ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

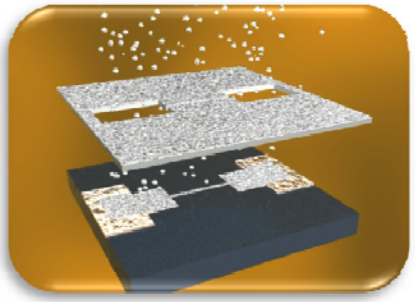
LMIS1
Laboratoire de Microsystèmes 1

Group Prof. Jürgen Brugger

« At the interface between
MEMS and Nanotechnology »

Stencil Lithography

What Is It ?



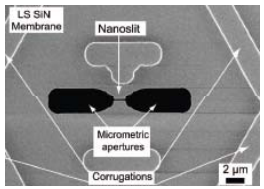
High-resolution shadow-mask technique

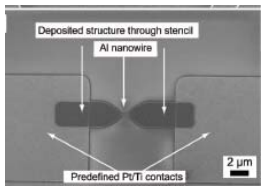
Advantages

- ❑ full-wafer (4 inch)
- ❑ sub-100 nm features
- ❑ parallel process
- ❑ resist-less
- ❑ on 3D surfaces
- ❑ on sensitive substrates
- ❑ with organic materials

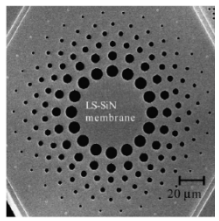
Available Processes

❑ material deposition

