DaLI Direct Laser Lithography

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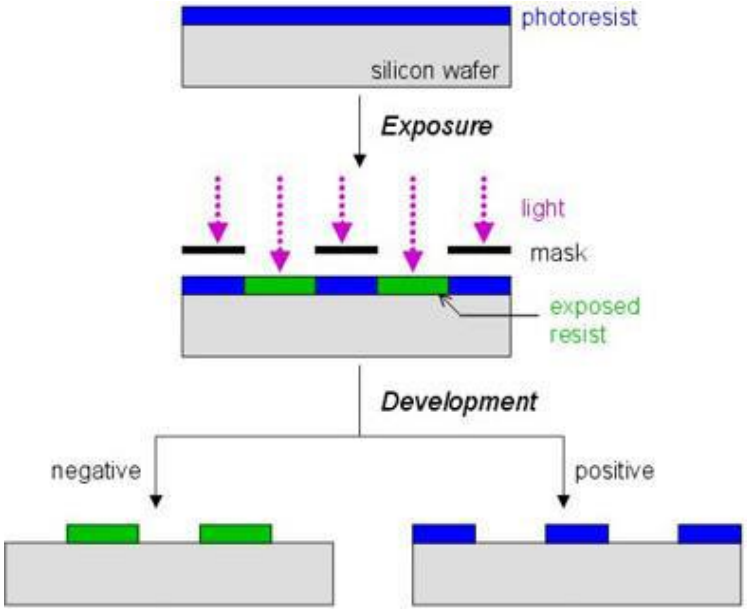
Lithography

- transfer of a pattern to a photosensitive material
- process used in microfabrication to pattern parts of films different thickness

- Types of photoresists:
  - ❖ Positive PR - Exposed regions dissolve
  - ❖ Negative PR -Unexposed regions dissolve
  - ❖ Image reversal PR



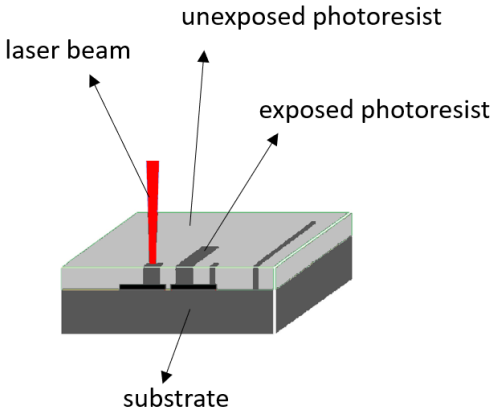
There are different types of UV lithography..

Lithography with mask

- Simple and fast exposure for larger wafers
- Same patterns for mass production
- Mask is expensive and it can’t be chanced

Direct laser lithography

- No need for masks
- Rapid prototyping system
- For research and development process

