

ULTRAFAST LASERS

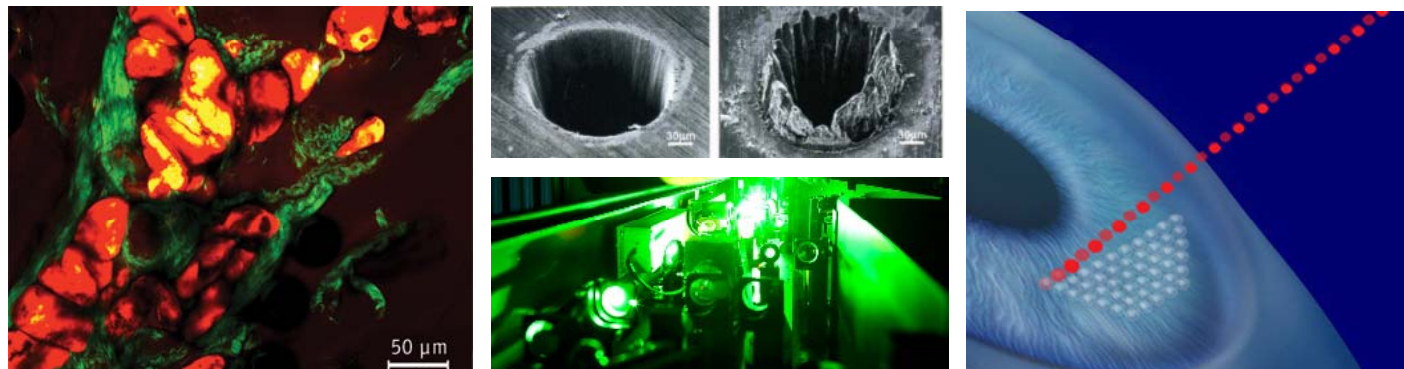
AVANCES EN I+D Y APLICACIONES INDUSTRIALES



“Microfabricación con tecnología ps: ejemplos de aplicación”



Teresa Molina - AIDO

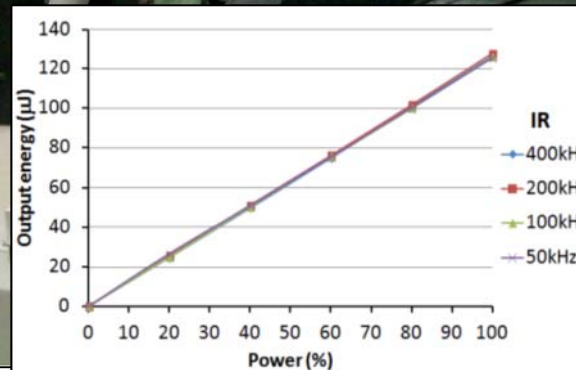
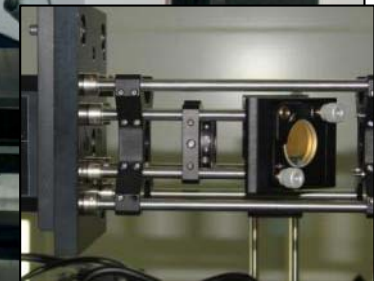


ULTRAFAST LASERS

AVANCES EN I+D Y APLICACIONES INDUSTRIALES

| Modelo | Trumpf TruMicro 5000 series | | |
|---------------------------------|-----------------------------|-----|-----|
| Longitud onda (nm) | 1030 | 515 | 343 |
| Calidad del haz M | < 1.3 | | |
| Potencia media máxima (W) | 50 | 25 | 15 |
| Frecuencia máxima (KHz) | 400 | | |
| Duración mínima de pulso (ps) | <10 | | |
| Diámetro haz sin focalizar (mm) | 5 | | |
| Cabezal galvanométrico | F-Theta f=100mm | | |
| Área de trabajo (mm x mm) | 60x60 | | |
| Ejes Cartesianos | X | Y | Z |
| Recorrido XYZ (mm x mm x mm) | 800 | 600 | 100 |
| Resolución XYZ (µm) | 1 | | |

LASER PS



MICROSCOPIA CONFOCAL, AFM

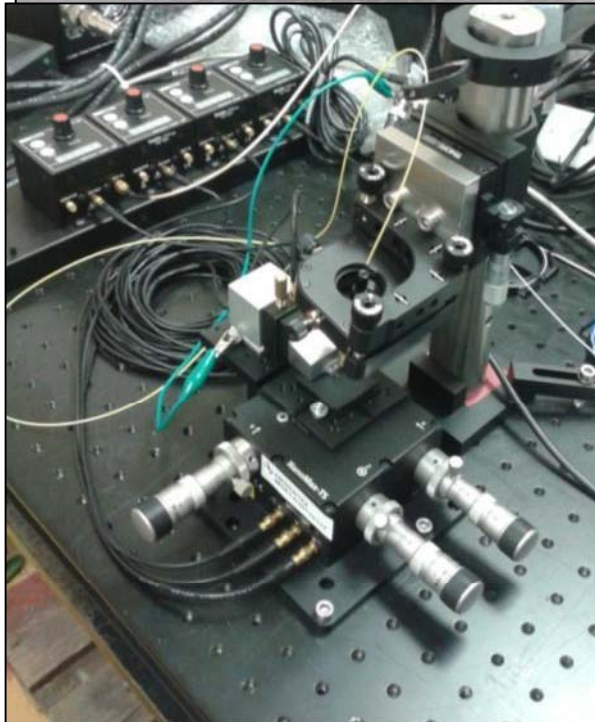


Modo interferométrico

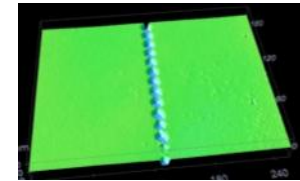
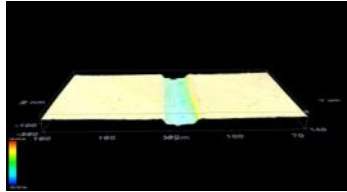
| | |
|---|------------------------------------|
| Aumentos | 10x |
| Apertura numérica | 0.30 |
| Campo de visión (μm) | 1270×950 |
| Resolución óptica (X/Y), azul (μm) | 0.47 |
| Resolución óptica (X/Y), blanca (μm) | 0.56 |
| Resolución vertical (nm) | PSI < 0.1 / ePSI < 1.0 / VSI < 4.0 |
| Rango vertical | PSI: 5 μm; ePSI 100 μm; VSI 10 mm |
| Velocidad de escaneado vertical (μm/s) | VSI/ePSI 4 – 18 |

Modo confocal

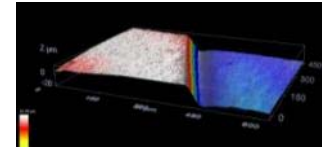
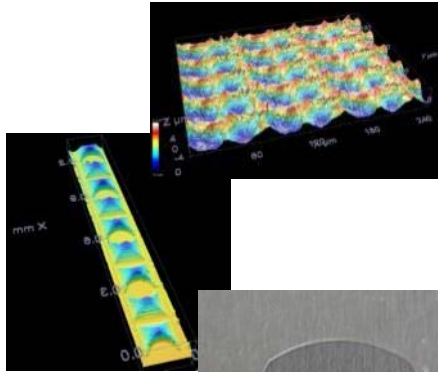
| Aumentos | 5x | 20x | 50x | 150x |
|---|-----------|------------|---------------|-------------|
| Apertura numérica | 0.15 | 0.50 | 0.90 | 0.95 |
| Campo de visión (μm) | 2550×1910 | 636.61×477 | 254.64×190.90 | 84.83×63.60 |
| Resolución óptica (X/Y) (μm) | 0.94 | 0.28 | 0.16 | 0.14 |
| Resolución vertical (nm) | <150 | <15 | <3 | <2 |
| Velocidad de escaneado vertical (μm/s) | 20 – 320 | 5 – 80 | 1 – 16 | 0.5 – 8 |



