High Speed Micro-Machining with Nano-Precision

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Company introduction

Crealas GmbH

- **Ultra high precision Microstructures**
- **Tooling for various molding and embossing techniques**
- **Six years of R&D consulting experience**
- **Your solution in microstructuring**

Crealas Expertise

- **From idea to industrial implementation**
- **Large area micro-structuring [up to 3 m^2]**
- **Know-how to replicate by electroforming**
- **Strong partnership with galvanic company**
- **Strong network for Hot-, UV-embossing and injection molding**

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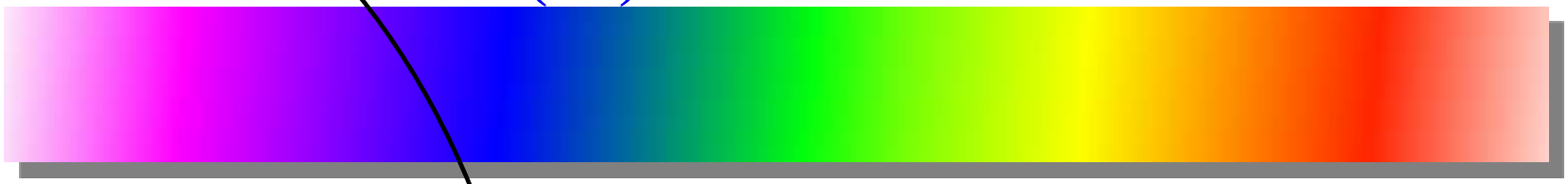
Micromachining Lasers

Excimer
Ar
GaAs
Nd:YAG (3ω)
CVL
Nd:YAG



Nd:YAG (4ω)
Nd:YAG (2ω)
HeNe
CO_2

Excimer	Nd:YAG	CO_2
157nm	1064nm	10600nm
193nm	532nm	9600nm
248nm	355nm	Other lines
308nm	266nm	
351nm	Other lines	

Pulse length ca. 20 ns

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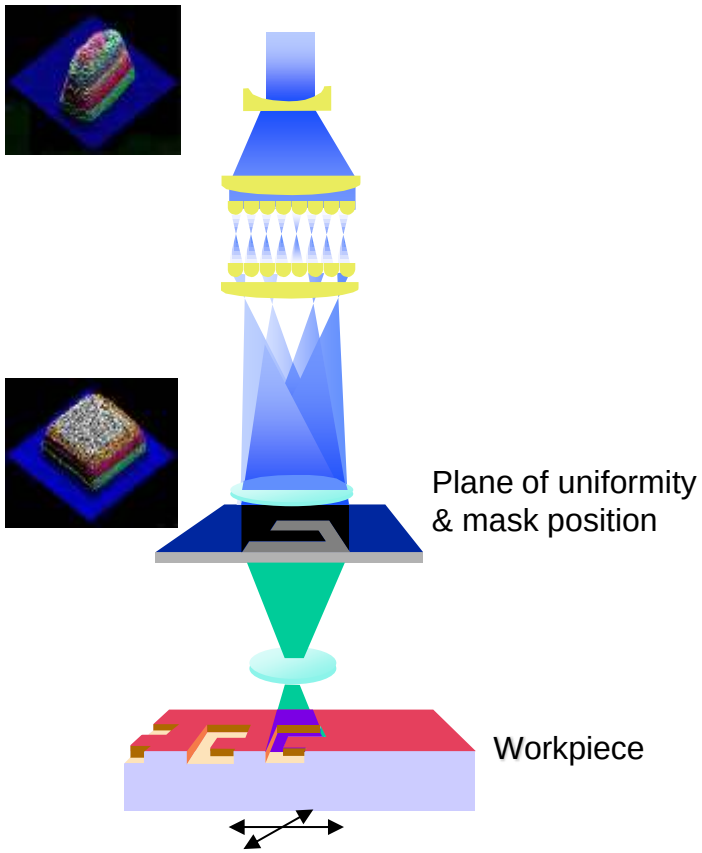
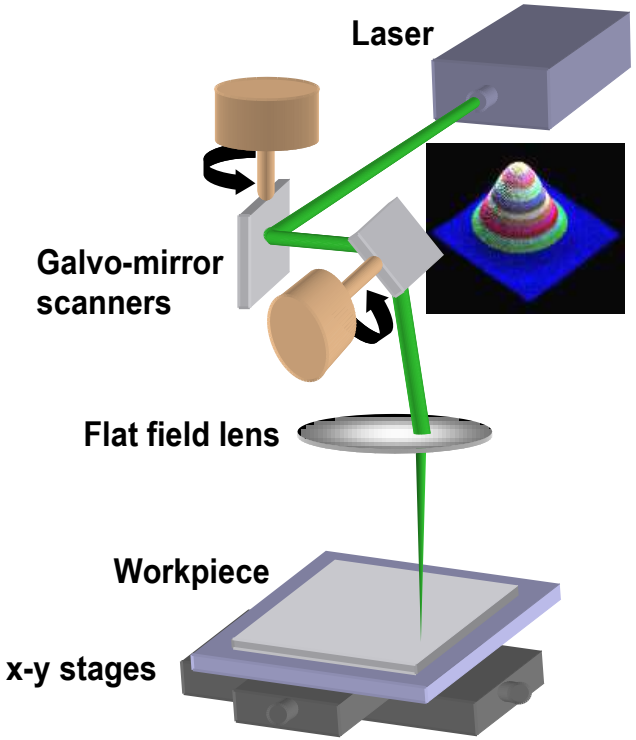
Two quite different laser ablation techniques

Mask imaging



Focussed spot

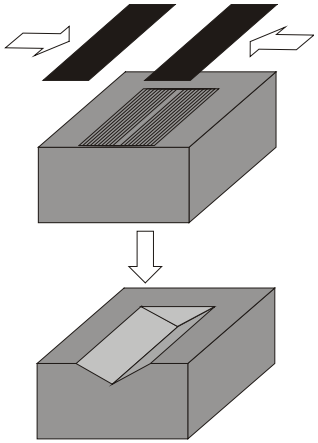


Pulse length ca. 20 ns

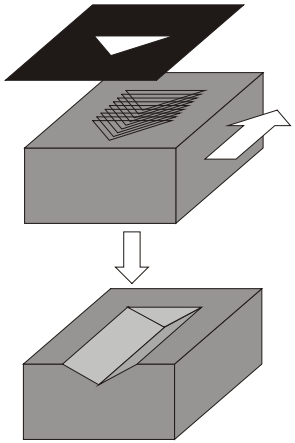
Mask techniques for 3D-Geometries

Projection ablation options for complex surface shapes

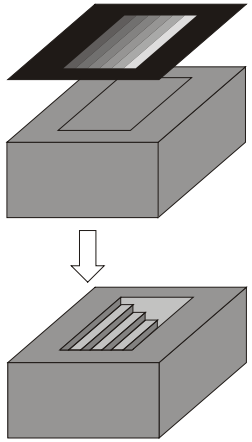
Variable aperture mask



Scanned Mask &/or workpiece



Half-tone mask



- Half-tone method is attractive in that it does not require CNC stage motion

However…

- Mask design is more complex, requiring detailed knowledge of material ablation characteristics over range of fluences