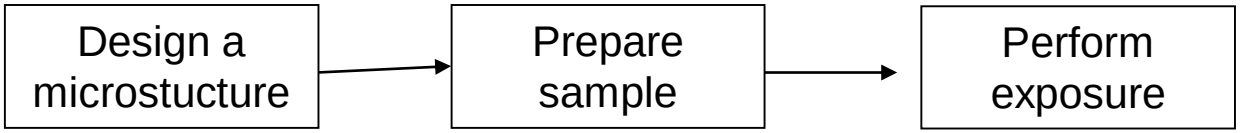


DaLI - An overview

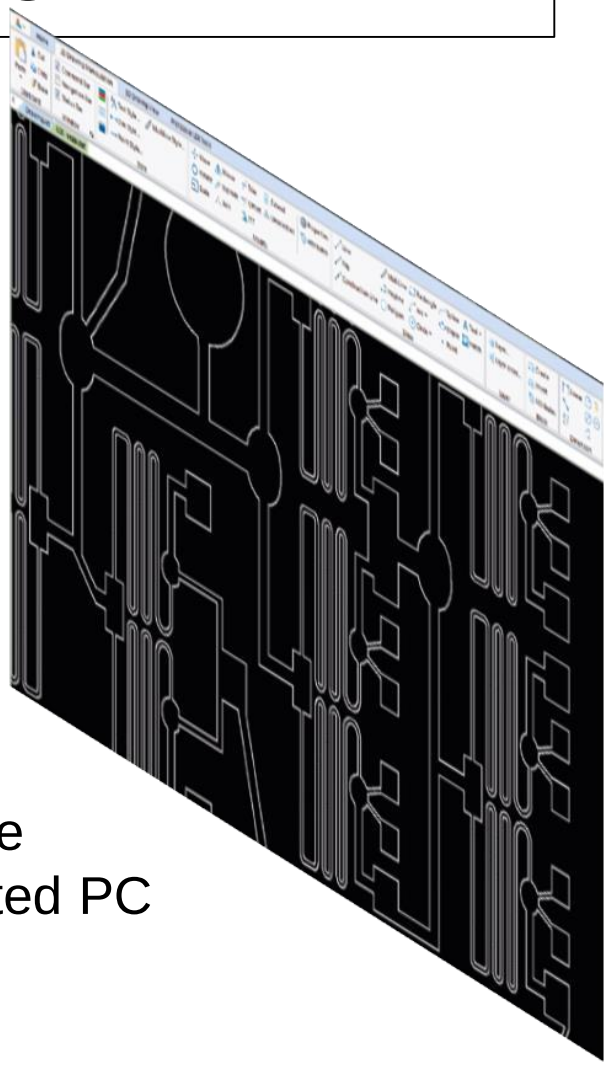
- Table top device
- Thermalization ensures ultimate precision
- Operated entirely through software
- User friendly
- In-house prototyping

- Substrate size up to 100x100 mm
- Laser wavelength375 nm
- Laser spot size (TEM00) 1 µm and/or 3 µm (software selectable)
- Laser spot positioning resolution<1nm
- Writing speedup to 100.000 spots per second
- Structure size down to 1µm
- Data input formats DXF, BMP
- Devicedimensions650 ×522 ×626 mm, 80 kg
- Integrated microscope for sample alignment and inspection