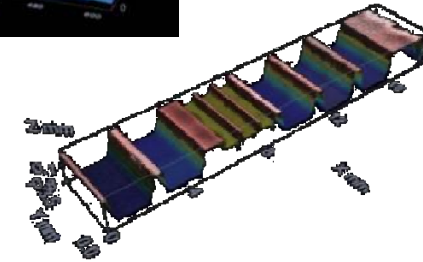
Eliminación selectiva de materiales



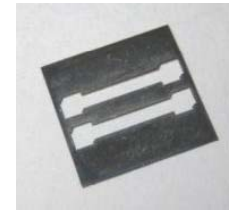
Texturizado superficial



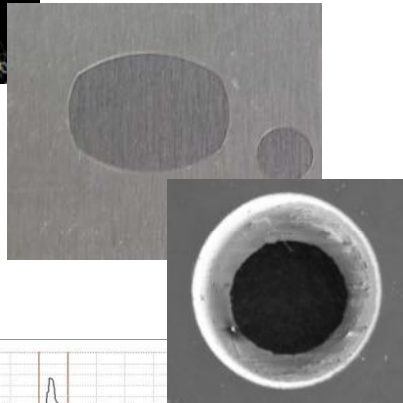
Vaciados



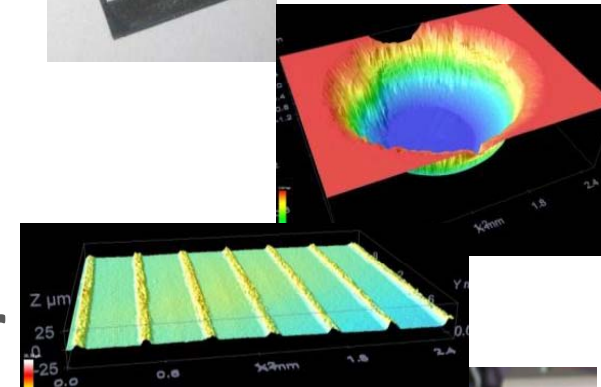
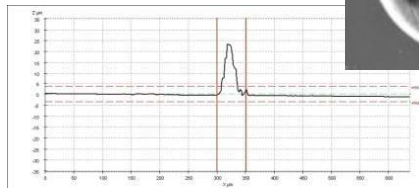
Corte



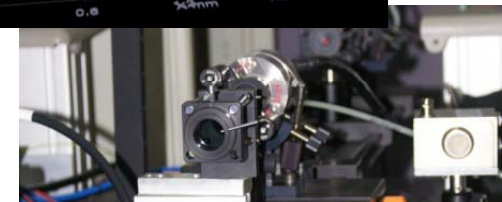
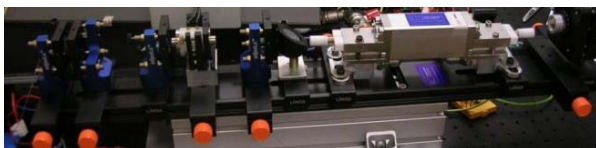
Taladrado



Escritura láser



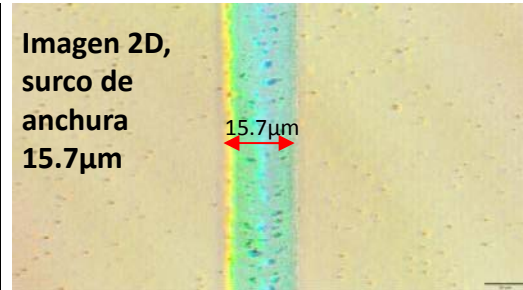
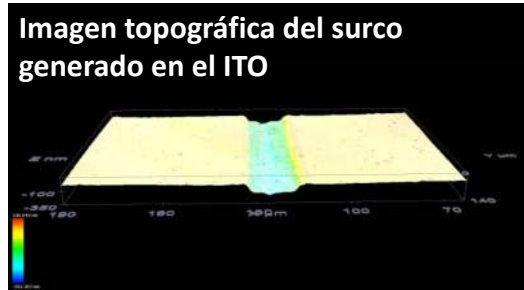
Ingeniería láser



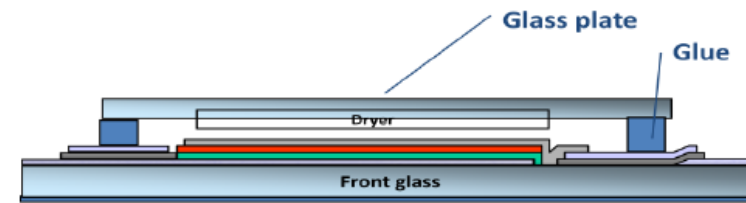
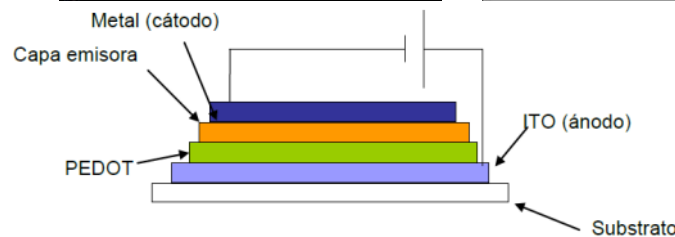
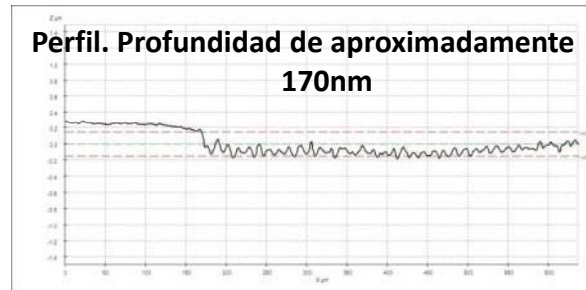
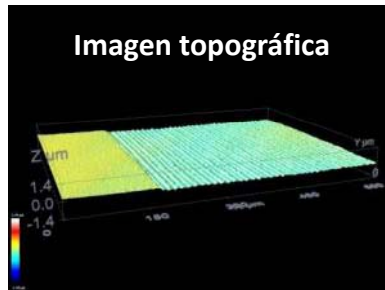
Eliminación selectiva de materiales

Eliminación de ITO sobre PET, fabricación de componentes para OLEDs

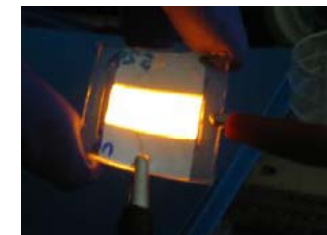
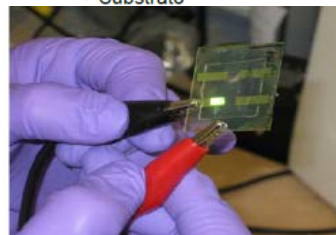
Eliminación de ITO sobre PET