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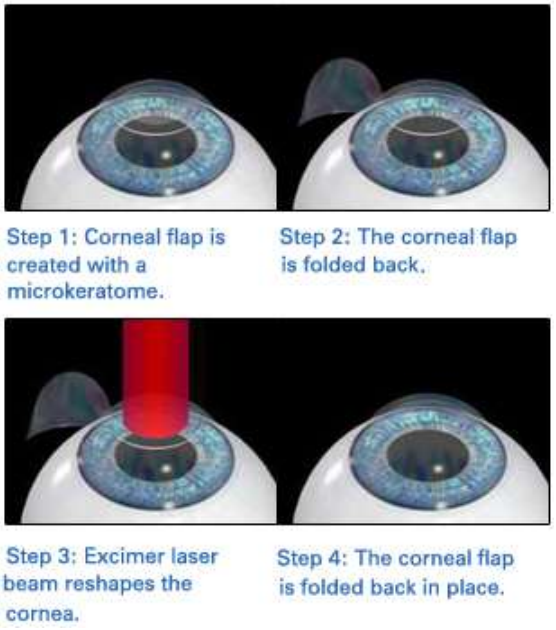
Industrial Scale Mask Imaging

Microelectronic chip manufacturing

LASIK (laser in situ keratomileusis)



Reel-to-Reel System direct cutting of 15`000 circuits a minute.

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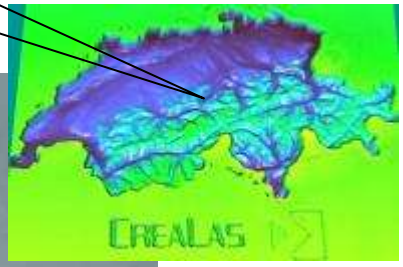
Crealas Technology:

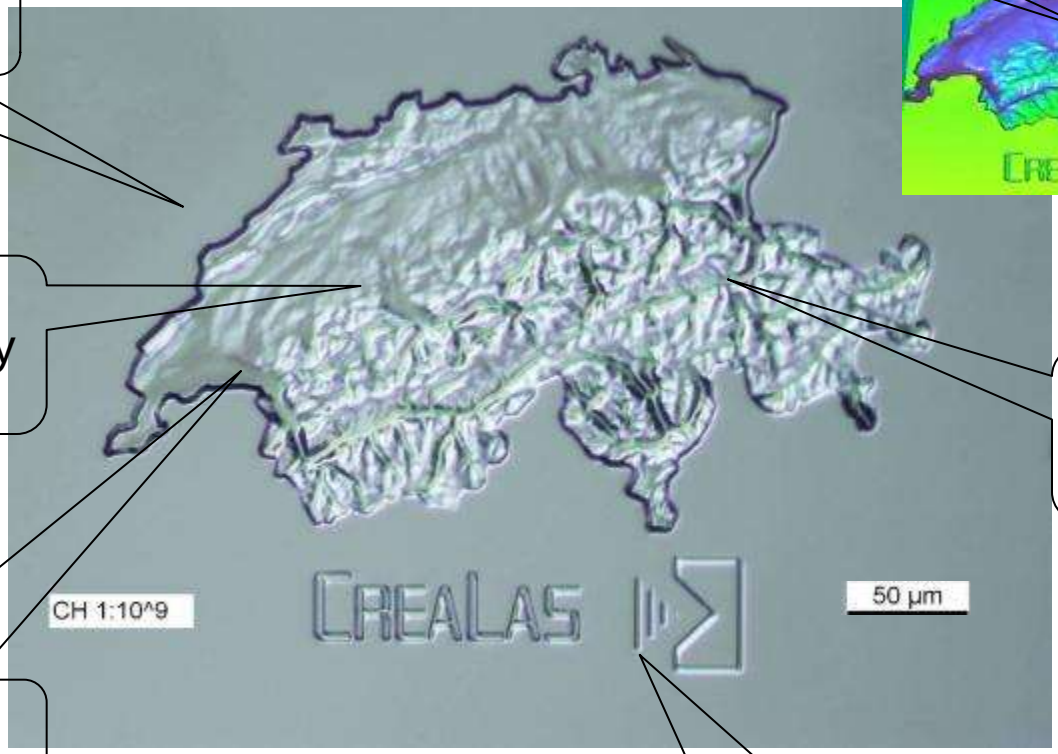
High depth definition (<100nm)



Ultra fast writing (5 ms)

Highly defined surface topography (1 km = 1 um)

Very low surface roughness (20 nm rms)



Thick film etching (5 um)

High resolution (2 um lines)

