POSSIBLE LASER TARGET FABRICATION AT THE ION BEAM CENTER (IBC)

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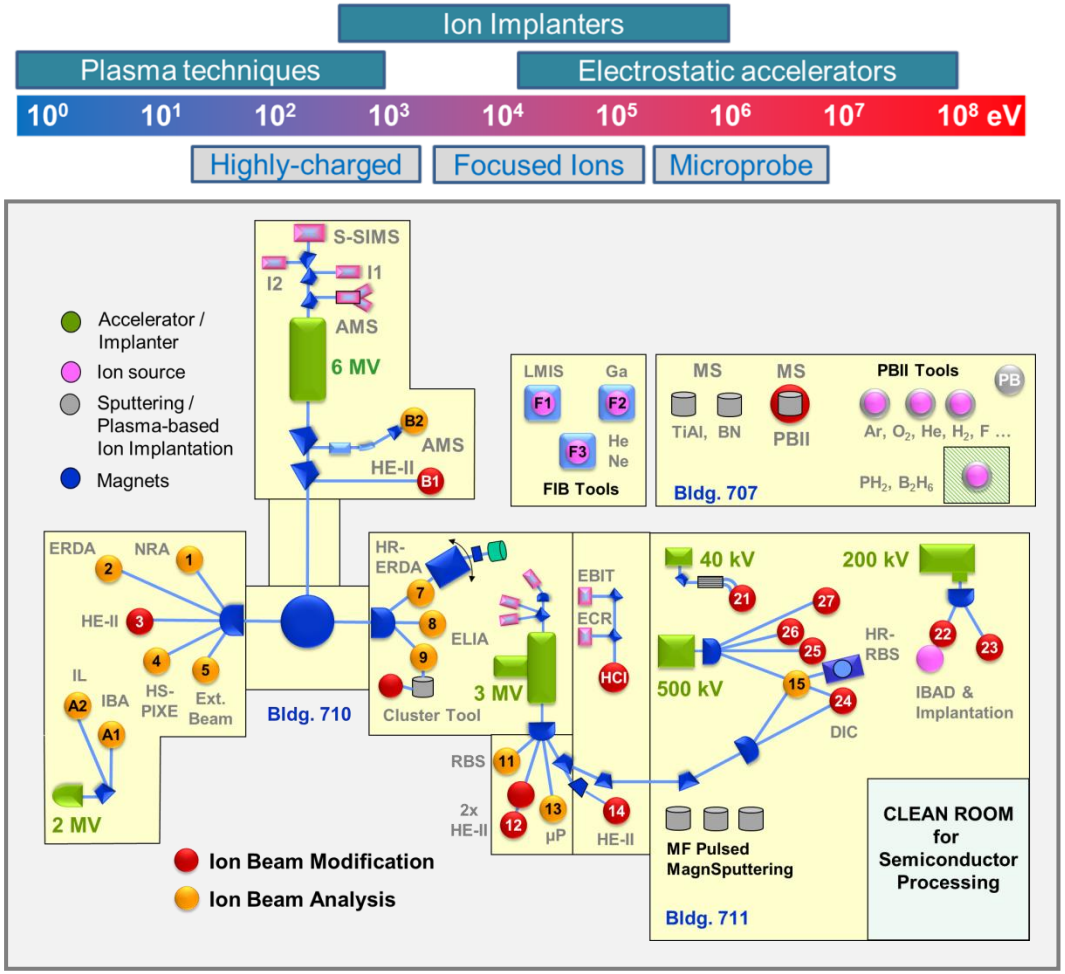
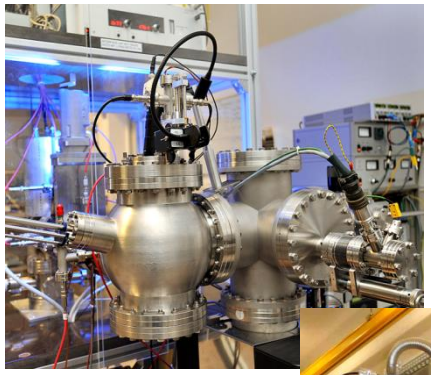
Motivation and Mission of the Insitute of Ion Beam Physics and Materials Research

