Behind the Scenes of a European Infrastructure for micro and nano fabrication and characterisation

Karlsruhe Institute of Technology

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At Nanotechnology PL

Satellite event to E-MRS fall meeting

September 14th 2010

SEVENTH FRAMEWORK PROGRAMME

What is EUMINAfab?

- European Research Infrastructure for multimaterial micro and nano fabrication and characterisation
- 10 partners from 8 countries
- EC funded, FP7 Capacities, Total budget: 7.8 M€
- March 2009 – February 2013

Funded by the European Commission
Grant agreement no.: FP7-226460

What does EUMINAfab do?

- Open innovation:

  Offer no fee access to over 70 micro and nano-technologies
- Knowledge management:

  Technology capability mapping and technology readiness levelling
- Technology integration:

  Develop process chains and technology demonstrators
- Increase mobility of scientists:

  Summer/winter schools and researchers exchange programme
- Build a sustainable infrastructure for micro and nano fabrication and characterisation

Further details on everything www.euminafab.eu
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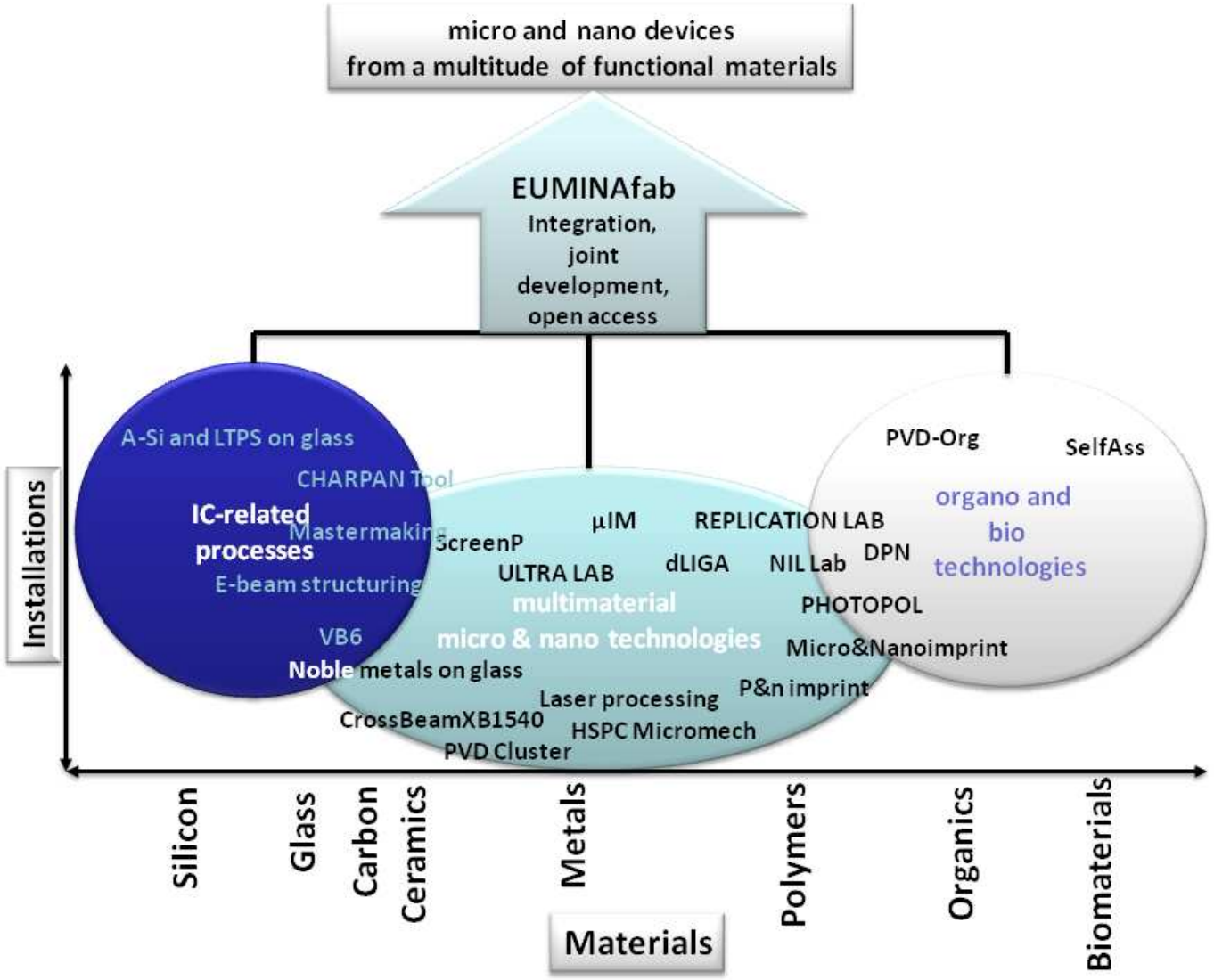
Comprehensive process portfolio