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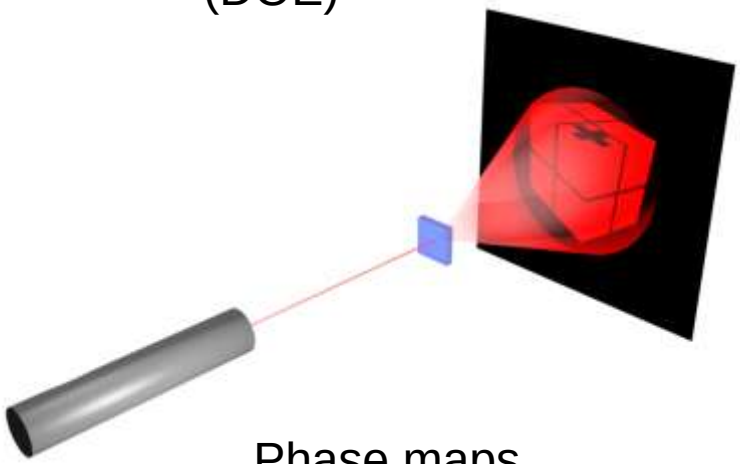
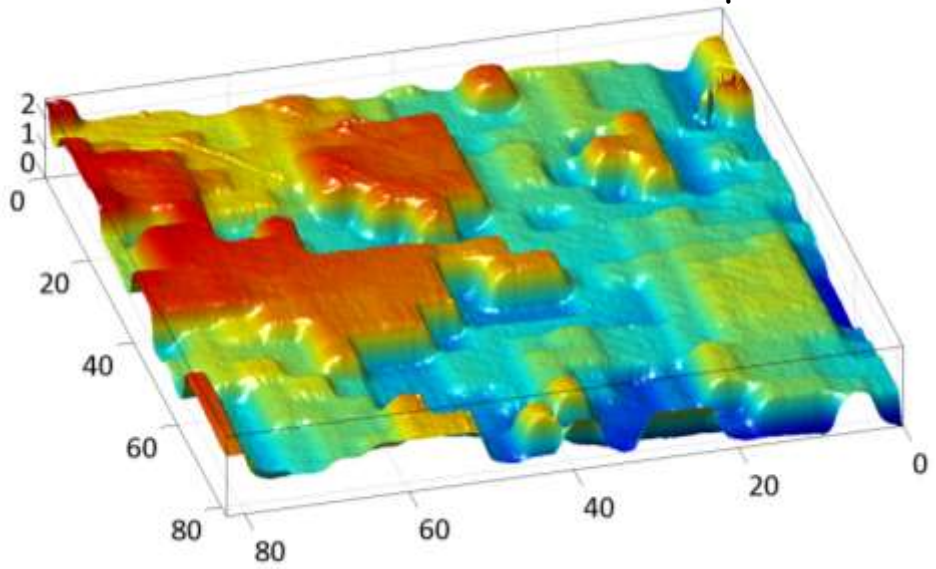
Nanometer precision in z

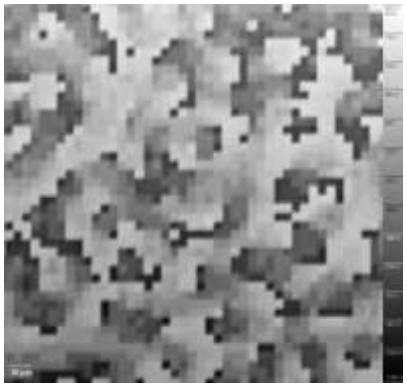
Diffractive optical element (DOE)



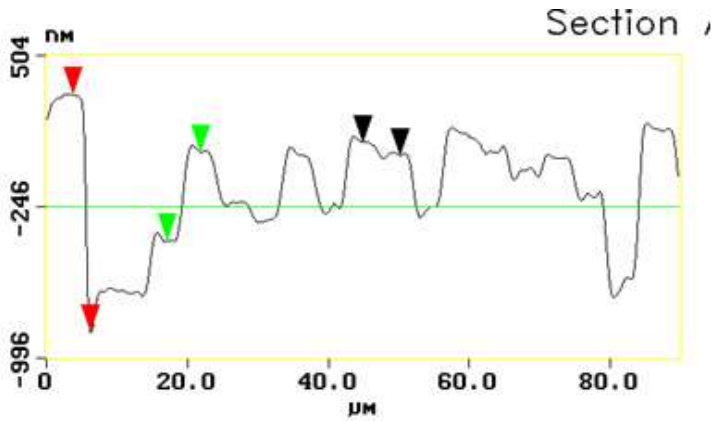
8-levels DOE : unit element 5x5µm²



Phase maps



20x



Horiz distance(L)	2.461 µm
Vert distance	1.176 µm
Angle	25.533 deg
Surface distance	4.805 µm
Horiz distance	4.746 µm
Vert distance	438.31 nm
Angle	5.276 deg
Surface distance	5.276 µm
Horiz distance	5.273 µm
Vert distance	62.632 nm
Angle	0.680 deg
Spectral period	
Spectral freq	
Spectral RMS amp	

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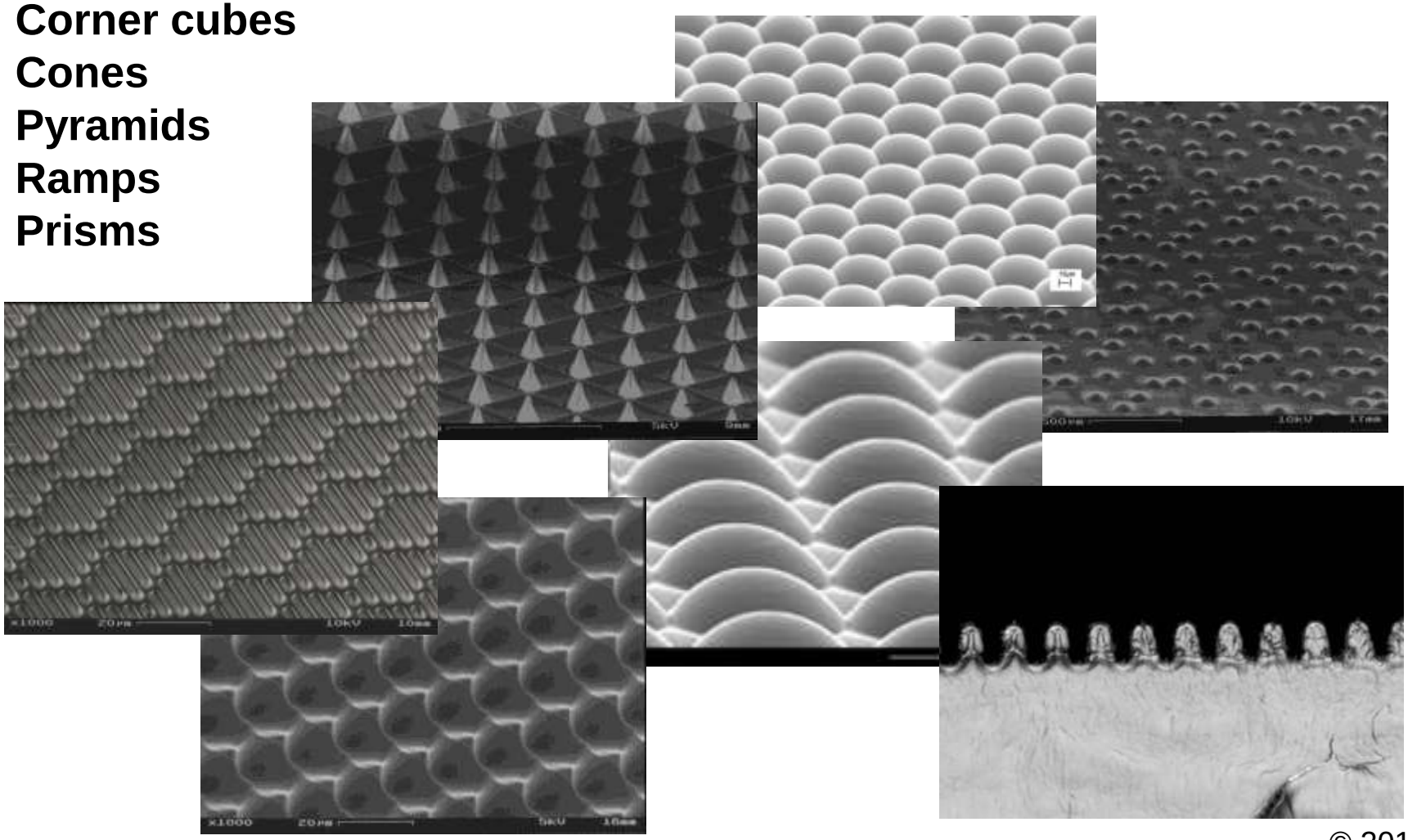
Highly Engineered Micro-Structures