DaLI through the eyes of a user

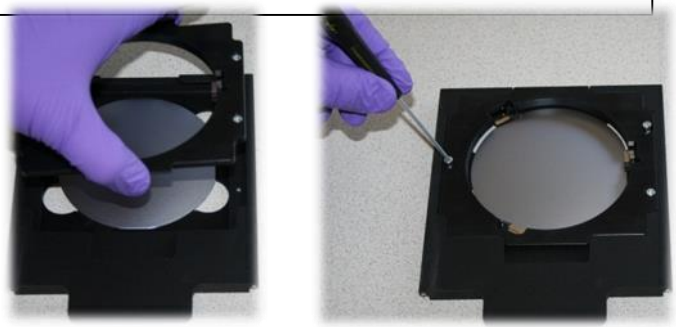


An intuitive way of designing a microstructure using CAD



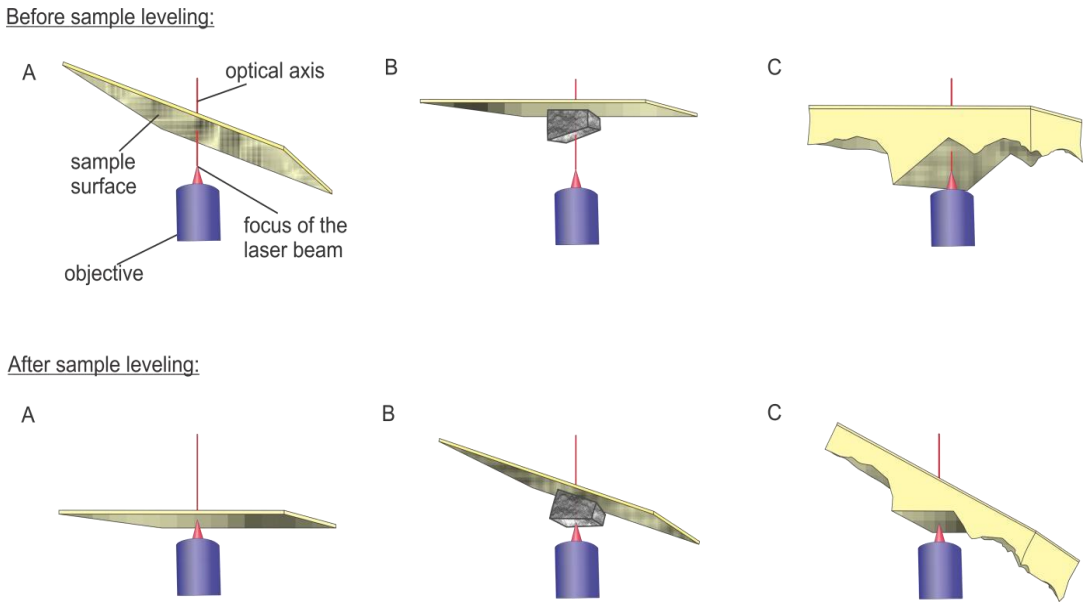
- many drawing tools available: line, polyline, circle, rectangle, array, ...
- import filters: dxf, bmp
- modify imported structure: move, scale, rotate, mirror, …
- Five (5) standalone versions of DaLI software available: design your structure on a dislocated PC

The sample is easily prepared for illumination



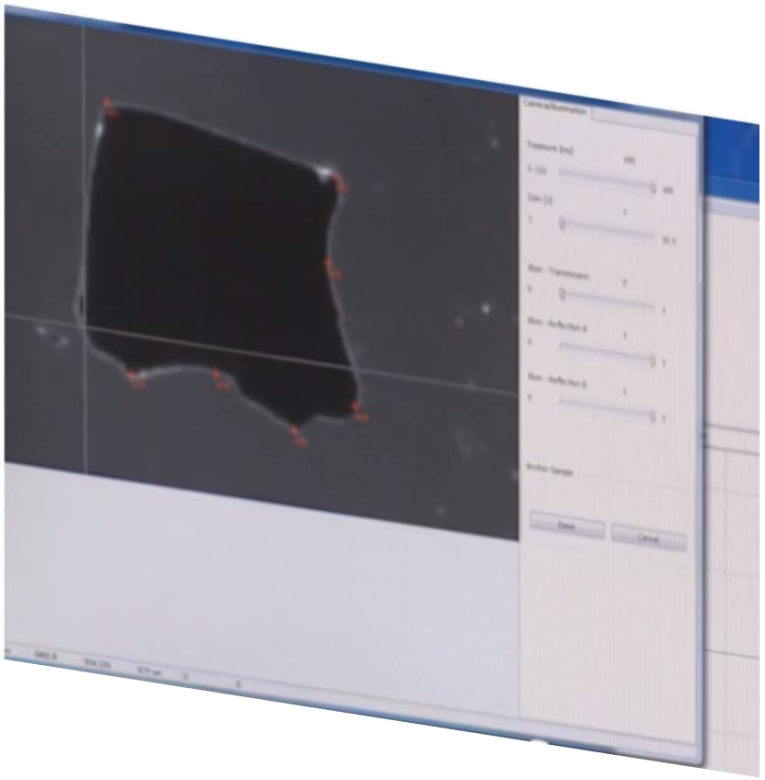
- sample mounted in customizable holder and slid into device