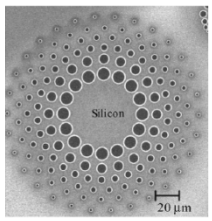




❑ material etching



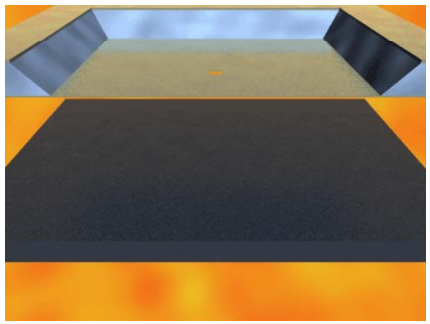
Low-stress SiN Stencil



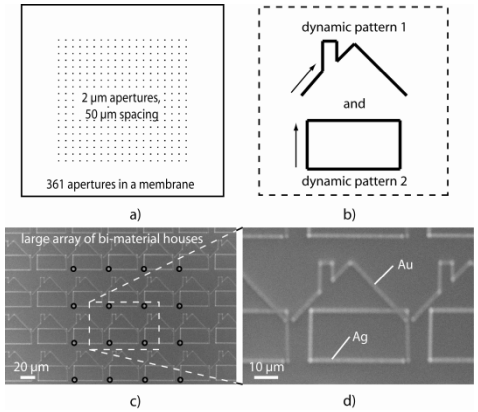
1 µm Si etched through stencil

❑ ion implantation

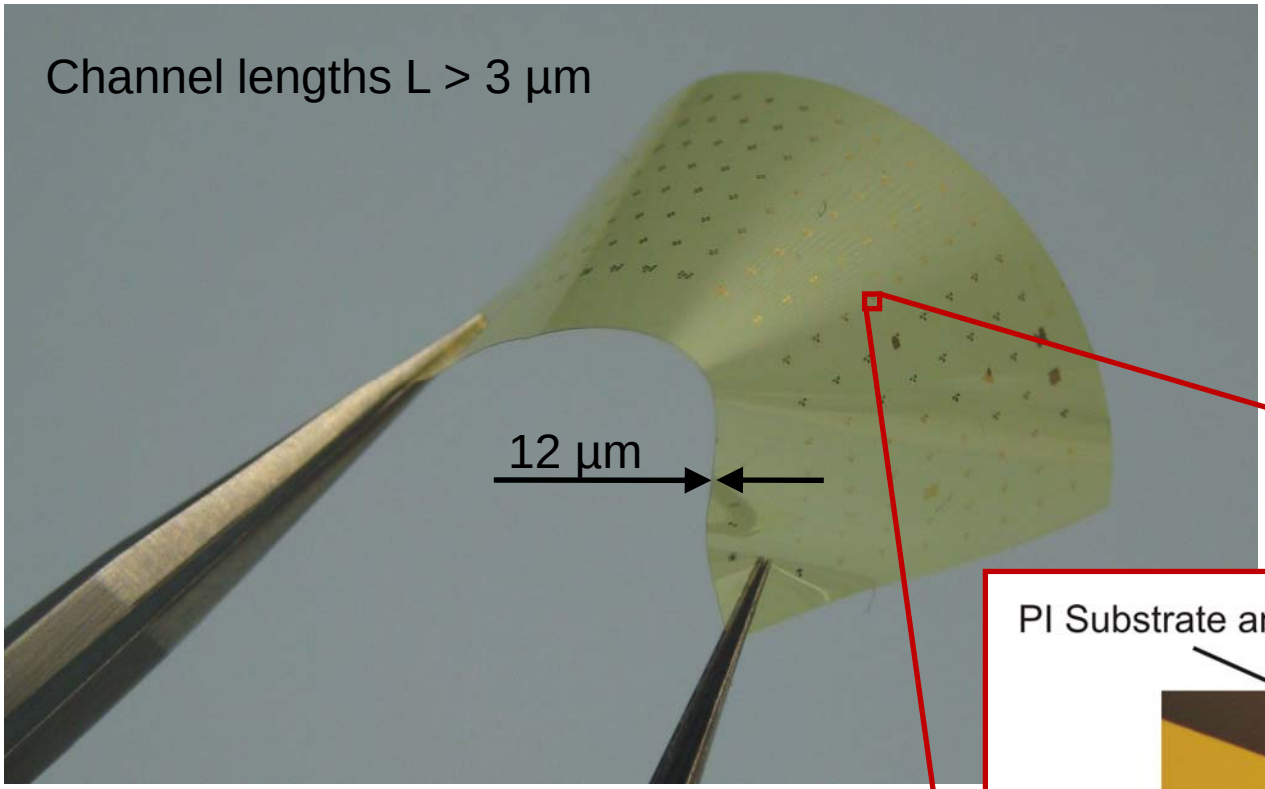
Dynamic Stencils



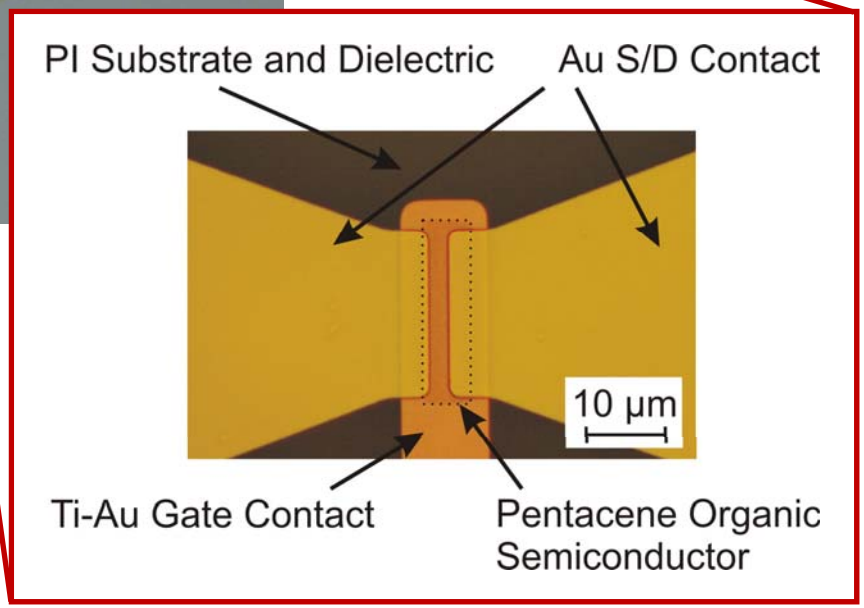
Stencil moves in-situ relative to the substrate during evaporation



OTFT on Flexible Substrates



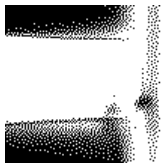
K. Sidler
Eurosensors 2009,
Switzerland



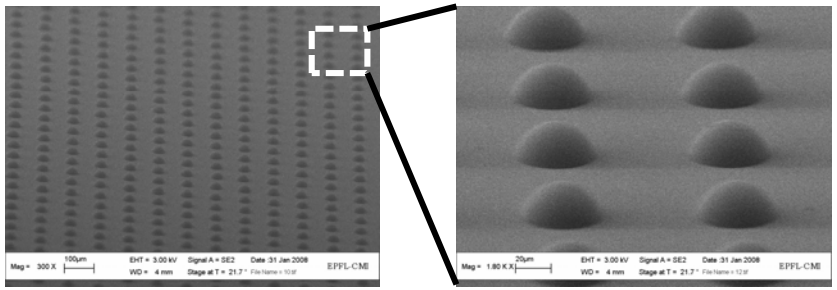
Stencil lithography applied to flexible polyimide layers to fabricate organic thin film transistors (OTFT)