- Special Micro lens arrays
- Corner cubes
- Cones
- Pyramids
- Ramps
- Prisms



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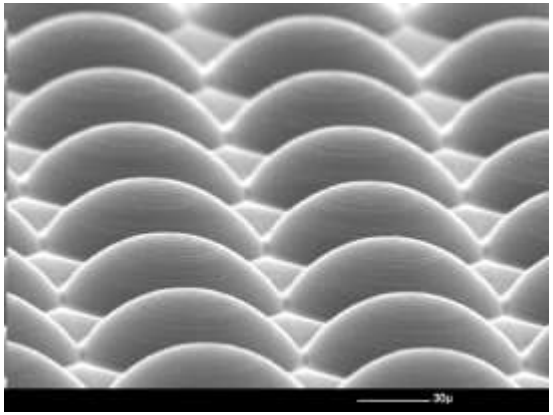
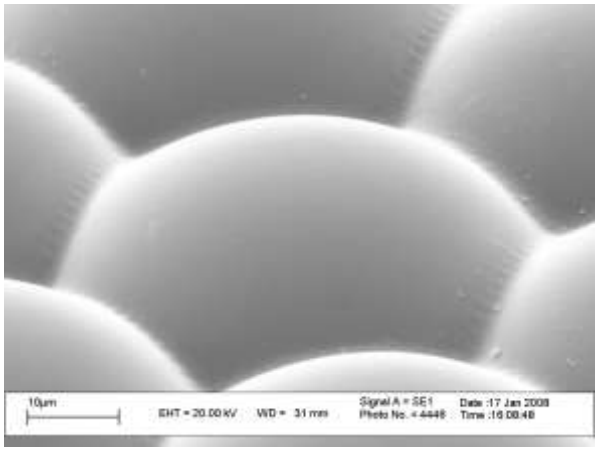
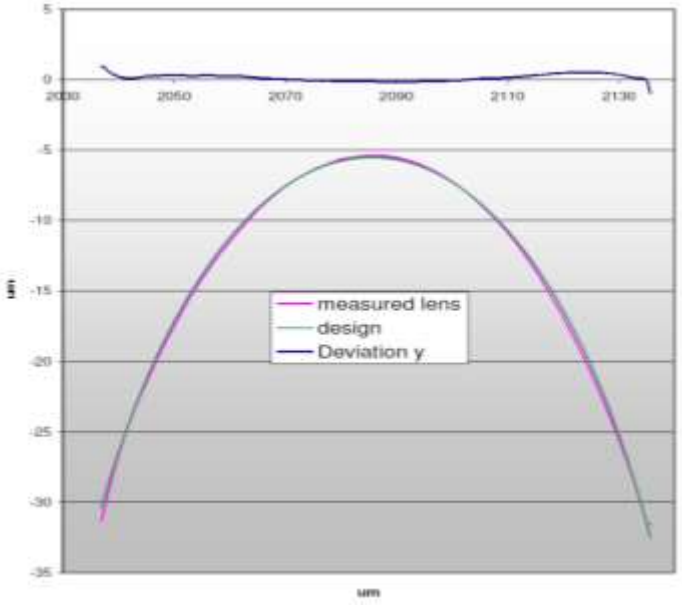
Feature Quality: Shape and Surface

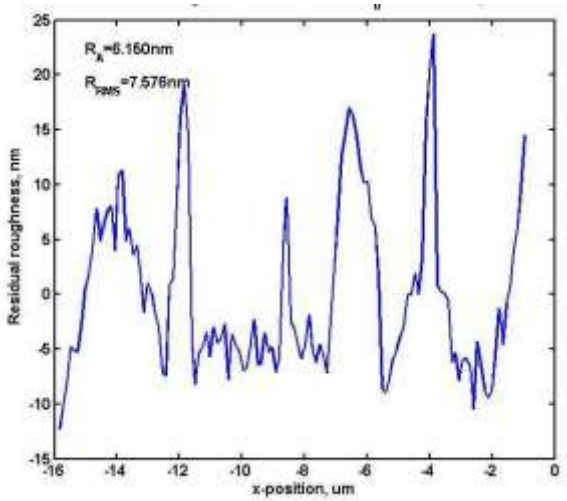


The average deviation from the best fit ROC is 147 nm with a ROC of 59.2 µm target is 60 µm.