Eliminación de un área de 2mm de ITO sobre PET



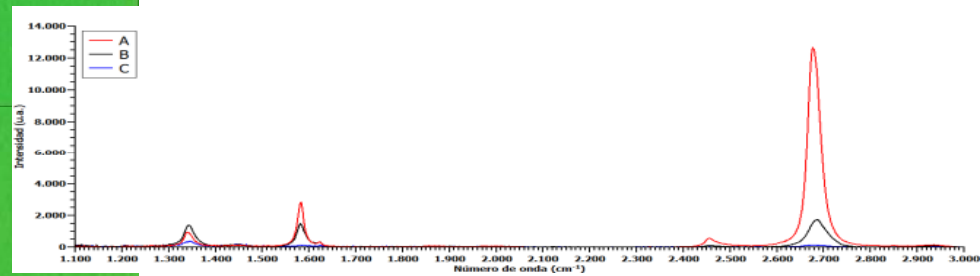
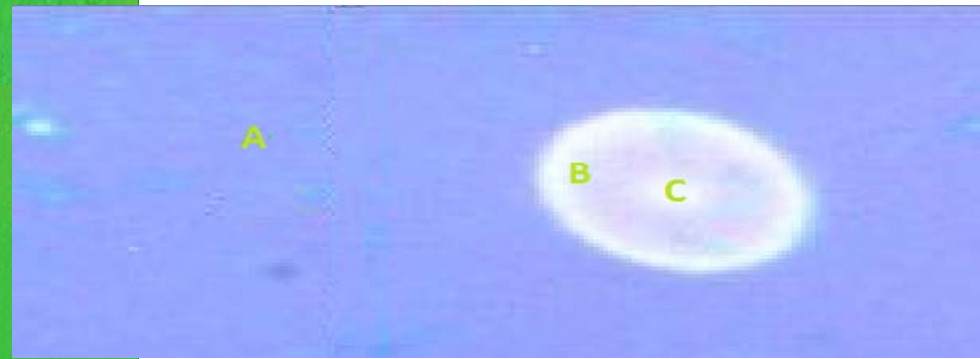
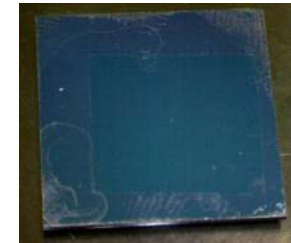
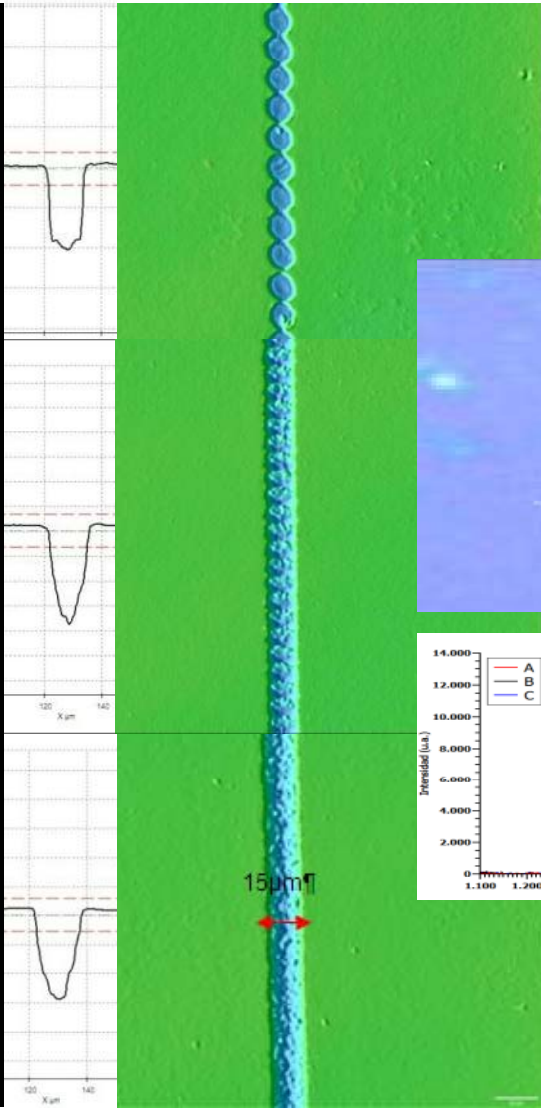
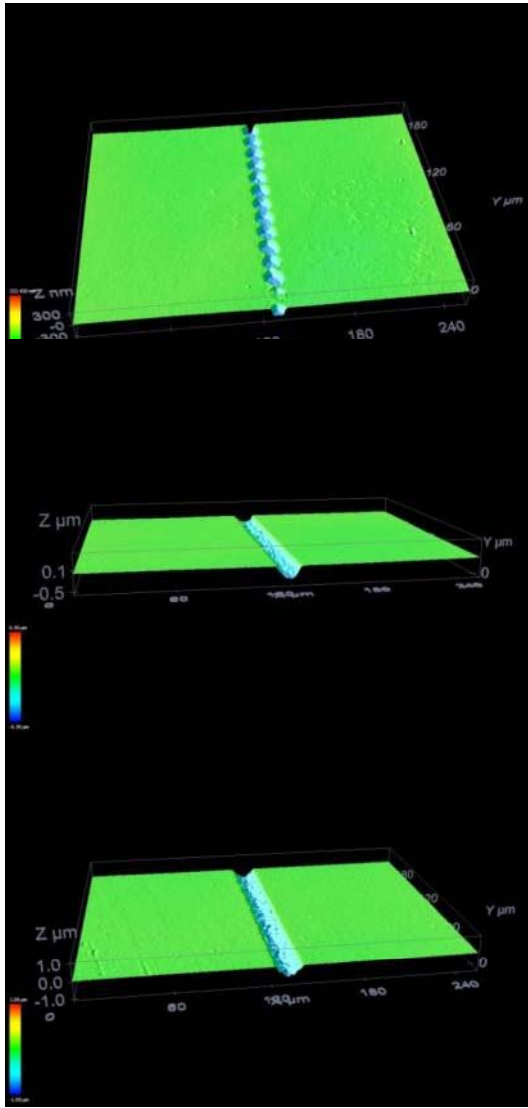
OLEDs Fabricados y encapsulados



Aplicación ICMOL - UVEG

Eliminación selectiva de materiales

Eliminación de monocapa de grafeno sobre sustrato de Si / SiO2

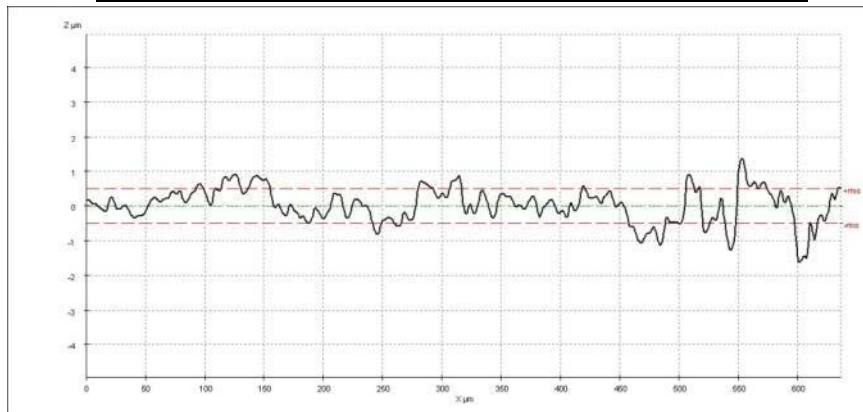
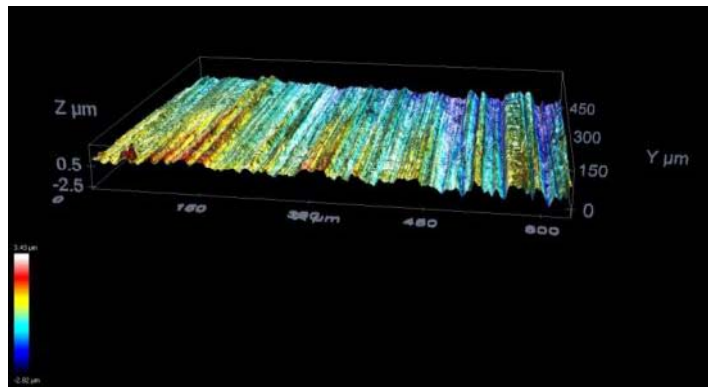
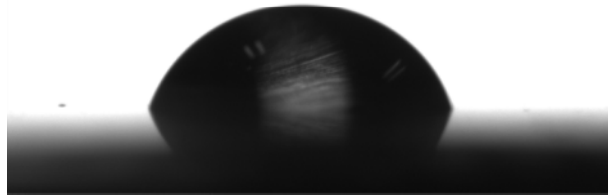


IMDEEA/2014/70 - GRAPHECOAT
Investigación y desarrollo de procesado y dispersión de grafeno en matriz polimérica para aplicación en recubrimientos industriales

Texturizado superficial

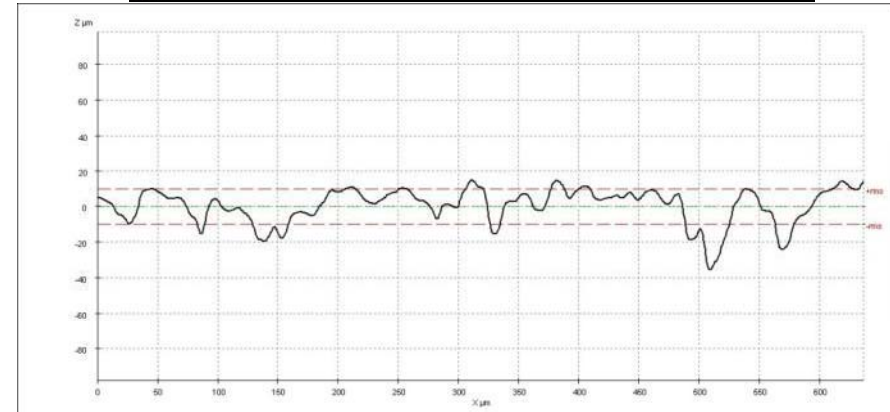
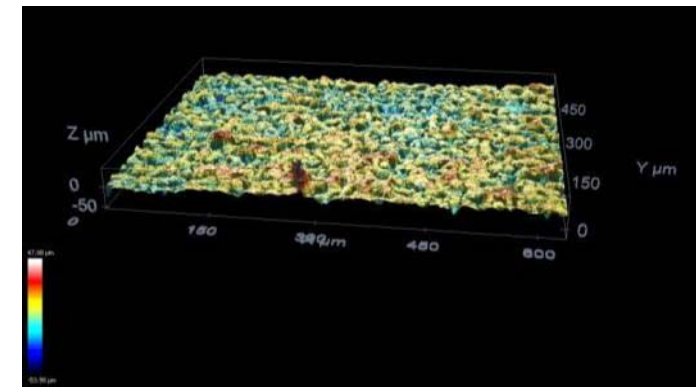
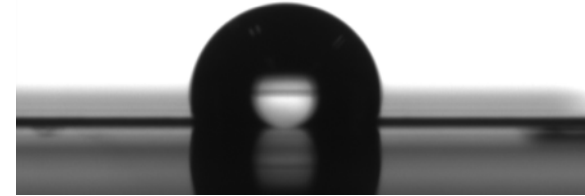
Procesado superficial en Al – superficies hidrófobas

