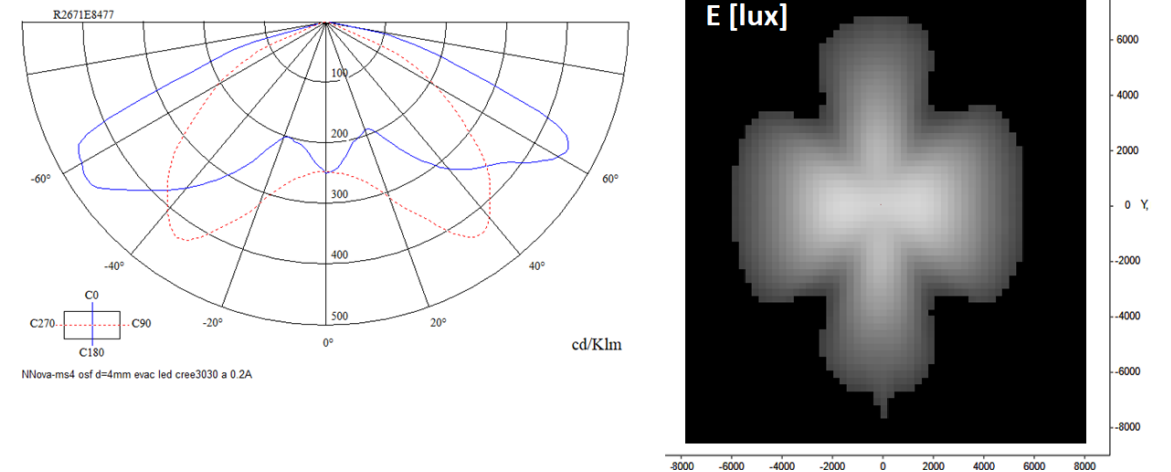
Freeform micro-optics (Customer: Daisalux)



Simulated value



Measured value

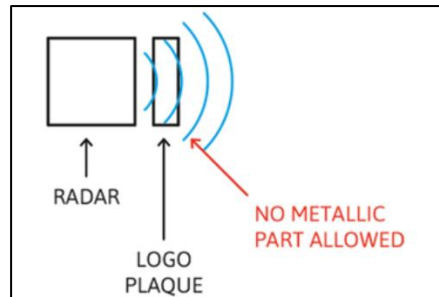




# Design texturing – Case Study: Land Rover Defender

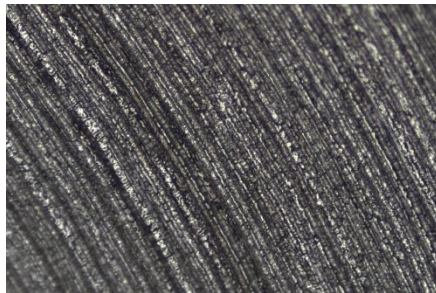
## 1. Customer request

Customer asks Microrelleus possibility to imitate brushed aluminum on mold to avoid metallic part because of new position of the radar



## 2. Microrelleus feedback and first action

Microrelleus analyzes using confocal microscope the desired material imitation and creates a design proposal.



## 3. Texturing the mold insert and final part

Thanks to our texturing limitless design possibility the radar can develop its function.



# Laser microstructuring – Case Study: microfluidics

## 1. Customer request

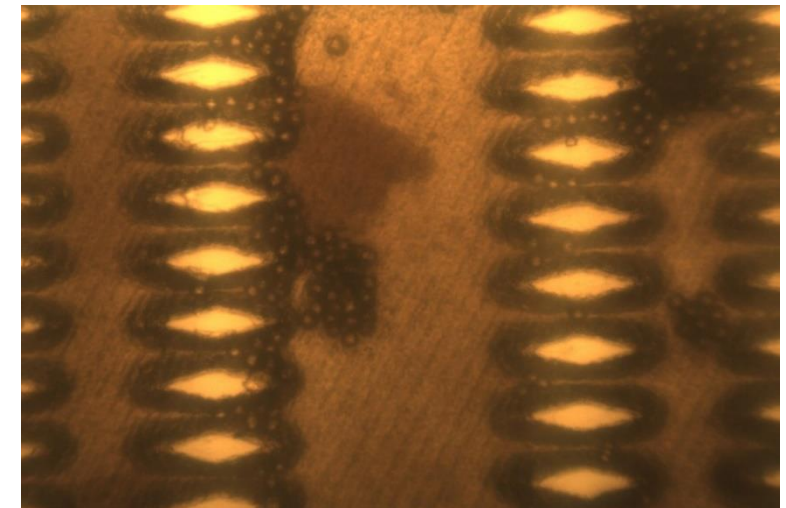
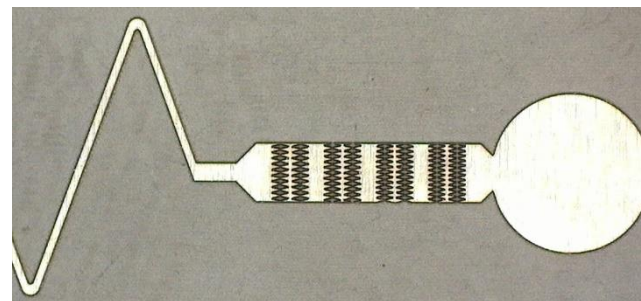
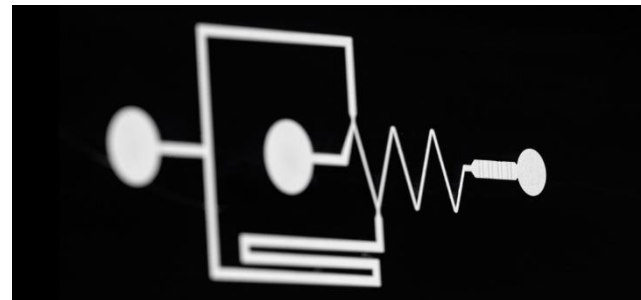
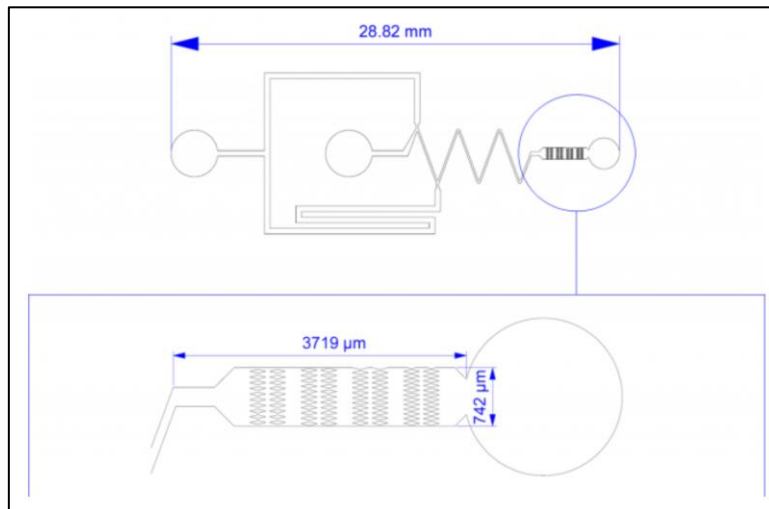
UPC asks Microrelleus possibility to directly engrave glass for a microfluidic chip for liquid biopsy for tumoral cells.