Surface roughness rms < 10 nm





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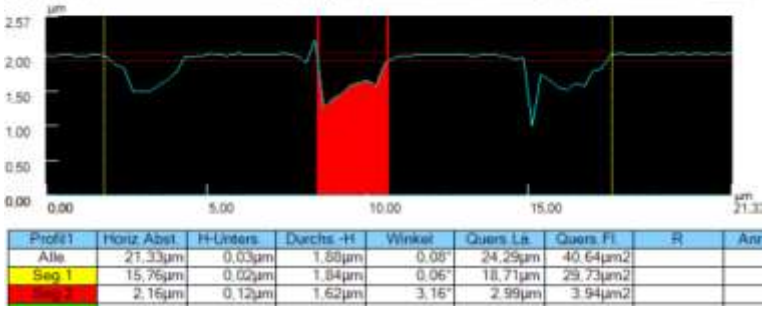
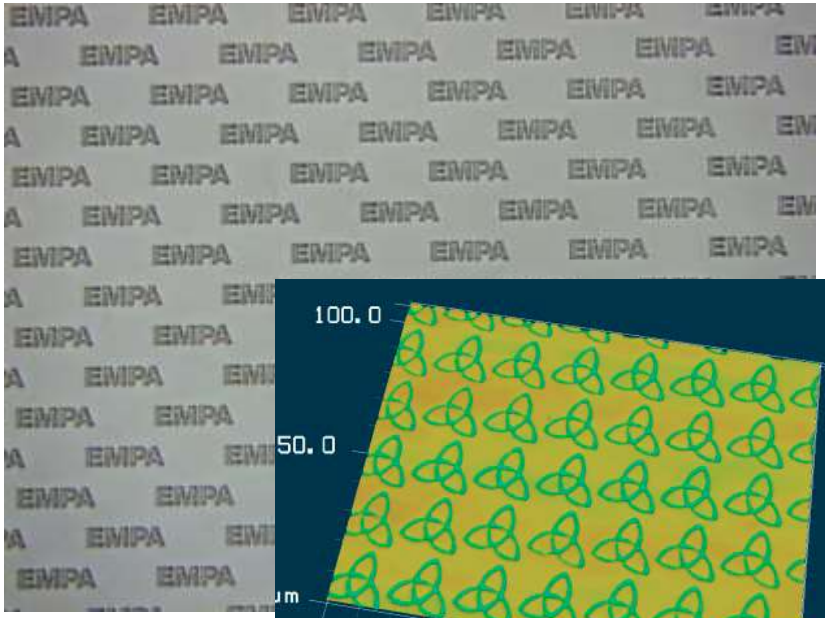
Super High Resolution Marking

Line width 2 µm & Text height 15 µm



Profil1	Horiz Abst.	H-Unters.	Durchs -H	Winkel	Quers La.	Quers Fl.	R	Anz
Alle	21.33µm	0.03µm	1.58µm	0.05°	24.29µm	40.64µm2		
Seg.1	15.76µm	0.02µm	1.84µm	0.06°	18.71µm	29.73µm2		
Seg.2	2.16µm	0.12µm	1.62µm	3.16°	2.99µm	3.94µm2		



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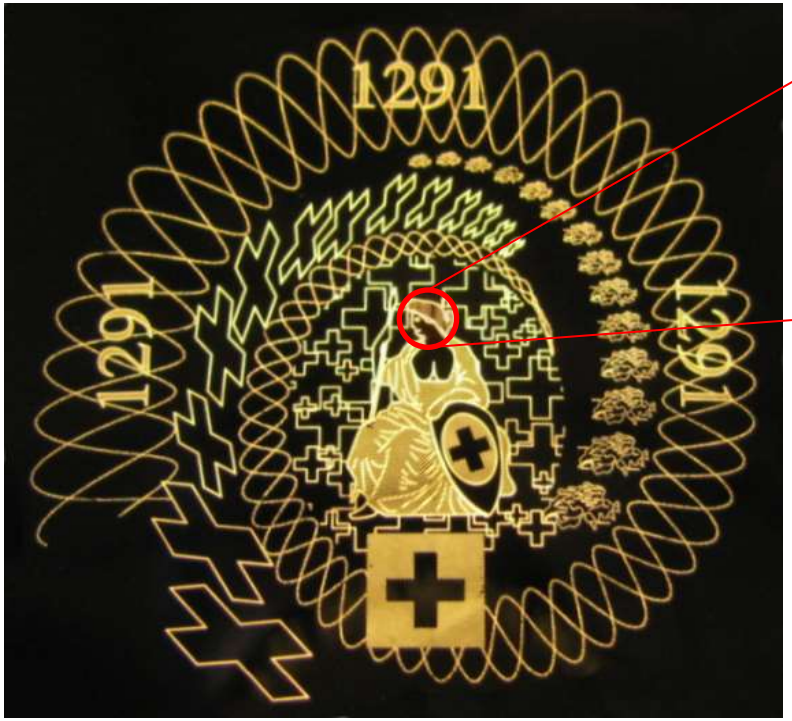
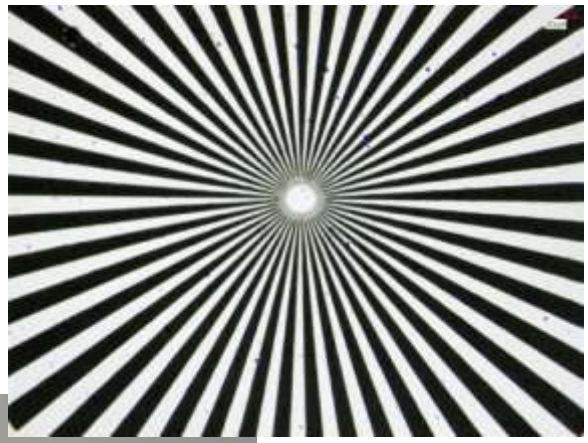
Super High Resolution Demetallisation

Demetallisation with 3 µm Resolution



4 mm



Demetallisation of Aluminium on PET

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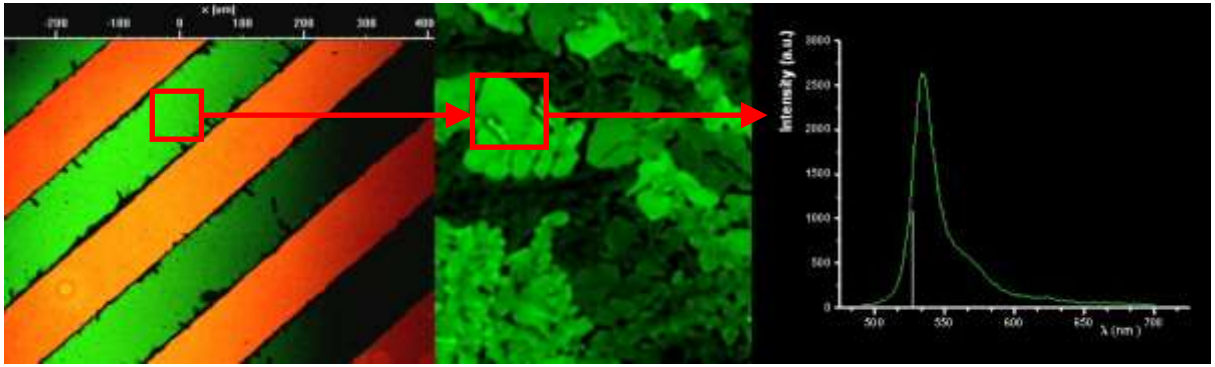
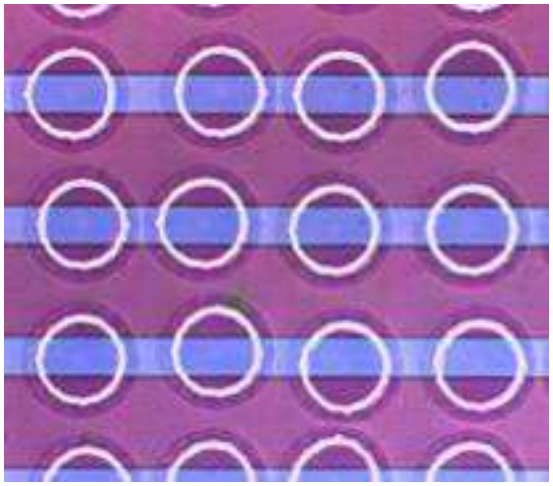
Flexible Electronics

Al cathode



Thin metal ablation without damaging organics underneath. Metal strips (orange) ablated from OLED (green) material with high magnification picture and intensity profile of emitted light.