36 installations → a MNT toolbox

EUMINAfab

µ and nanostructuring

- Electron beam
- E-beam & SCIL
- Ion beam (Focus-sed cross beam)
- Ion beam (parallel ion beams)
- DPN
- Direct X-ray litho
- Laser technologies (e.g. ps, fs, surface texturation)
- Mechanical µma-chining (freeform)
- Photopolymeristn.
- Mastermaking process chain
- DRIE (Si, glass, SiO2)

Thin film deposition

- PVD technologies (e.g. noble metals, DLC, nanocomposi-tes, metals, nitrides)
- Org. PVD (e.g. organic liquids & powders,oxides)
- CVD (metals, polymers, ceramics)
- Self Assembly (e.g. semiconductors, organic)
- Screen printing (e.g. metals, dielectrics)
- Optical Coating

Replication

- µ injection moulding (e.g. polymers, metals, ceramics; small series)
- µ hot embossing (small series)
- Thermal imprinting & UV-NIL
- NIL process chain (UV photolitho, dry & wet etching)

Characterisation

- HRTEM
- XPEEM
- Auger Nanoprobe
- In situ synchrotron X-ray diffracto-metry (> 2010)
- AFM, conductive AFM
- Spectrophotometry /-radiometry
- Profilometry (e.g. low force contact mode & white light mode)
- µCMM
- Low force balance, ellipsometry

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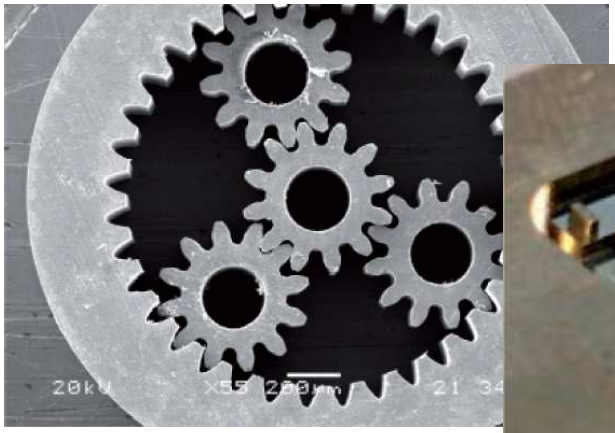
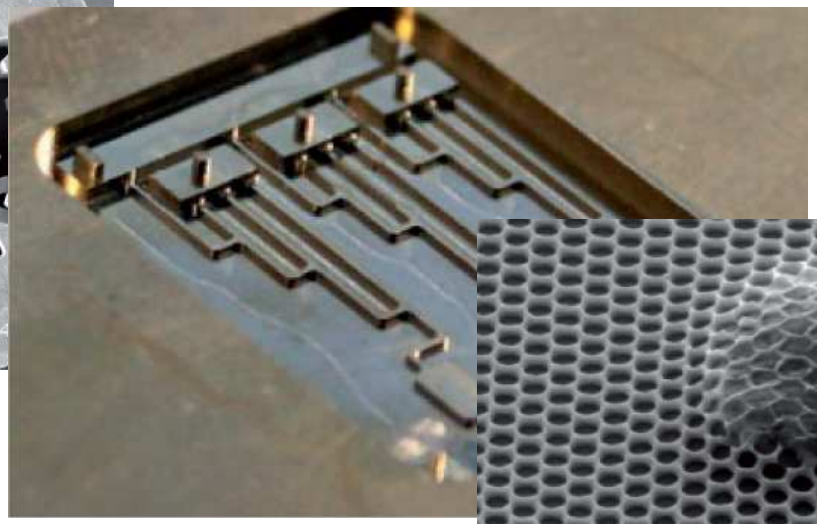
KIT Karlsruhe Institute of Technology