Aluminio sin mecanizar $\theta = 72^\circ$



Aluminio sin mecanizar Ra = 400nm

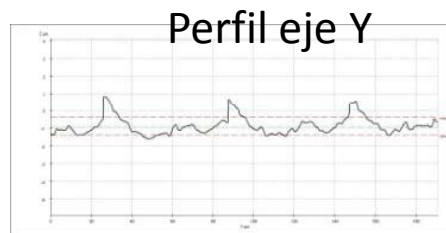
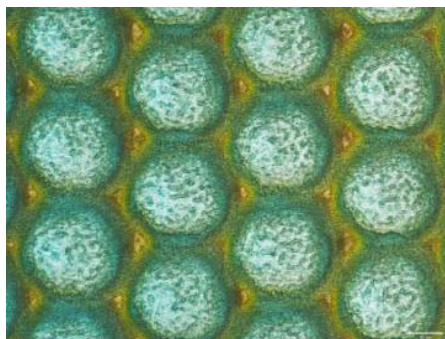
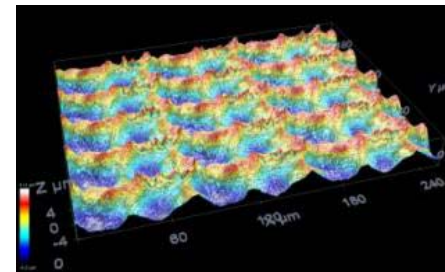
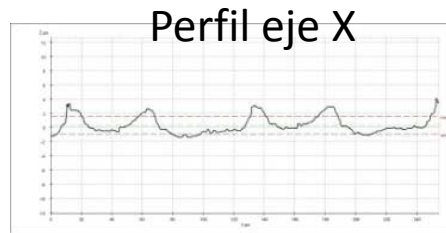
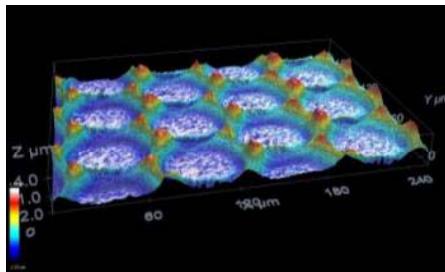
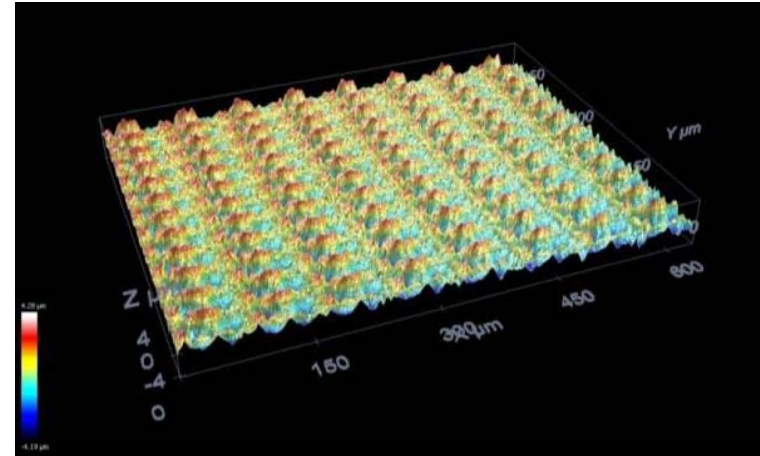
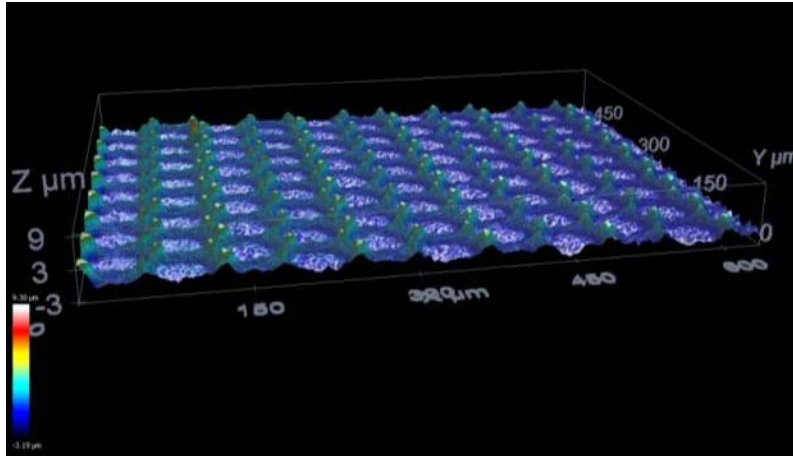
Aluminio mecanizado láser $\theta = 103^\circ$



Aluminio mecanizado Ra = 7um

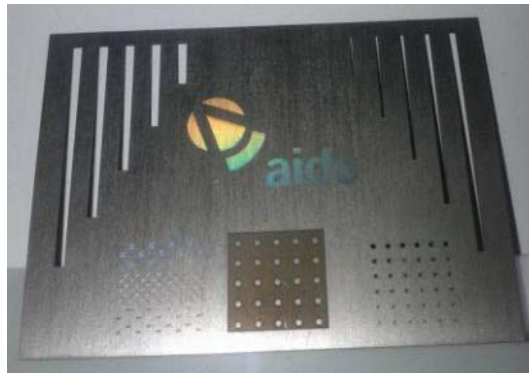
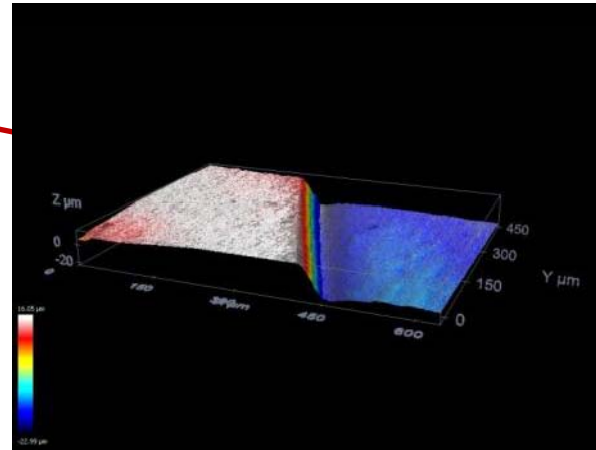
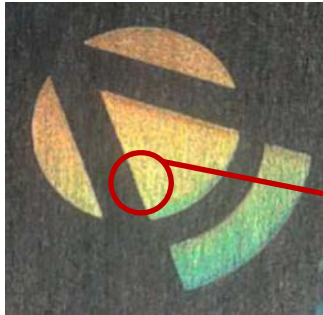
Texturizado superficial

Microtexturizado en silicio



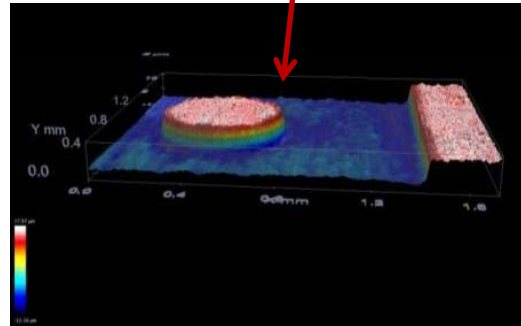
Texturizado superficial

Codificación / estructuración superficial



Vaciados

Vaciados sobre tungsteno



Microtexturizados en PC (espesor 1.2mm), aplicaciones de sensado.