Inkjet printing of Polymers

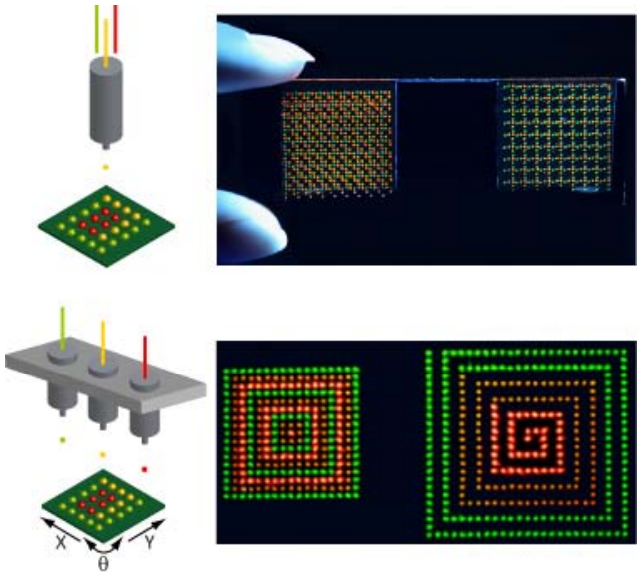
- Multi-material inkjet printing
- Drop-on-demand IJ printing of SU-8
- Inkjet printing of micro-lenses



Drop on demand printing



V. Fakhfouri et al., “Drop-On-Demand Inkjet Printing of SU-8 Polymer “, Micro and Nanosystems, 1 (2009) 63-67.



J. Y. Kim et al., "Inkjet printing multicolor nanoscrystal composite" in SMALL, 2009

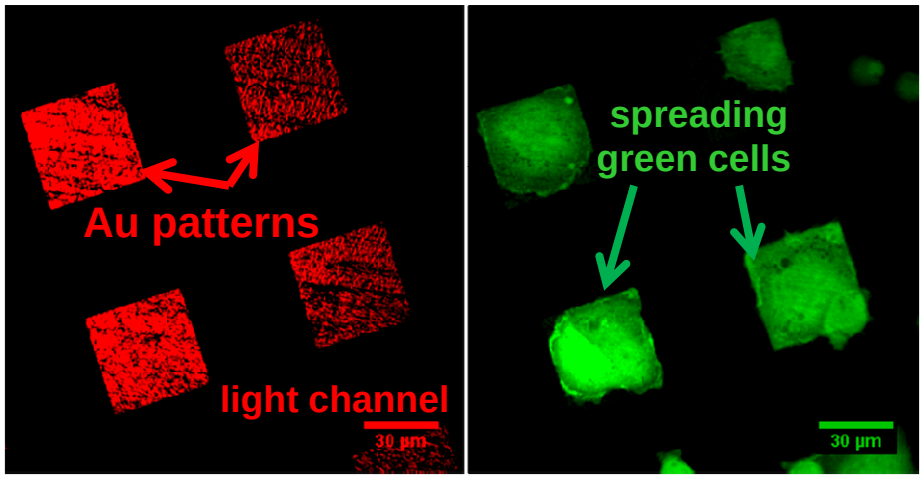
Micro and Nano for Biology

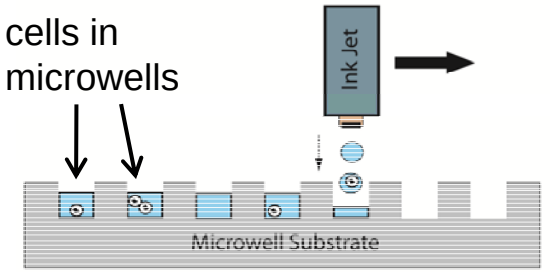
Stencil Lithography

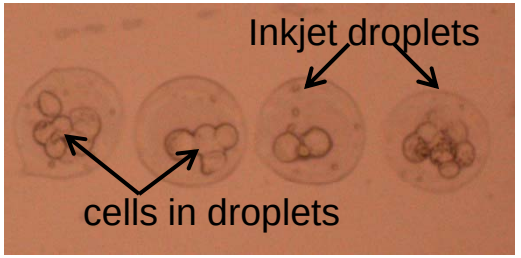
- Pattern cells on a variety of substrates
- Study how cells behave and interact with their environments
- Coatings to improve medical devices