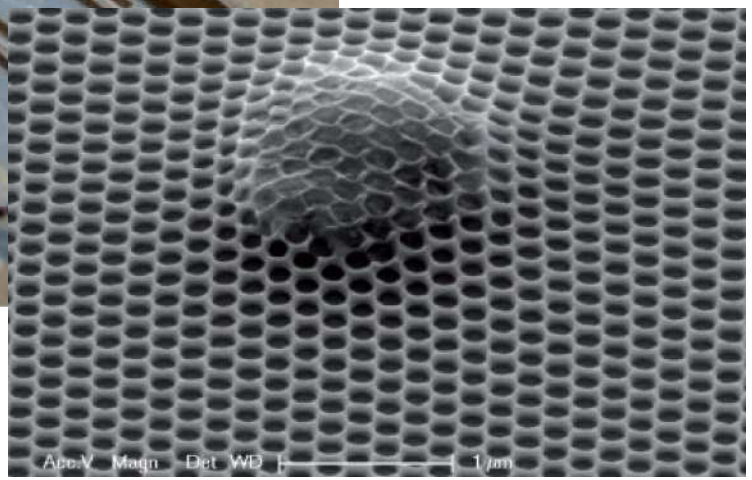
Some Examples Micro – Nano Patterning



mechanical microstructures
(© TEKNIKER)



mould inserts
(© Cardiff University)



nano printing on curved surfaces
(© Philips MiPlaza)

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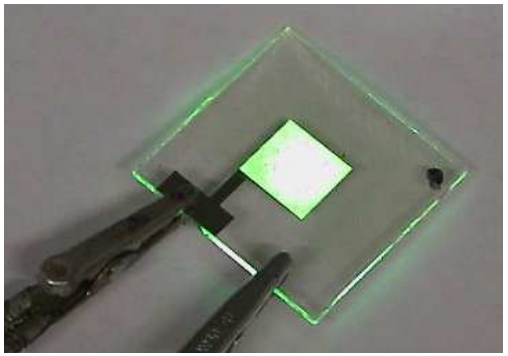
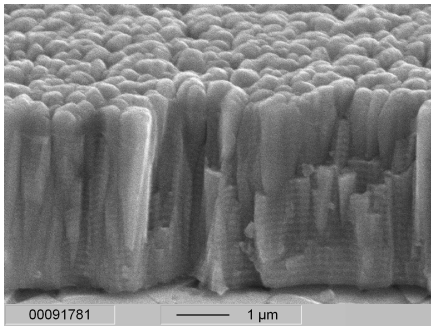
Some Examples: Thin film deposition

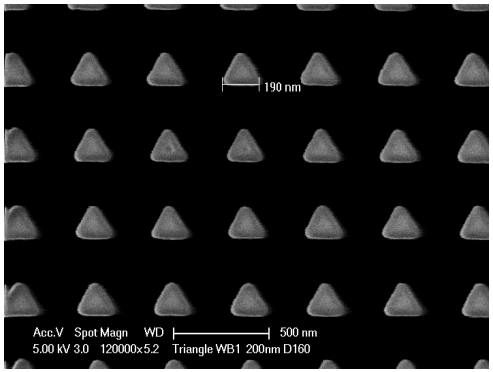
- CVD
- PVD Cluster for layers and coating tools and organic device fabrication
- Self assembling tools
- Thin film noble metals
- Optical Coatings: new September 2010



OLED single pixel (10x10 mm) fabricated by vacuum deposition
© Centro Ricerche FIAT