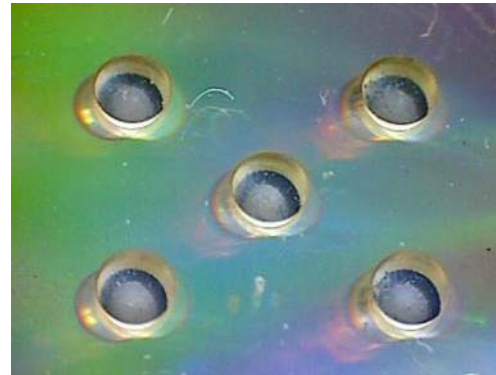
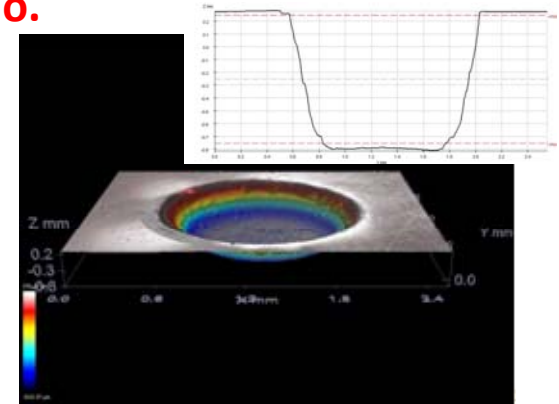


Imagen micropocillos con sistema láser IR
Tp (5vaciados) = 30min



Láser IR
P = 1.06mm

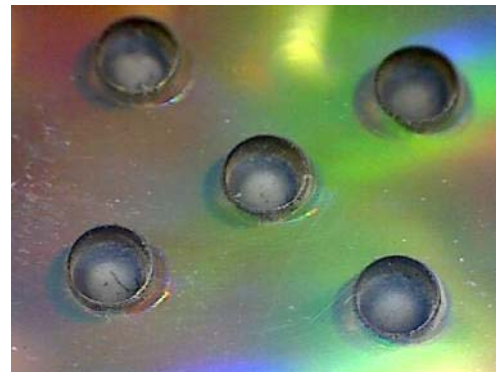
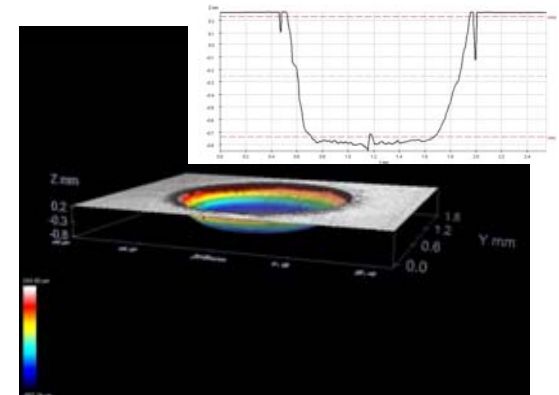


Imagen micropocillos con sistema láser UV
Tp (5vaciados) = 15min

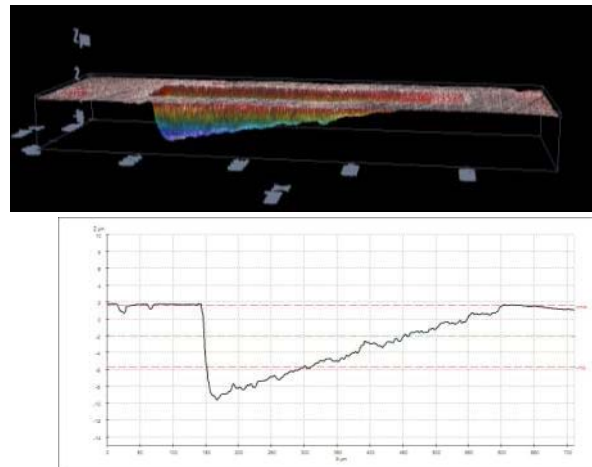


Láser UV
P = 1.03mm

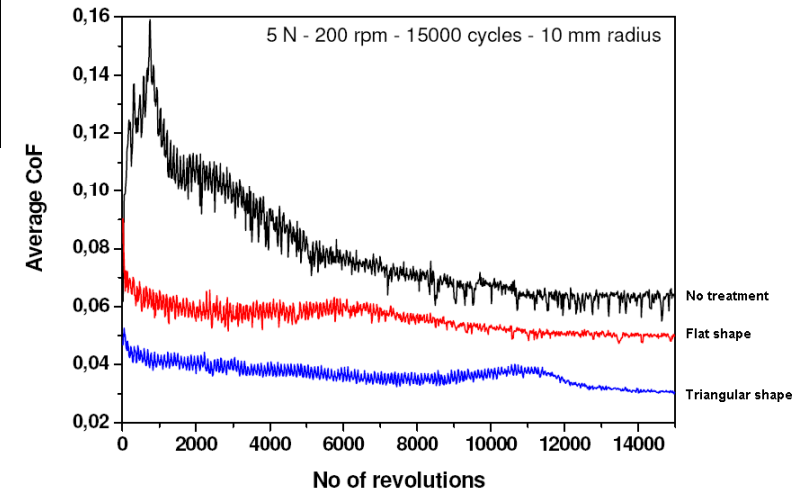
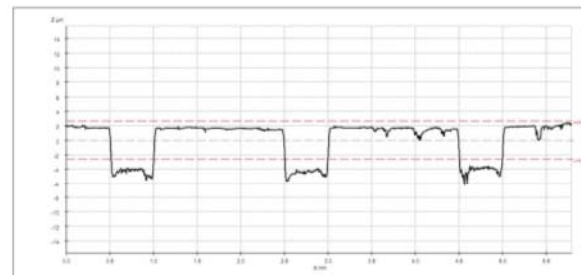
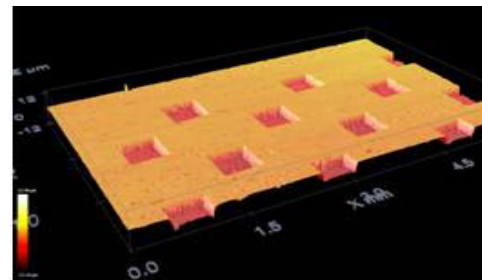
Vaciados

Microestructuración superficial para mejora de propiedades tribológicas

AISI 316
Perfil fondo triangular
Profundidad: 11µm
Longitud: 450µm
Ancho: 95µm



AISI 316
Perfil fondo cuadrado
Profundidad: 6 µm
Lado: 500 µm



| Type of sample | Average Coefficient of Friction |
|-----------------------------------|---------------------------------|
| AISI 316 no treatment | 0.07 |
| AISI 316 with flat cavities | 0.05 |
| AISI 316 with triangular cavities | 0.03 |