## 2. Microrelleus engraves the glass with the micropattern.

Femtosecond laser technology allows Microrelleus to engrave the glass with the required quality and tolerances.

## 3. Validation tests with PS particles to mimic tumoral cells separation.

The micropattern is functional and the microfluidic device works properly.

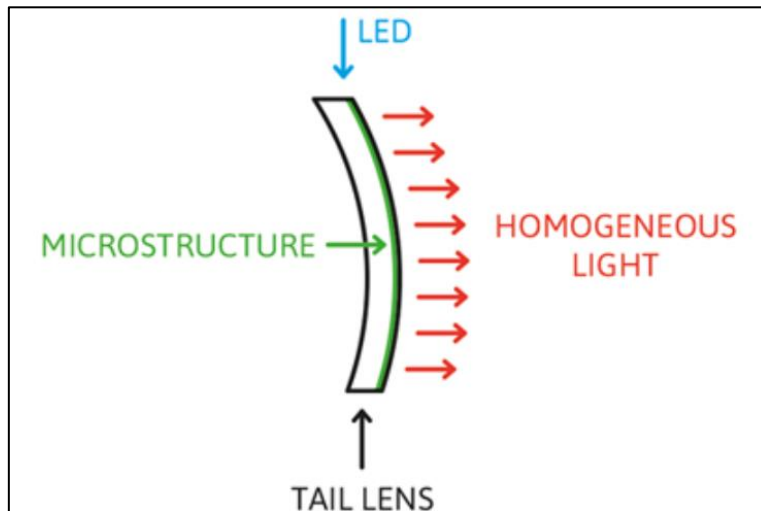




# Laser microstructuring – Case Study: Cupra Tavascan

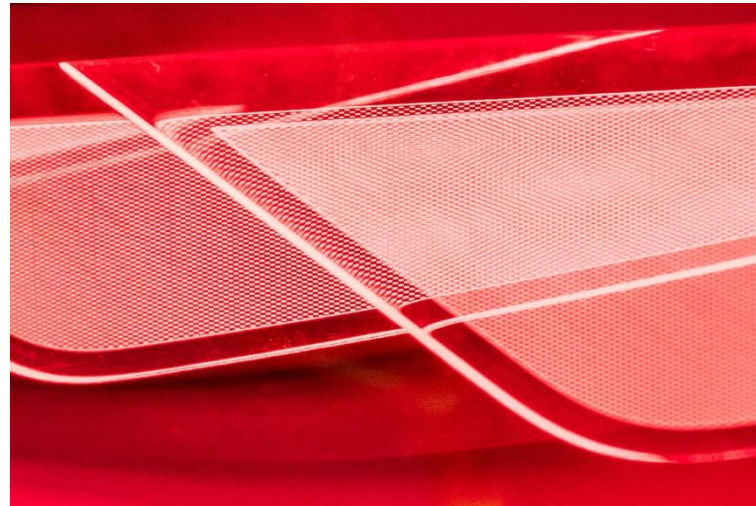
## 1. Customer request and Microrelleus feedback

Cupra explains Microrelleus idea to introduce microstructuring for a new concept of tail lenses. The purpose is to reach light homogeneity from a perpendicular placed light source.



## 2. Microstructuring concept and prototype texturing

When the microstructure is decided Microrelleus engraves the final 3D shape prototype. The goal is to obtain a functional prototype.



## 3. Final product – Cupra Tavascan concept

Femtosecond laser technology allowed Cupra engineers to evolve from uniform lines to uniform surfaces that provide their designs the opportunity to work in three dimensions.



# microrelleus

Laser microstructuring  
Laser texturing  
Industrial engraving

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