Fracture surface of a TiN/ZrN multilayer coating © KIT



Noble metals Thin film deposition: 10-1000 nm
© MiPlaza

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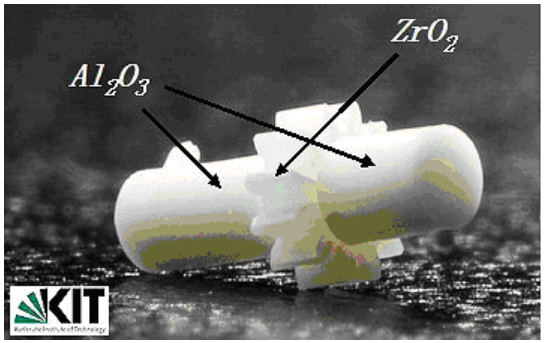
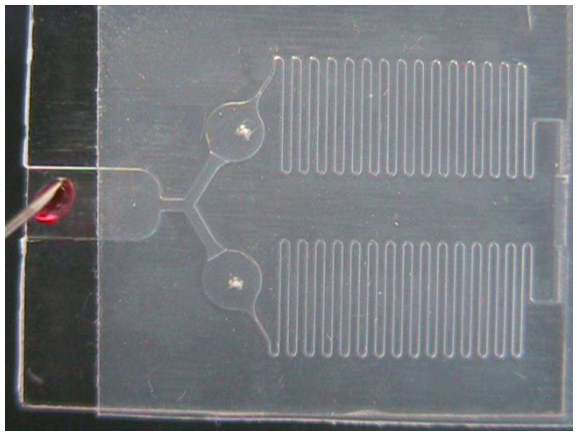
Some Examples: Replication

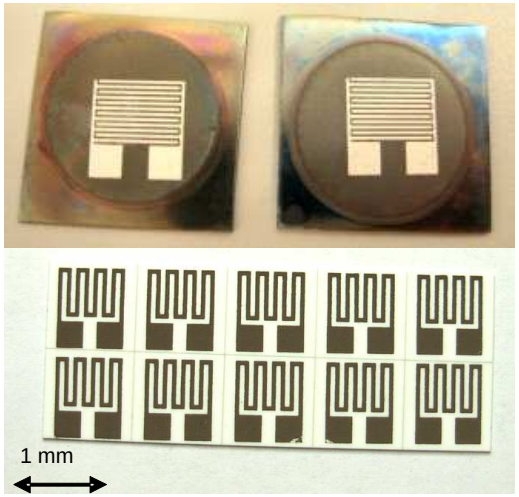
- Micro & Nano Imprinting
- Micro injection moulding
- Reactive ion etching
- Hot embossing



Combined gear wheel / shaft
2C injection moulding © FZK



Microfluidic device replicated by hot embossing in a 1 mm thick PMMA film (© TEKNIKER)



Screen printed Ni on alumina and Ag on porous titania for **gas sensors** (© Centro Ricerche FIAT)

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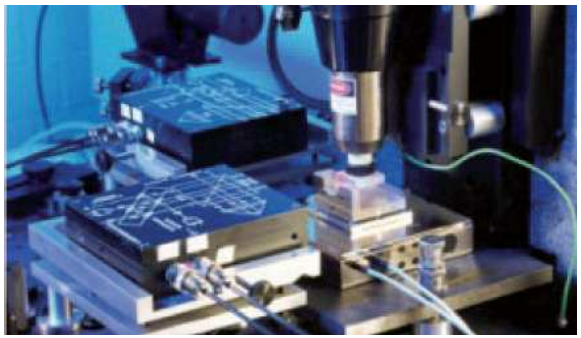
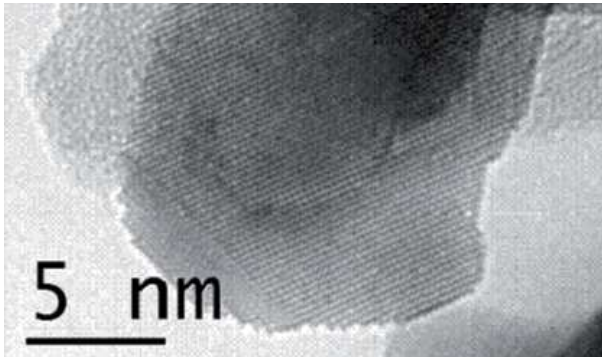
Some Examples: Characterisation