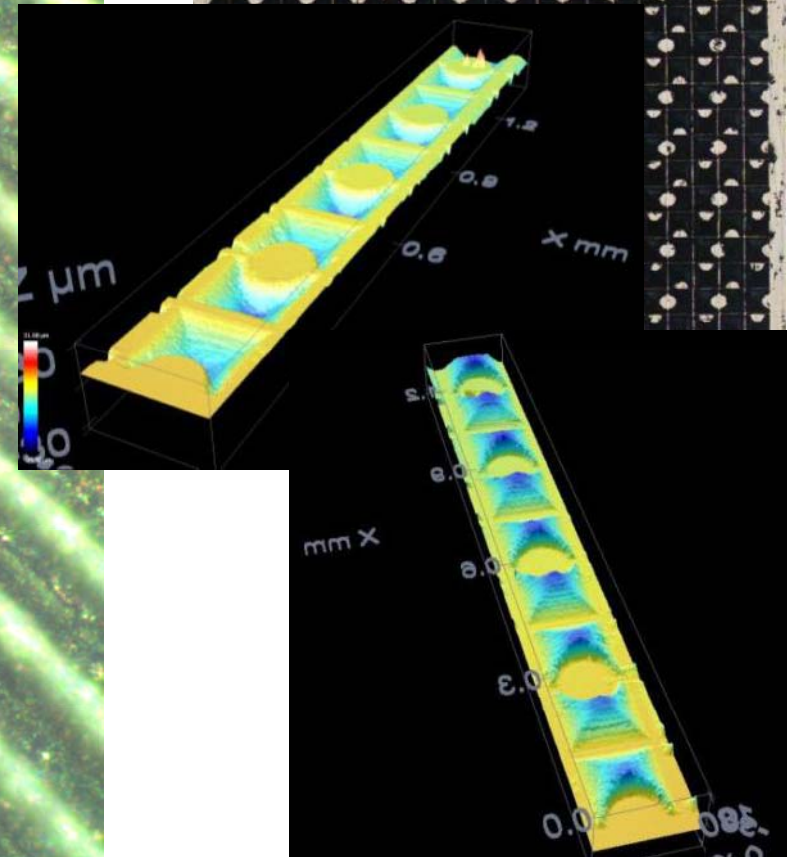
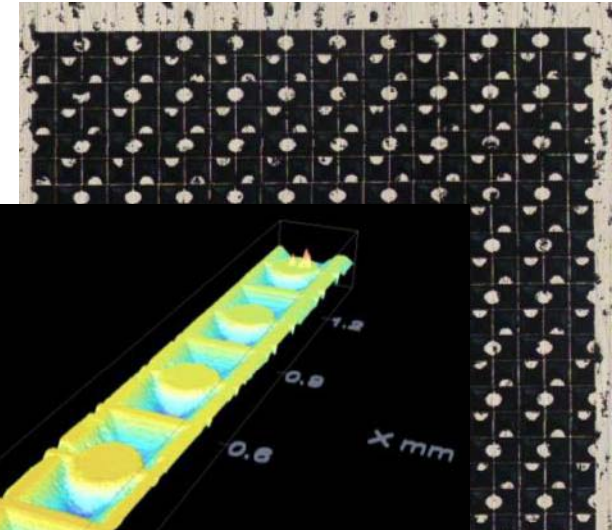
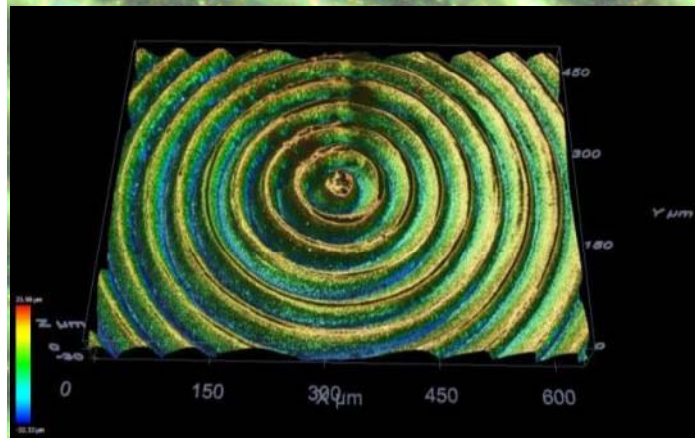
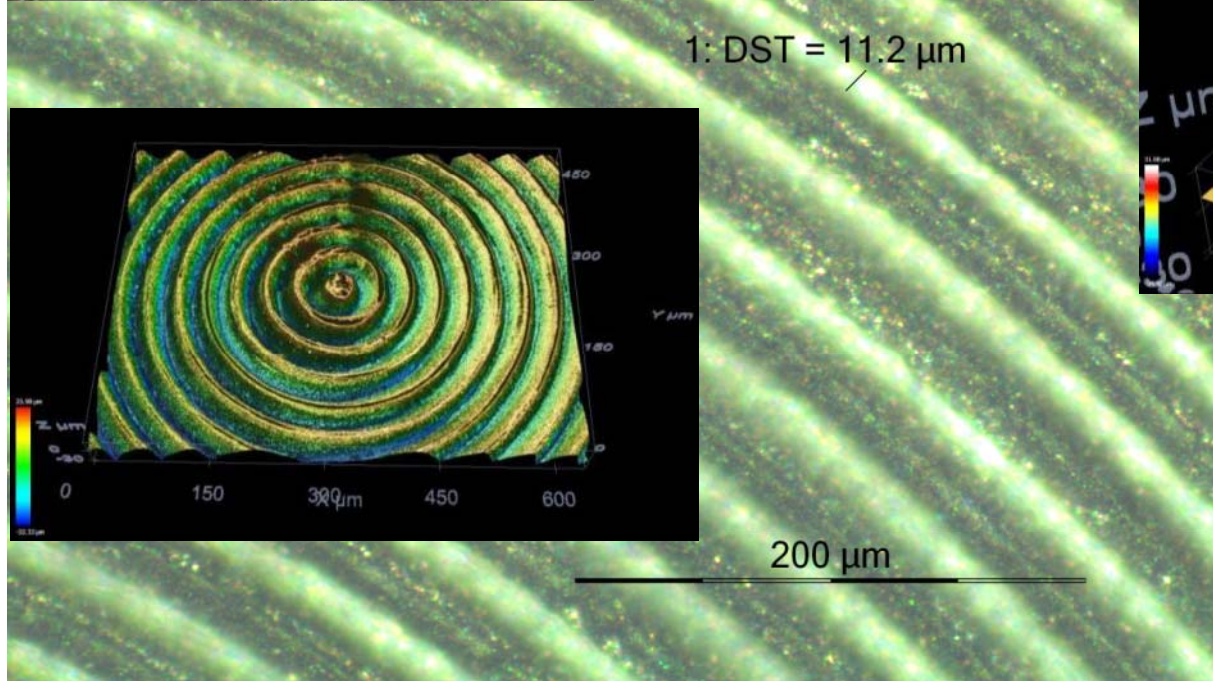
Vaciados

Moldes sobre Al, Cu, otros metales / aleaciones

Imagen 2D, muestra de 4mmx4 mm

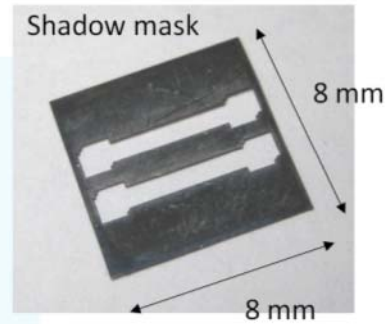
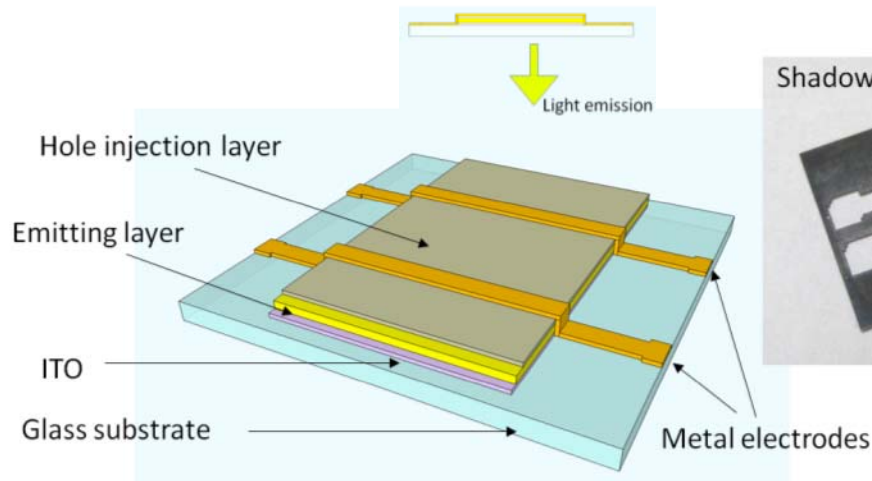