InkJet Printing

- Pattern cells and bio
- Deposit costly biomaterials with minimal waste
- Arrange cells in 3D structures to make artificial organs



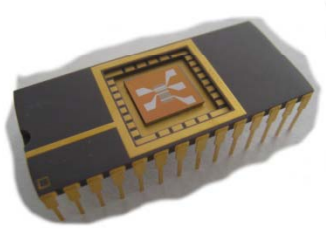




K. Pataky (in prep)

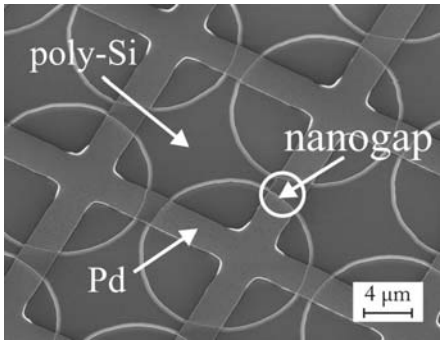
Nanosensors

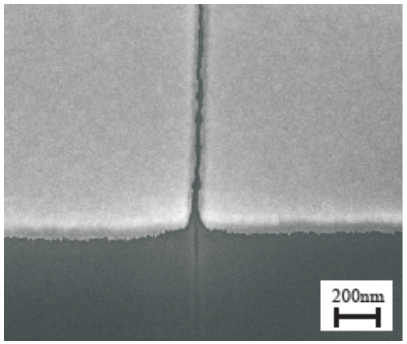
- Nanogap H_2-sensors

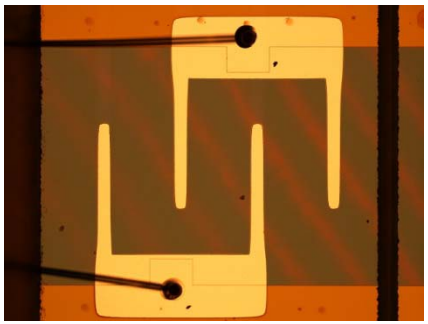


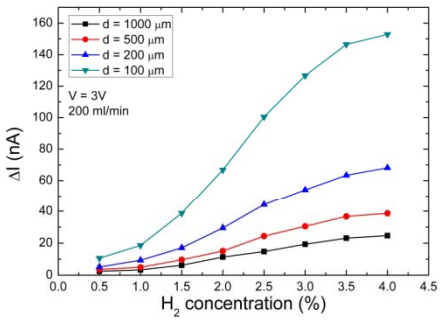
Various technologies:

- Single **nanogaps**
- Ordered nanogaps arrays
- Ultrathin Pd films





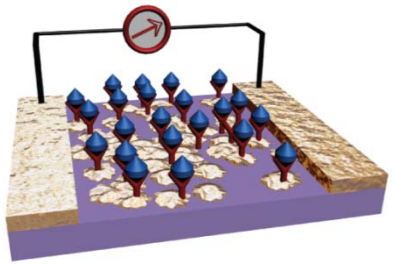


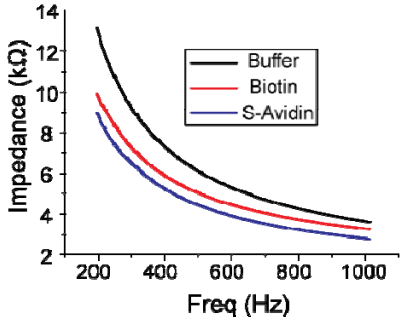


Th. Kiefer, PhD 2009

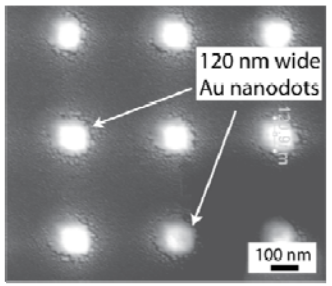
- Biosensors

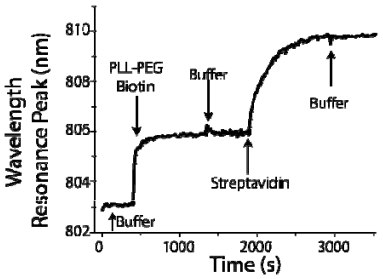
• Impedance measurements on discontinuous films