- sample levelling enables exposing surfaces of irregular shapes



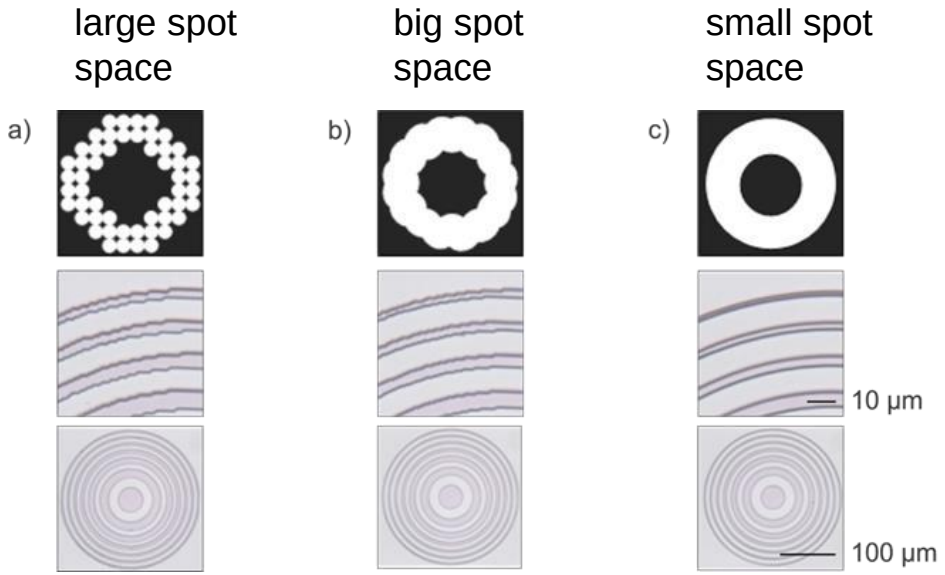
And pre-existing structures can be used for anchoring

- Sample anchoring enables:
  - positioning, scaling, rotating of the new structure relatively to the existing structures
  - marking small target surfaces



Working parameters control the process quality

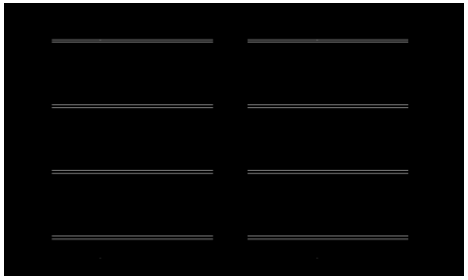
- Assign working parameters
  - Fine (1 µm)or coarse (3 µm)laser beam
  - Spot spacing
  - Exposure dose [mJ/cm^2]

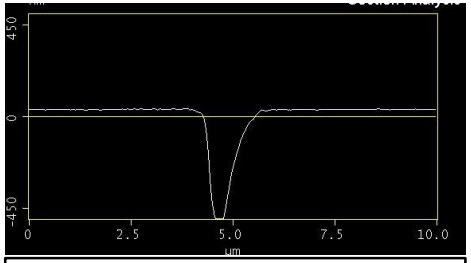


Small spot spacing results in high details and crisp, sharp edges.
Large spot space provide fast exposure of larger areas.