ITO anode



Laser scribed ITO and the UV-embossed lens array aligned to the ITO lines.

Flexible organic illuminator demonstrator.

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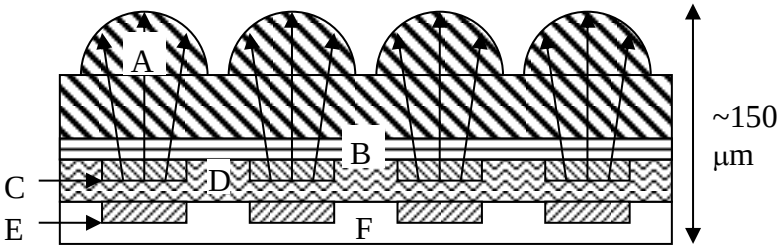
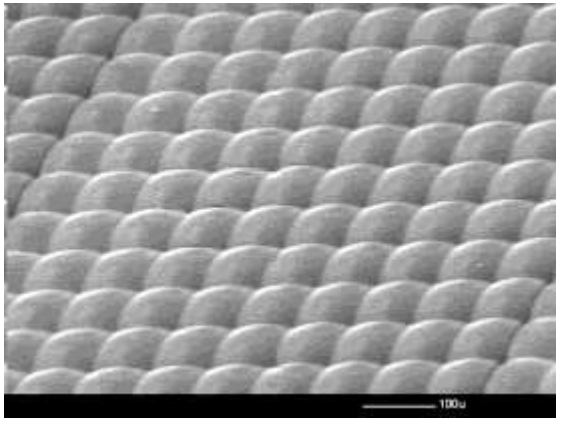
Flexible Organic Illuminator



Device structure of flexibel OLED illuminator or display: A) micro optics, B) barrier layer, C) ITO andode, D) OLED material, E) Al cathode, F) Encabsulation

A



Micro lenses directly laser ablated into PET

C

ITO ablation of 10 µm (left) and 100 µm lines nicely aligned to lenses on the backside.