Distancia entre surcos:
40µm
Anchos crestas: 7µm
Profundidad: 20µm



Corte

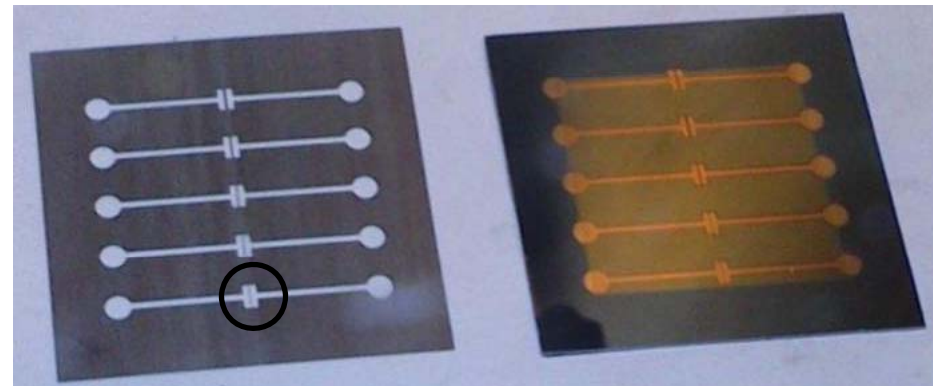
Máscaras



Tungsteno: canal de 35 μm entre dos perforaciones

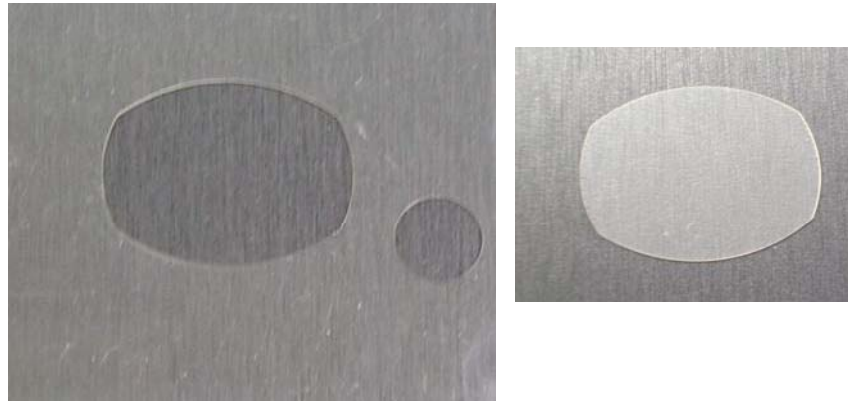


Aplicaciones ICMOL - UVEG

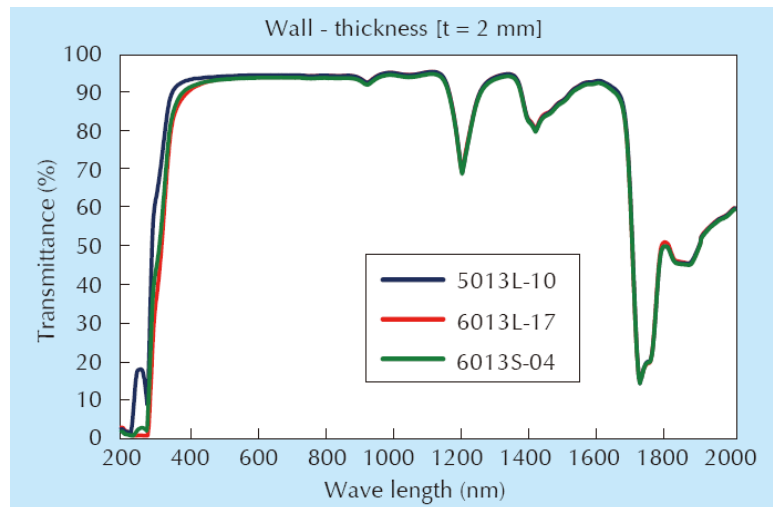


Corte

Corte de COP, COC

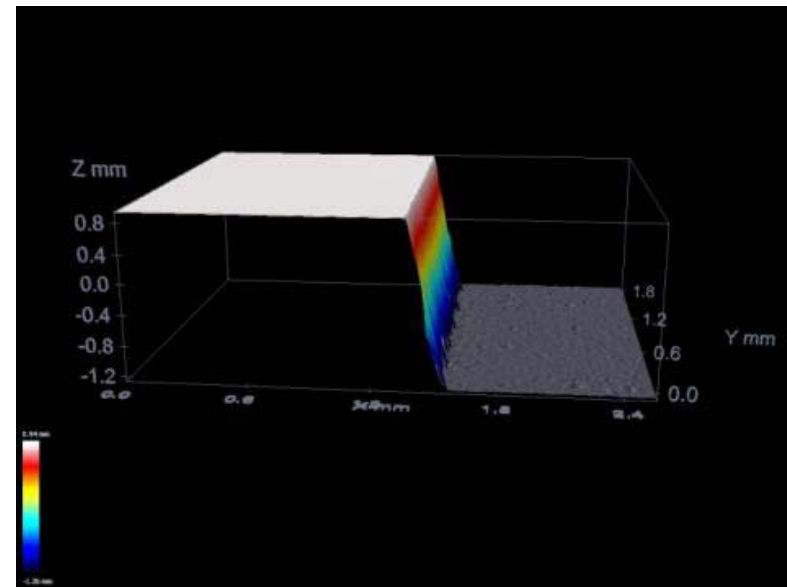
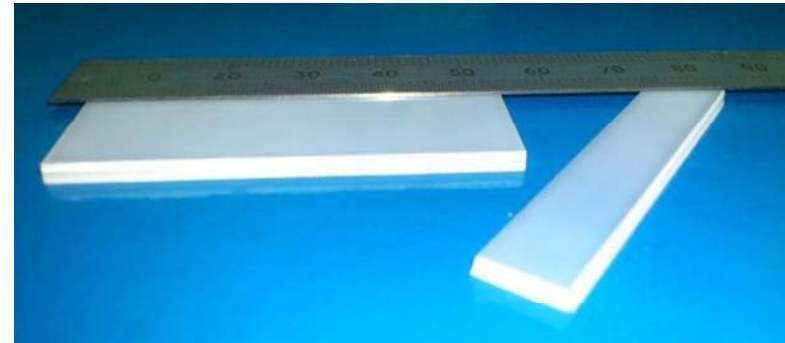


- ✓ Reducción de efectos térmicos
- ✓ Sin redeposición de material
- ✓ Materiales transparentes al láser pueden procesarse



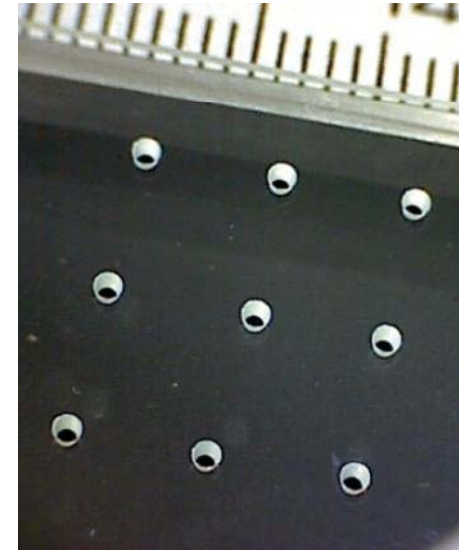
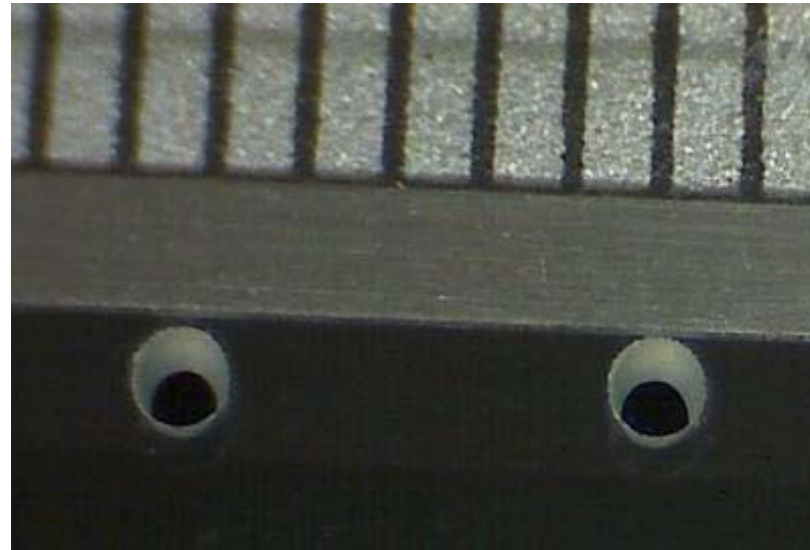
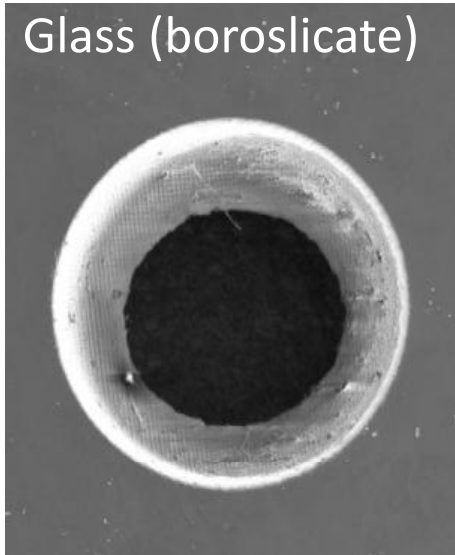
Corte de vidrio

Corte de vidrio de 2.1 mm espesor



Taladrado

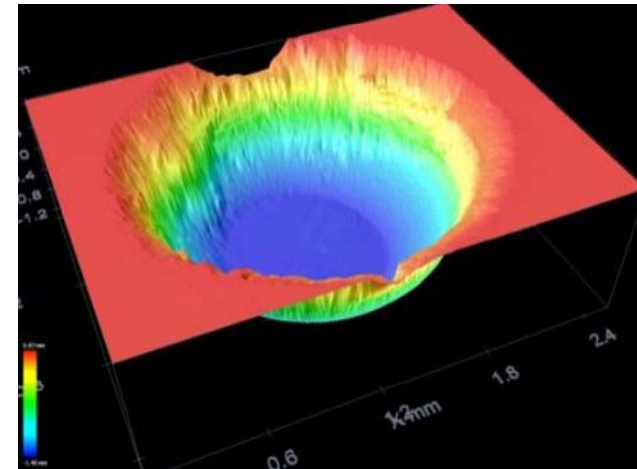
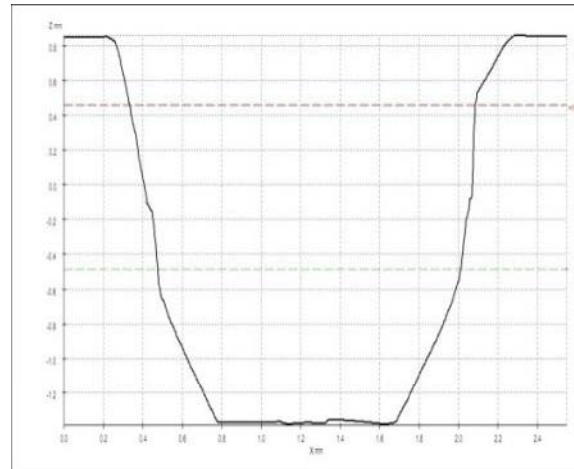
Glass (borosilicate)