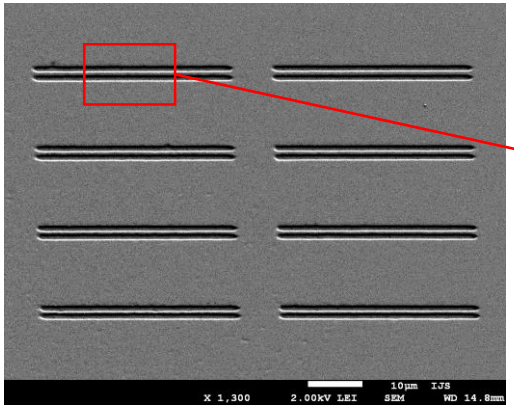
AZ 1505

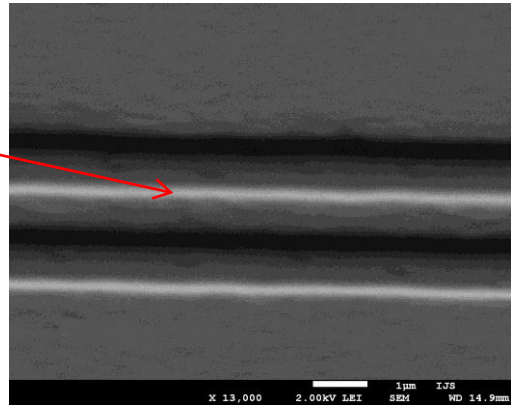
- Positive photoresist
- Thickness up to 700nm
- Resolution down to 1µm
- Application in manufacture of microelectrodes, electrical circuits, transistor chips, manufacture of masks on Chromium