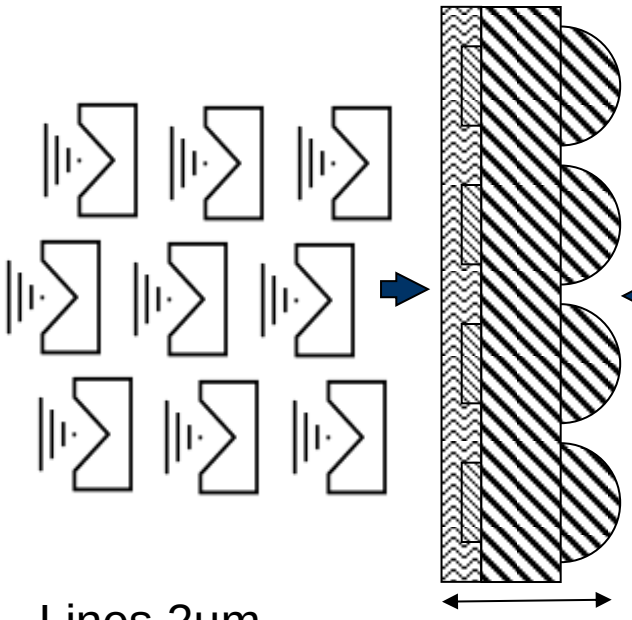
Moiré Magnifier

µ-structure enable thin and flexible optical device

Object array

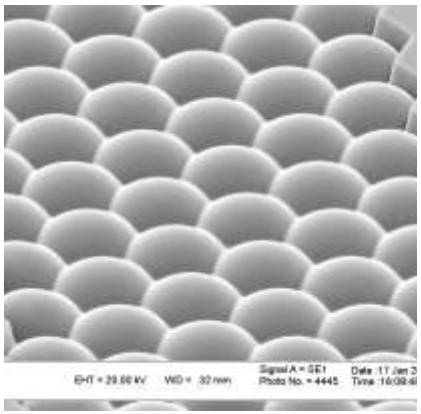
Lens array

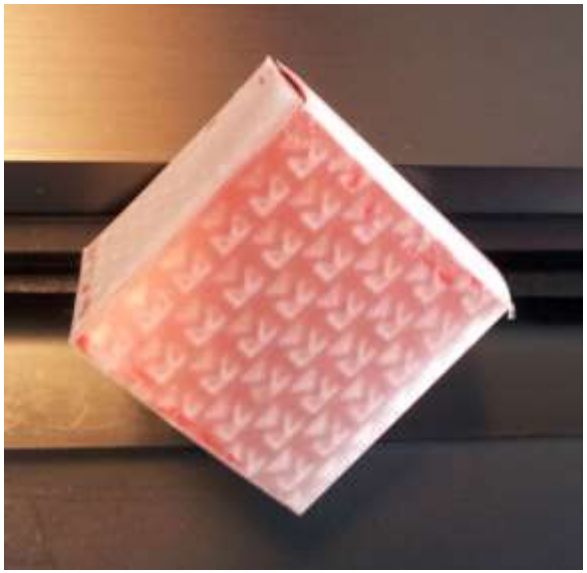
Packaging foil



Lines 2µm

< 30 µm





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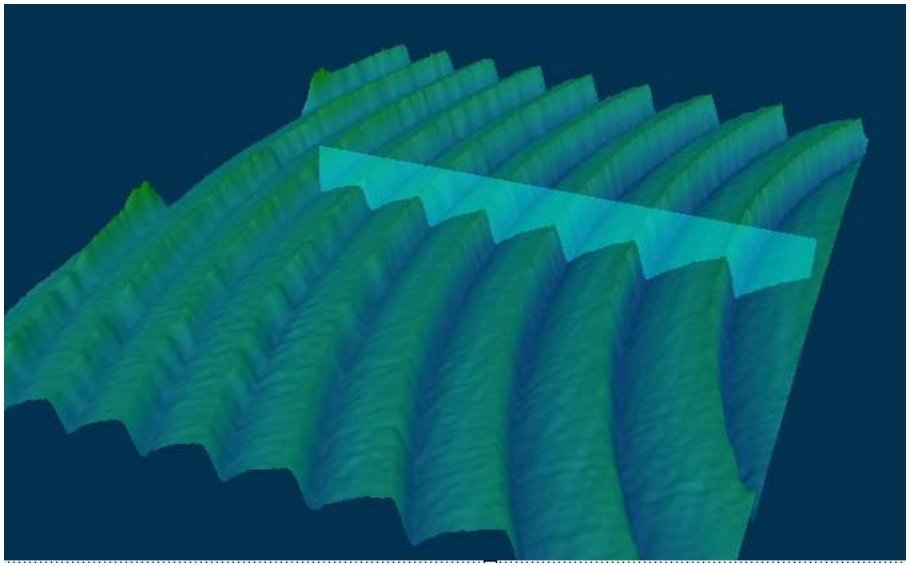
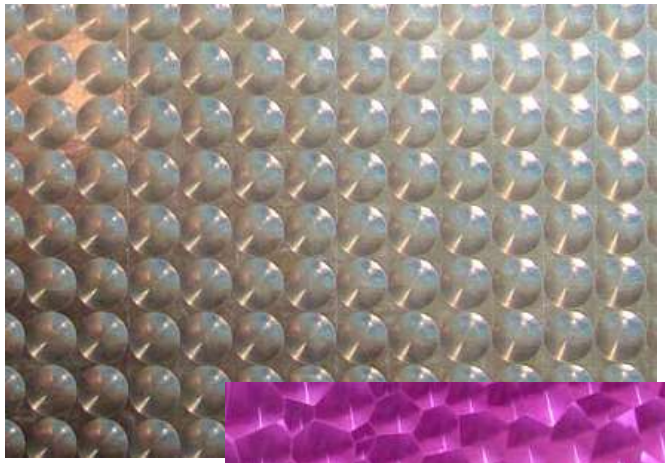
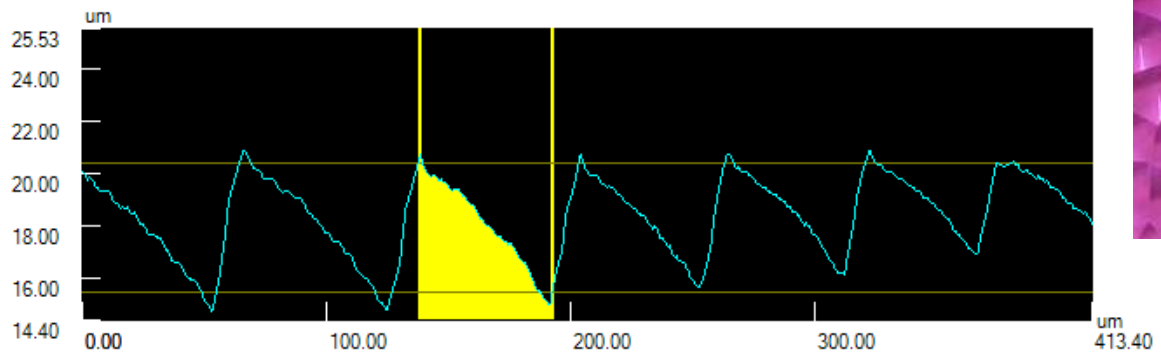
Shallow Fresnel Lens for Decor







Profile1	Horz. dist.	Hght. diff.	Hght. ave.	Angle	C.S. length	C.S. area	R	Comment
All	413.40um	2.01um	18.37um	0.28°	424.41um	1780.16um2		
Seg.1	54.82um	4.91um	18.05um	5.12°	55.61um	222.39um2		

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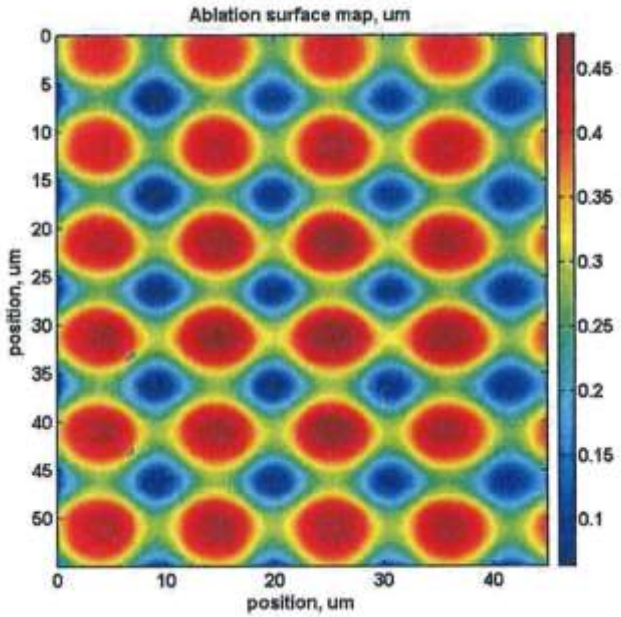
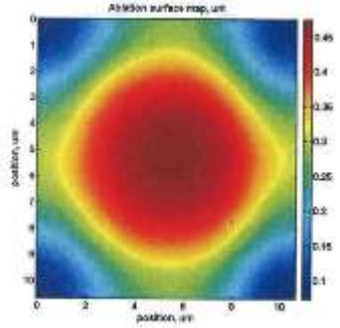
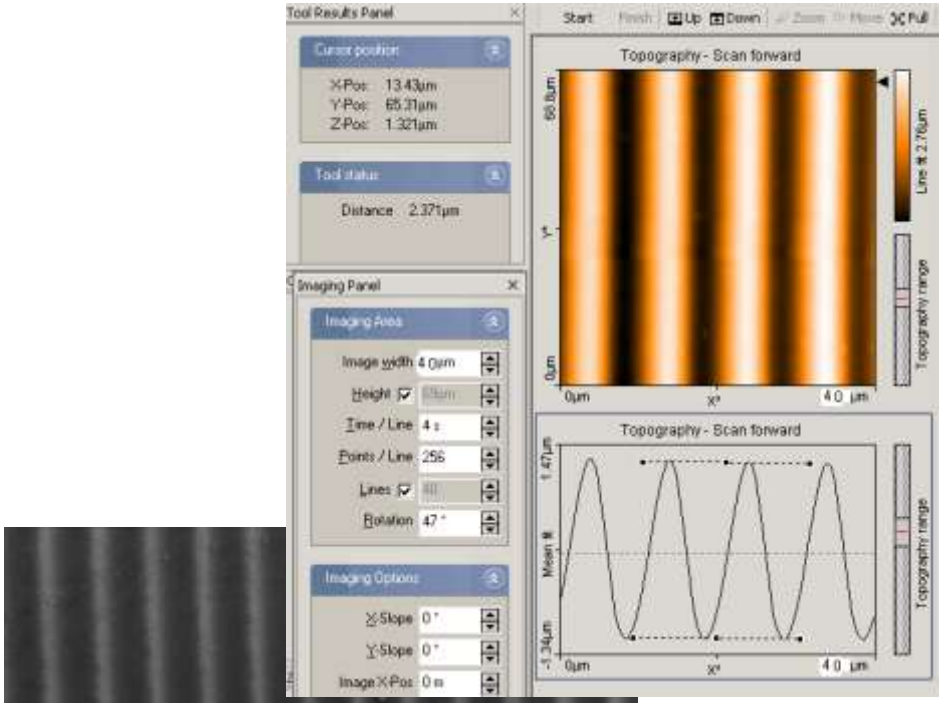
Shallow continuous profiles