1 mm diám 1.5 mm grosor

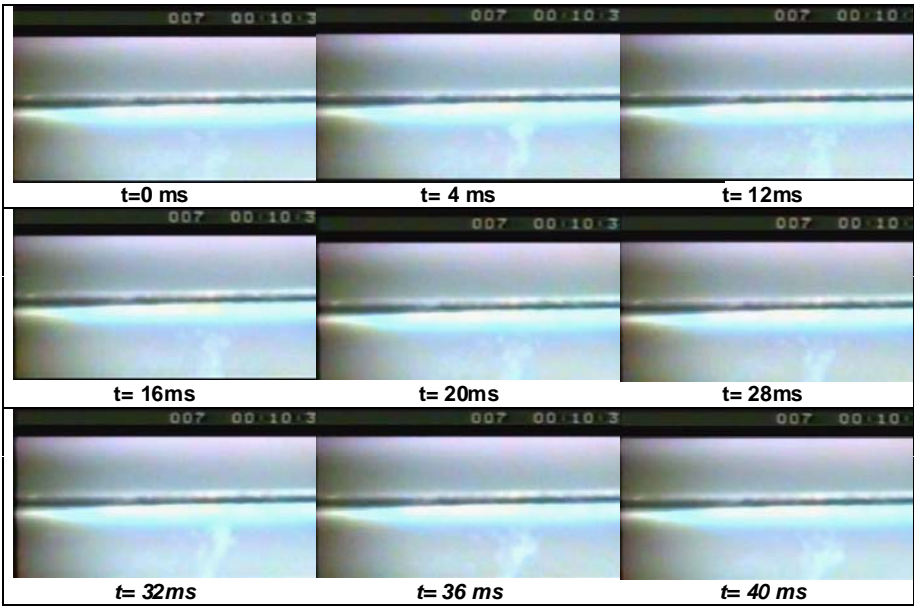
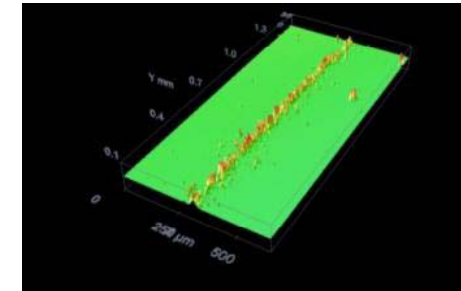
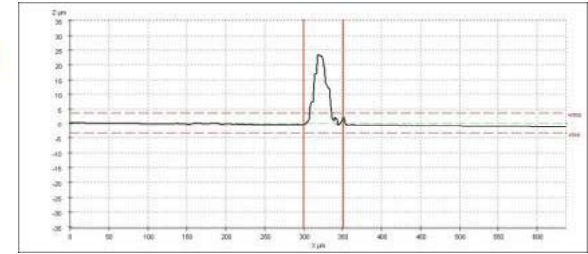
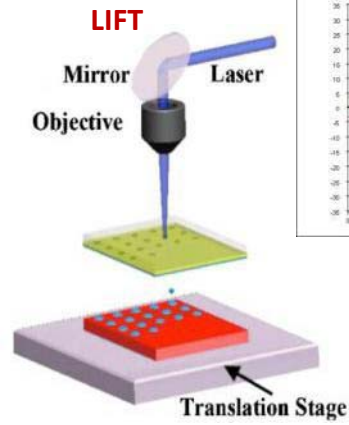
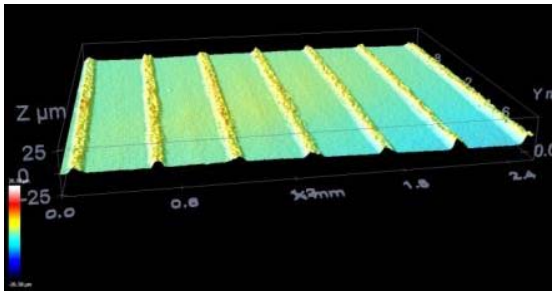
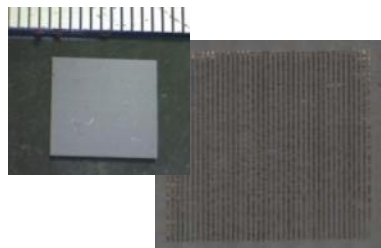
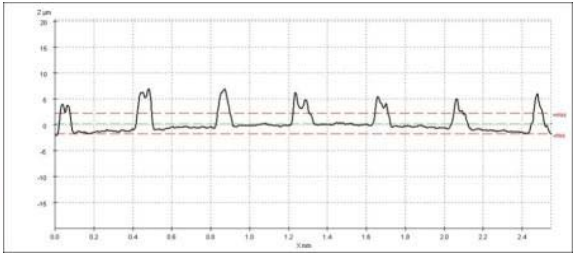
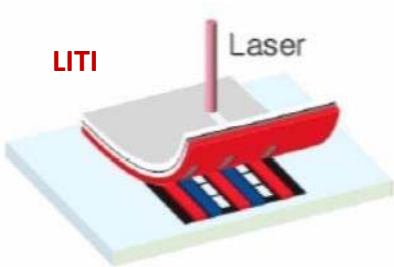


Fused silica



0.88 mm diám inf. 2.3 mm grosor

Escritura láser

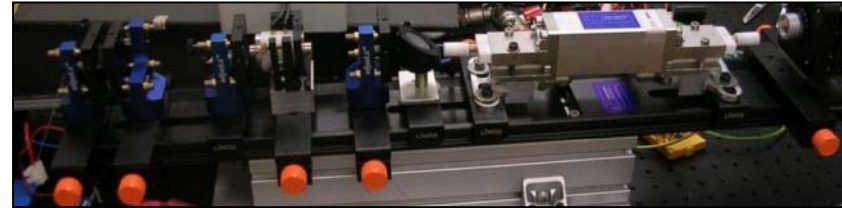


Laser engineering

Nd:YAG laser (pumped by lamps)

Nd:YAG laser (pumped by diode laser)

CO2 laser with advanced control systems

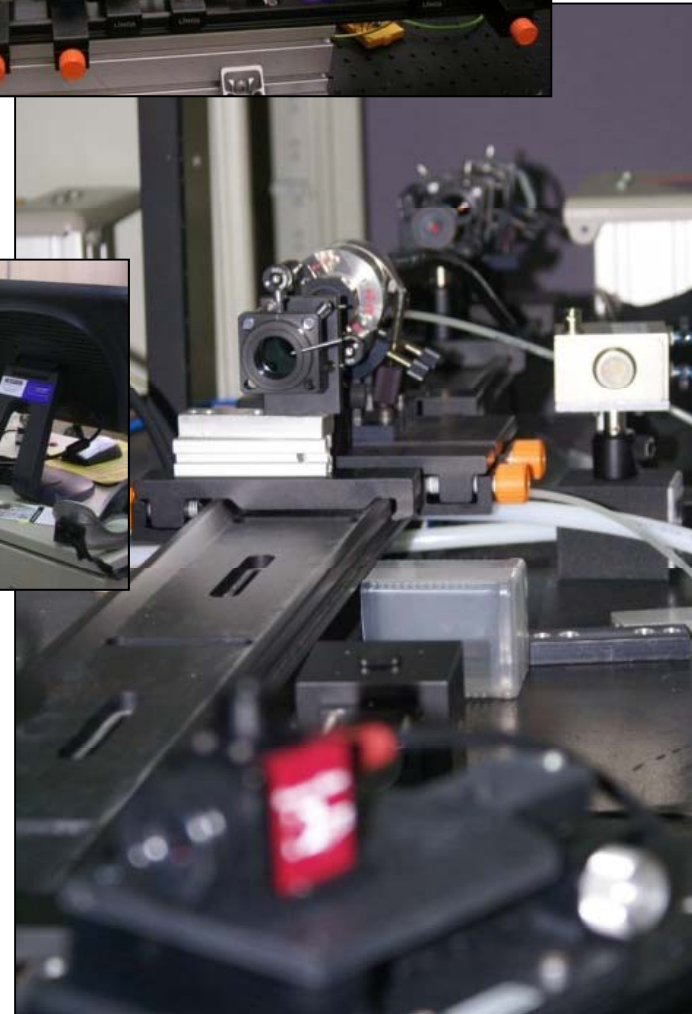


Nd:YAG

300 mJ

10 ns

20 to 50 Hz



CUESTIONES, CONSULTAS, PROPUESTAS ...

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