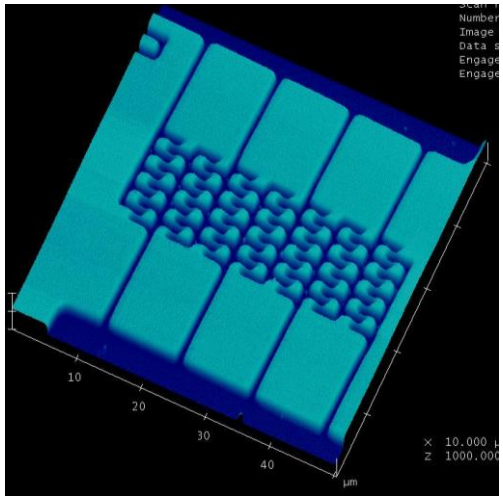


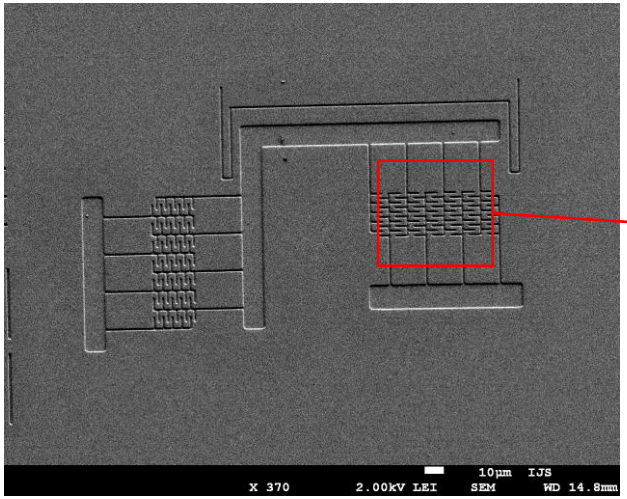
Width at the bottom: 195nm

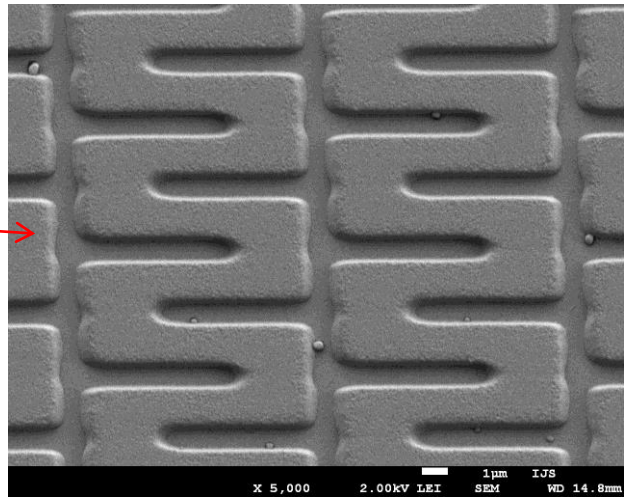


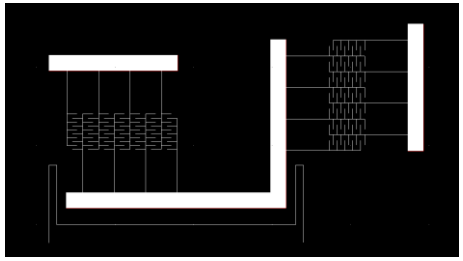


AZ 1505







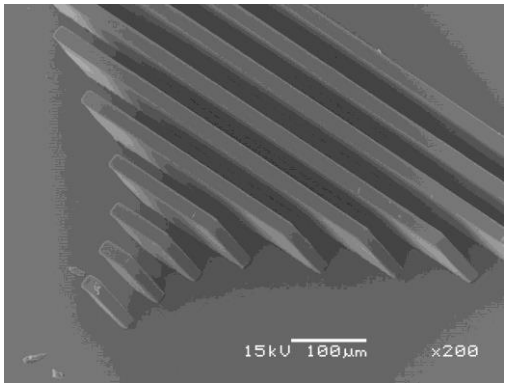


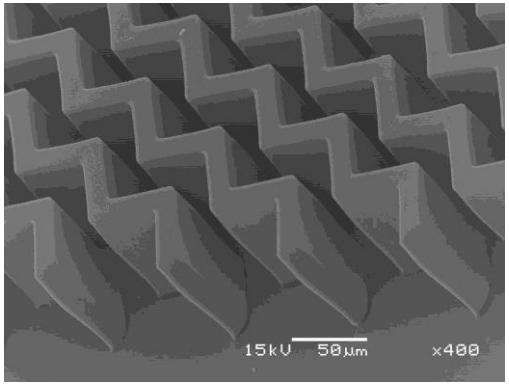
Lines are 1µm

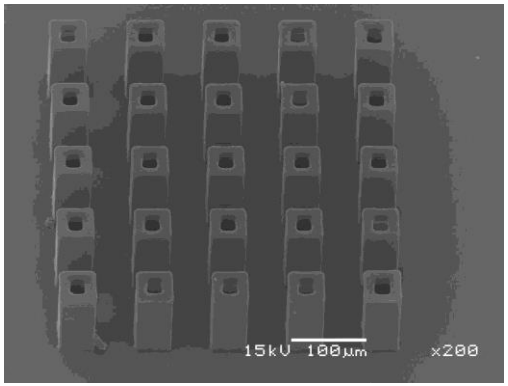
Gap between lines is app. 2 µm

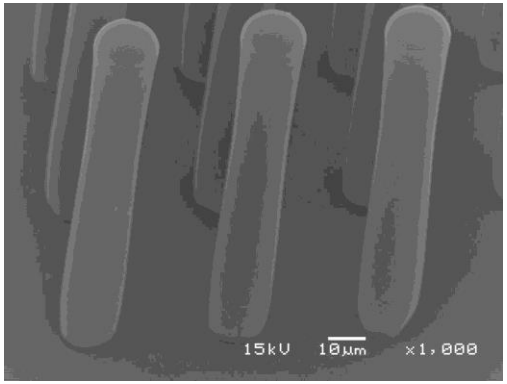
SU-8 2050

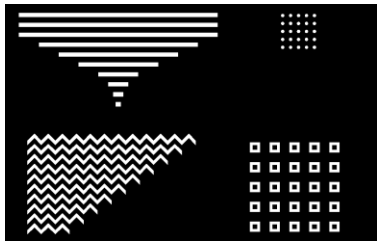
- Negative photoresist
- High aspect ratio imaging with near vertical walls
- Thickness up to 200 µm
- Application in microfluidics, manufacture of channels, filters, particle traps, manufacturing of micromolds.