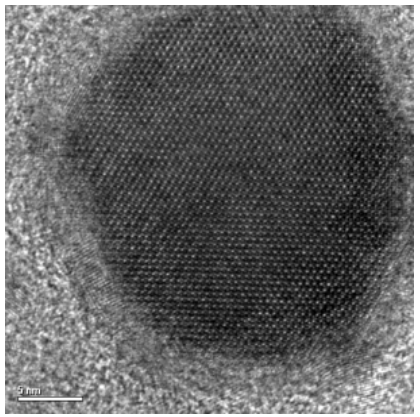
- Transmission Electron Microscopy
- NANO Beam Line (from 2010)
- Electro-optical characterization
- Metrology



metrological atomic force microscopy
© NPL



nanomaterials characterisation
© CEA Grenoble



HRTEM image of Co/CoO particles showing the **atomic arrangement** © Forschungszentrum Karlsruhe/KNMF

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EUMINAfab

….in the area of micro nano fabrication and characterisation

….do you have all **necessary capacities & capabilities** to realize your ideas

?

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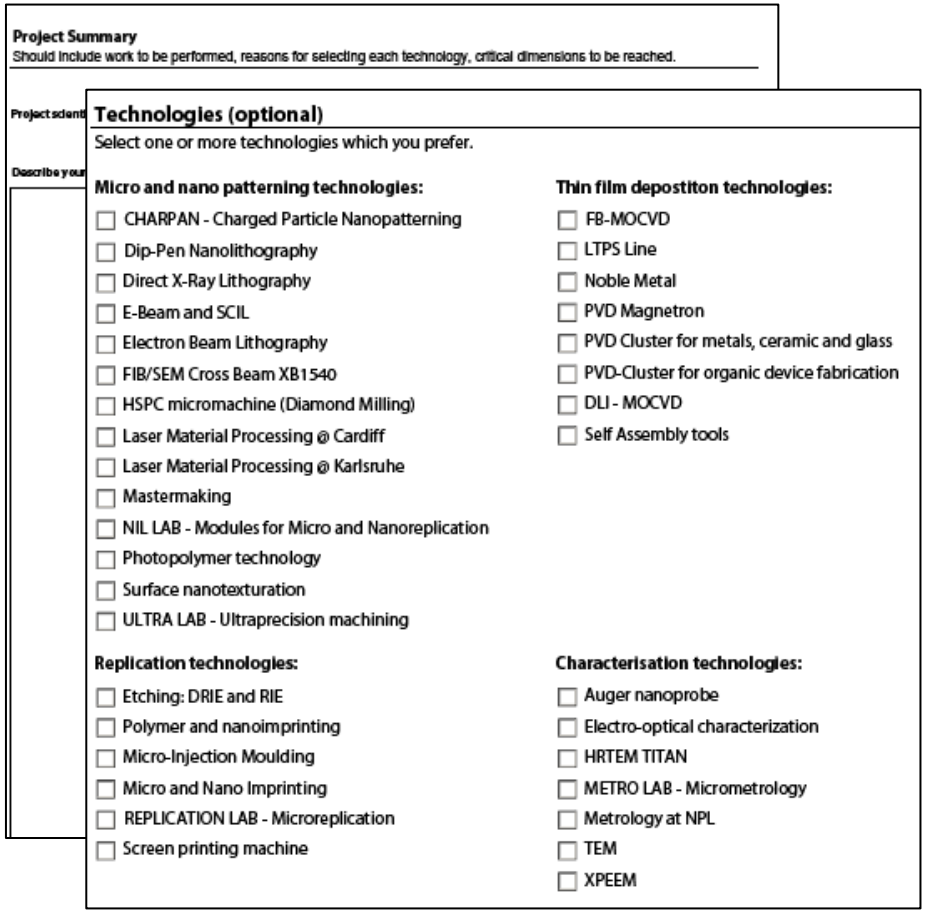
User requests

User request form

- Project summary
  - Work to be performed
  - Reasons for selecting each technology
  - Critical dimensions
- Technology portfolio
  - Select technologies
  - Level of experience

www.euminafab.eu



Project Summary
Should include work to be performed, reasons for selecting each technology, critical dimensions to be reached.