•Localized Surface Plasmon Resonance in Metallic Nanodots





O. Vazquez-Mena, PhD 2009

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nano-tera.ch

SELFSYS (Fluidic-mediated self-assembly for hybrid functional micro/nanosystems)

Self-assembly of cylinder pairs and encapsulation of a specific substance

Fig 1: Released of a substance

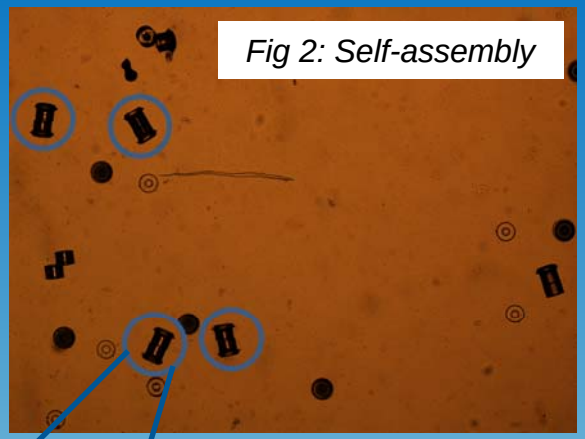


Fig 2: Self-assembly

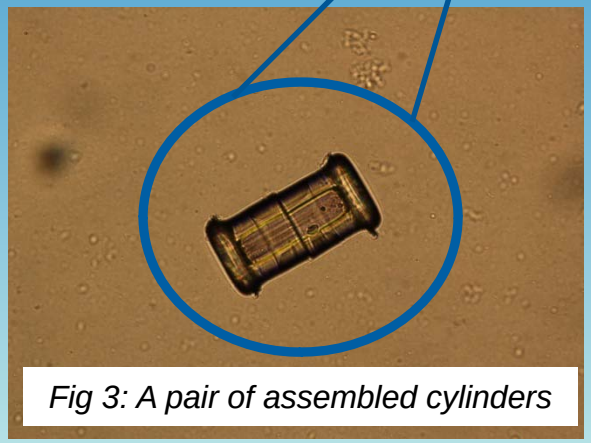
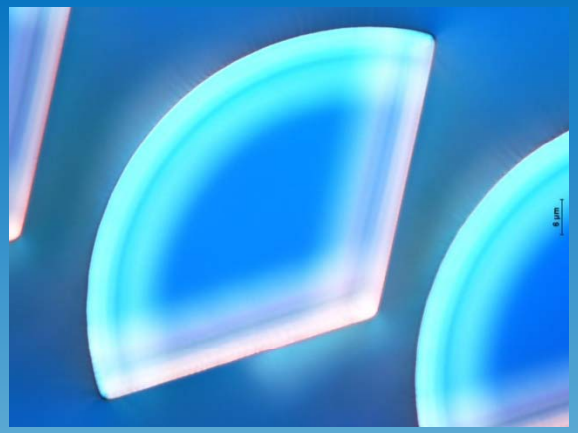


Fig 3: A pair of assembled cylinders

Fig 4: SU-8 triangle shaped compound, angle of 120°



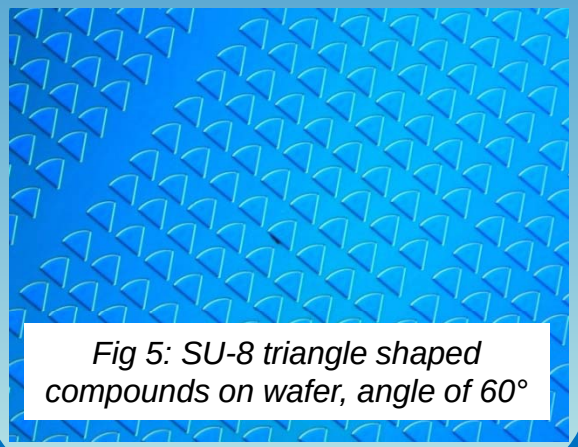


Fig 5: SU-8 triangle shaped compounds on wafer, angle of 60°