- Fabrication and investigation of nanostructured systems with special electronic, optic and magnetic properties.
- Investigation of materials for future information technology
- Applications in micro/nanoelectronics and optoelectronics, magnetic storage, etc.
- Use of three large scale facilities of the HZDR:

  - **Ion Beam Centre (5 eV - 50 MeV)**
  - Radiation Source ELBE (free electron laser, λ = 3 - 280 µm)
  - High Magnetic Fields Laboratory (up to 90 T)

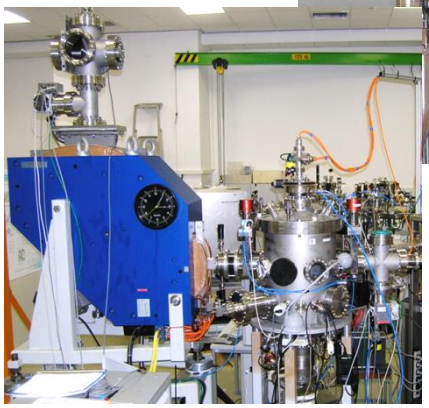
Versatile facilities and instrumentation for materials modification and analysis with ions





SNIPER Tool for single ion implantation

High-energy implantation endstation



Magnetic Spectr. for high-resolution RBS

6 MV Tandem Accelerator

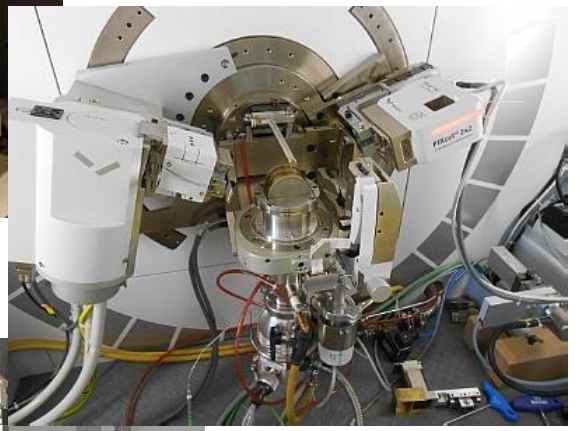
In addition within IBC:
Nanofabrication and Analysis Techniques