Project scient

Describe your

Technologies (optional)
Select one or more technologies which you prefer.

Micro and nano patterning technologies:
- CHARPAN - Charged Particle Nanopatterning
- Dip-Pen Nanolithography
- Direct X-Ray Lithography
- E-Beam and SCIL
- Electron Beam Lithography
- FIB/SEM Cross Beam XB1540
- HSPC micromachine (Diamond Milling)
- Laser Material Processing @ Cardiff
- Laser Material Processing @ Karlsruhe
- Mastermaking
- NIL LAB - Modules for Micro and Nanoreplication
- Photopolymer technology
- Surface nanotexturation
- ULTRA LAB - Ultraprecision machining

Thin film depostiton technologies:
- FB-MOCVD
- LTPS Line
- Noble Metal
- PVD Magnetron
- PVD Cluster for metals, ceramic and glass
- PVD-Cluster for organic device fabrication
- DLI - MOCVD
- Self Assembly tools

Replication technologies:
- Etching: DRIE and RIE
- Polymer and nanoimprinting
- Micro-Injection Moulding
- Micro and Nano Imprinting
- REPLICATION LAB - Microreplication
- Screen printing machine

Characterisation technologies:
- Auger nanoprobe
- Electro-optical characterization
- HRTEM TITAN
- METRO LAB - Micrometrology
- Metrology at NPL
- TEM
- XPEEM

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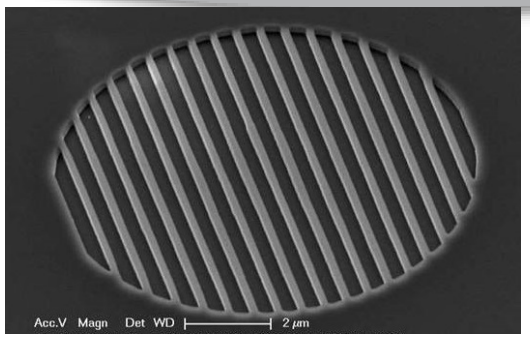
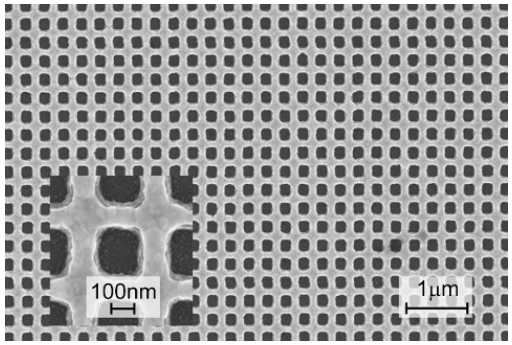
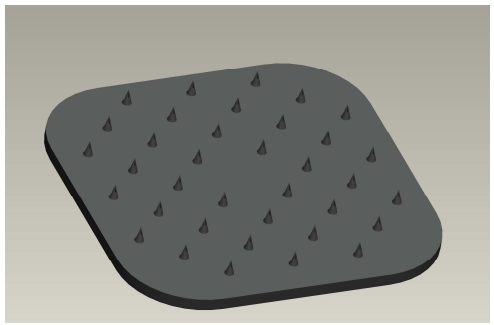
Focus technological applications three presentations







Nanofabrication - direct write and replication patterning technologies in EUMINAfab
Frank Dirne Miplaza Philips Research

Micro and nanofabrication technologies for optical and sensor applications
Jorge Ramiro TEKNIKER

Mastermaking and Structuring Facilities
Steffen Scholz Cardiff University

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Some of the people behind the scenes

EUMINA*fab*

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