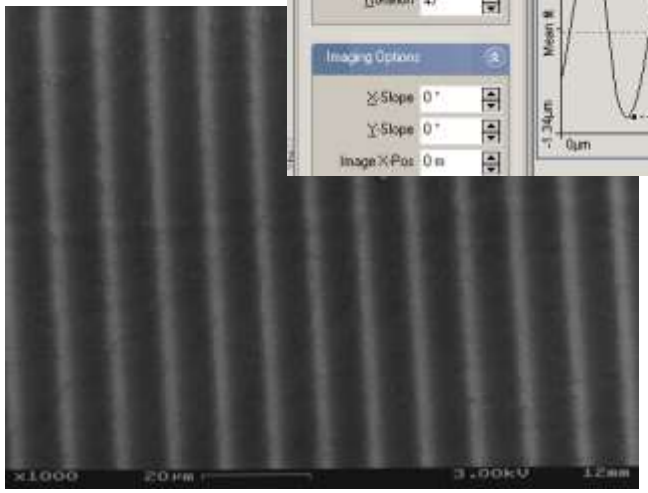
MLA: d=10µm, h=500 nm





Sinus gratting: p=10µm, h=2.3µm





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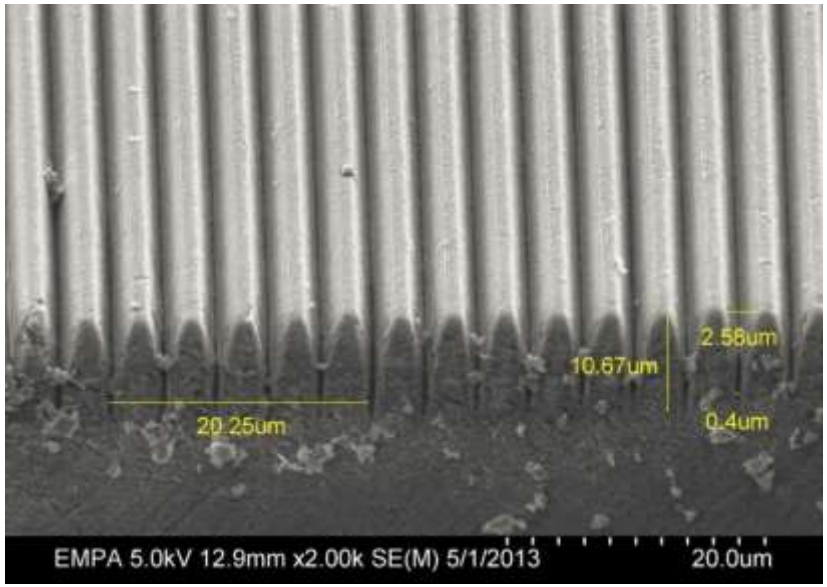
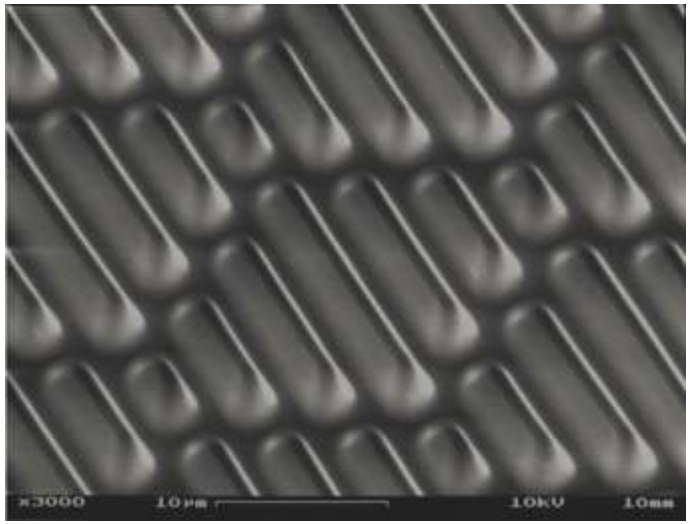
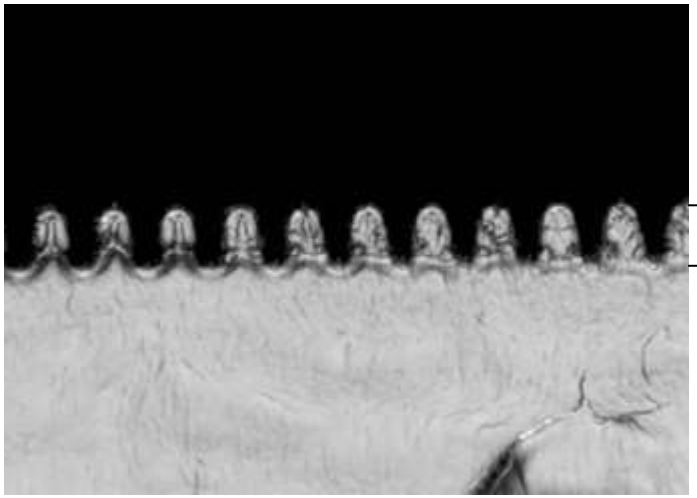
Few Micron Sized Structures



Direct writting of 2 µm gratting in PDMS



Direct writting of 2 µm Geometries



Direct writting of 6 µm Gratting (aspect 1:1)

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