Lithography

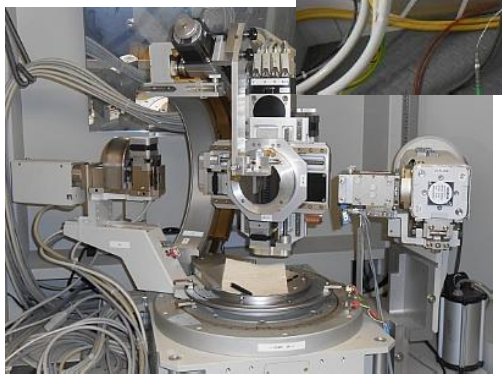
Electron Microscopy

Wet Chemistry

Etching



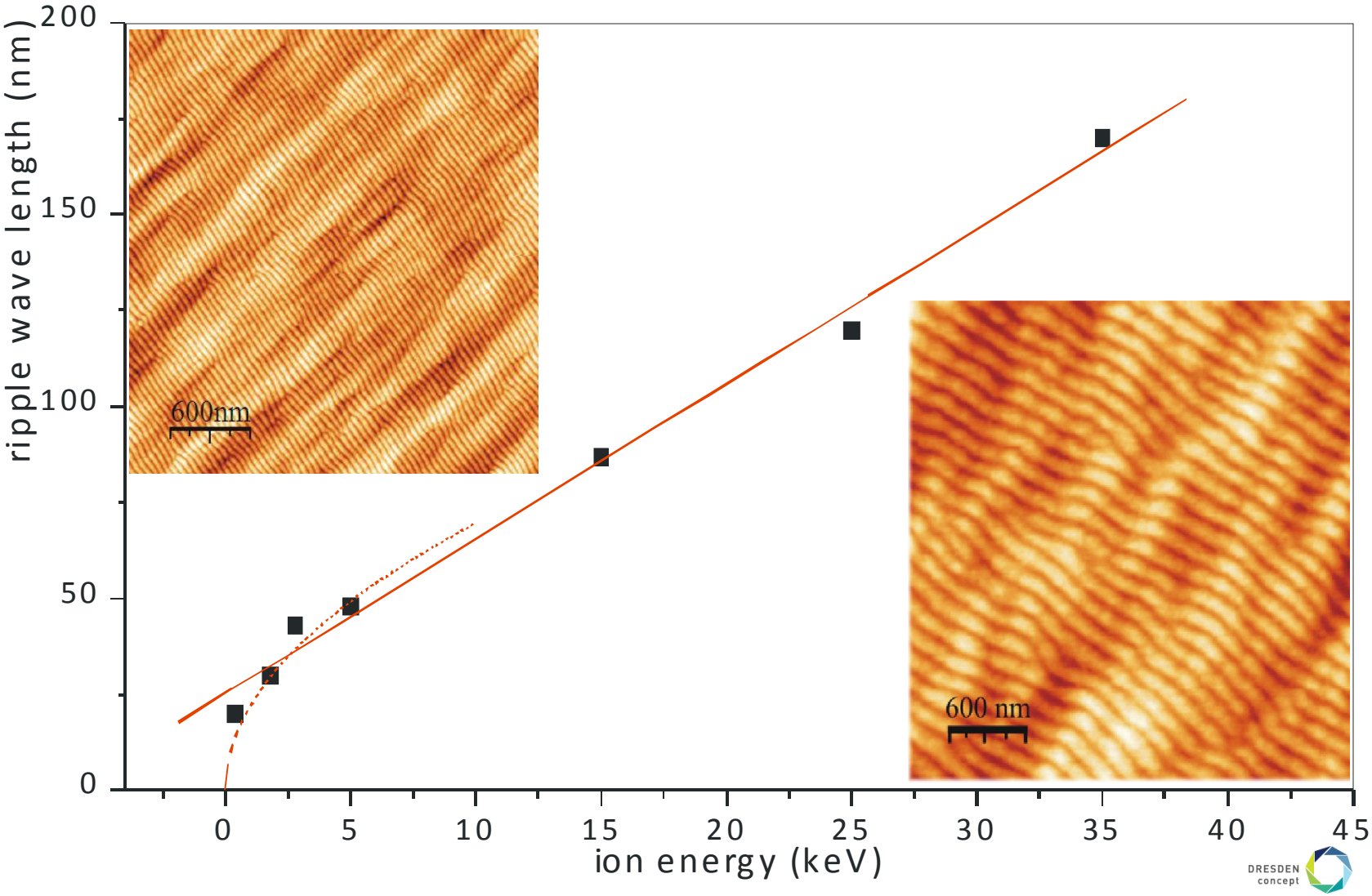
Deposition