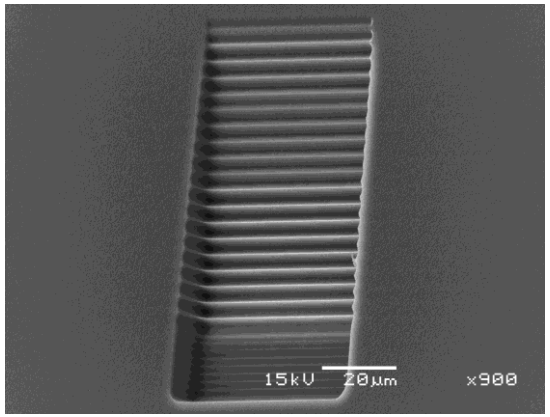


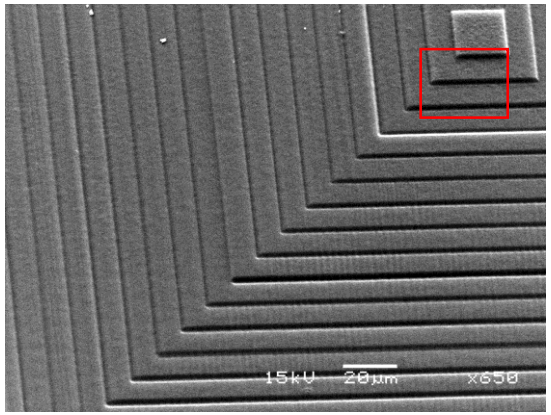




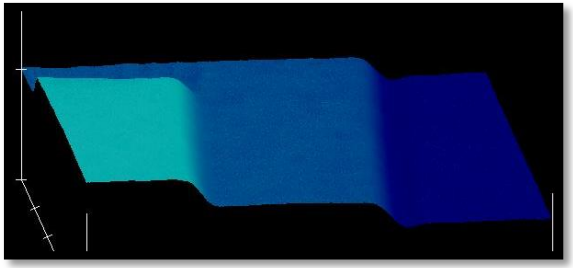
Ma-P 1275

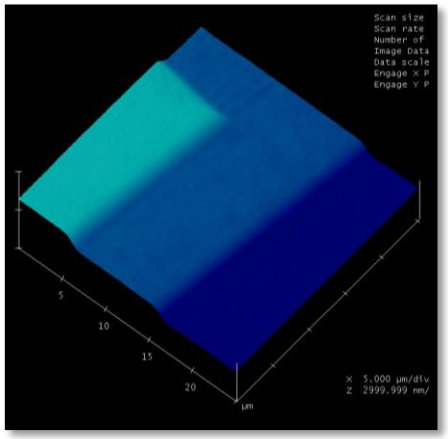
- Positive resist
- Thickness up to 60 µm
- Applications in microfluids, binary lithography, for etching, metal deposition, lift off process





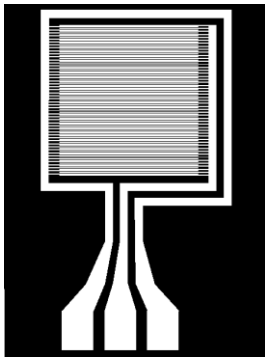
Each step is app. 700nm

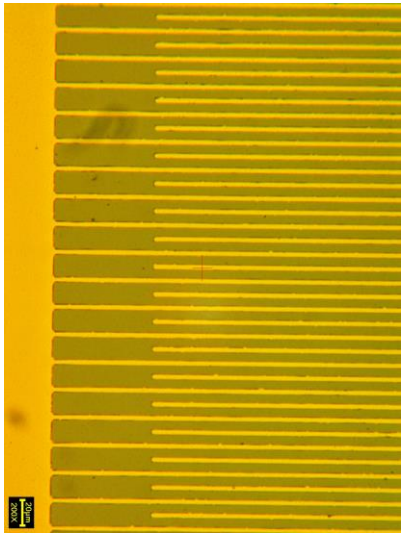




LOR 3A and S1805

- Combination of 2 photoresist for undercut profile
- Applications in electronical circuits, transistor chips





Last thoughts...

- DaLI system is constantly evolving to have higher resolution
- System is perfect for research institute as we use it for different applications
- System is thermally independently thermalized so it doesn't need special environment
- In lithography is also very important how do you prepare sample, as it effects on exposure

Thank you for your attention!