Lab-based x-ray techniques

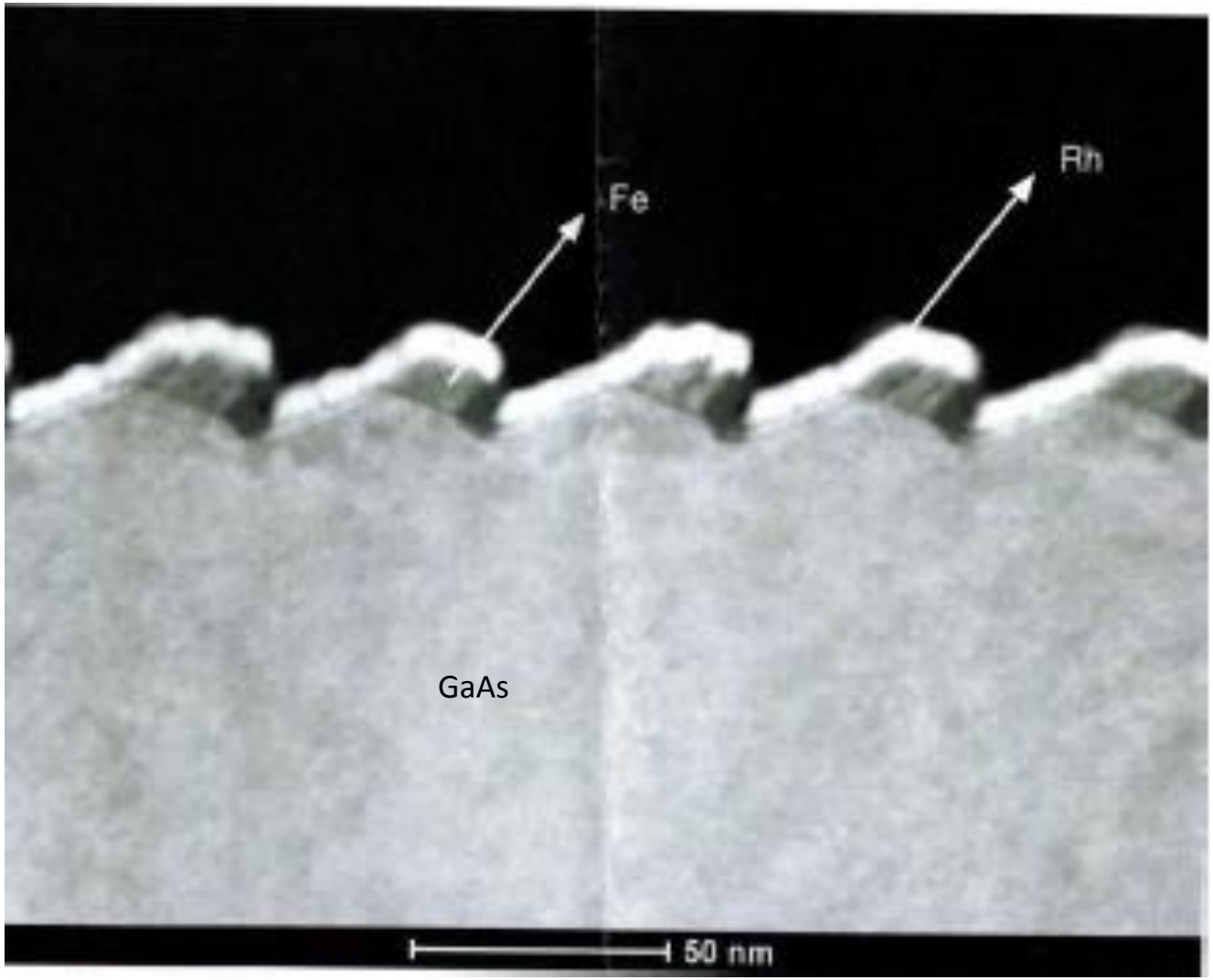
Examples of nanofabricated structures

Ripple structures due to ion erosion (self-organization)

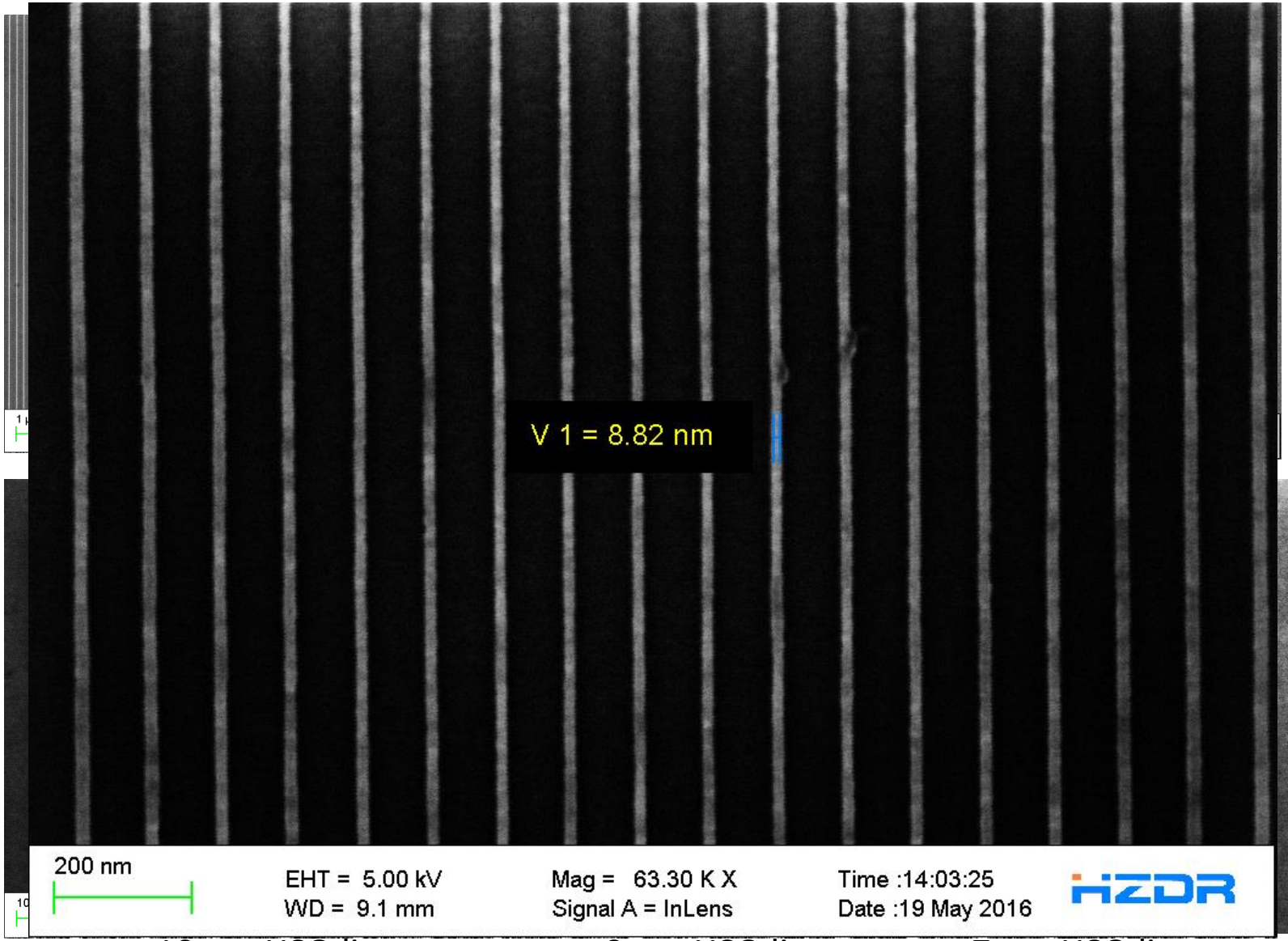


Nanowires on ripple structures

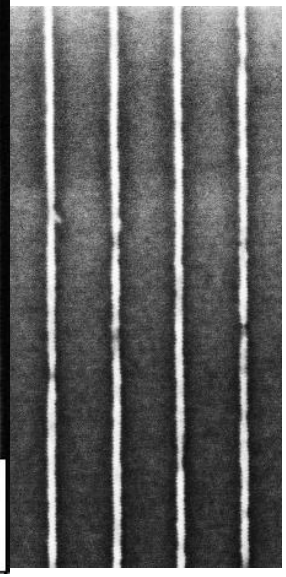
Cross-section TEM



Electron lithography of lines

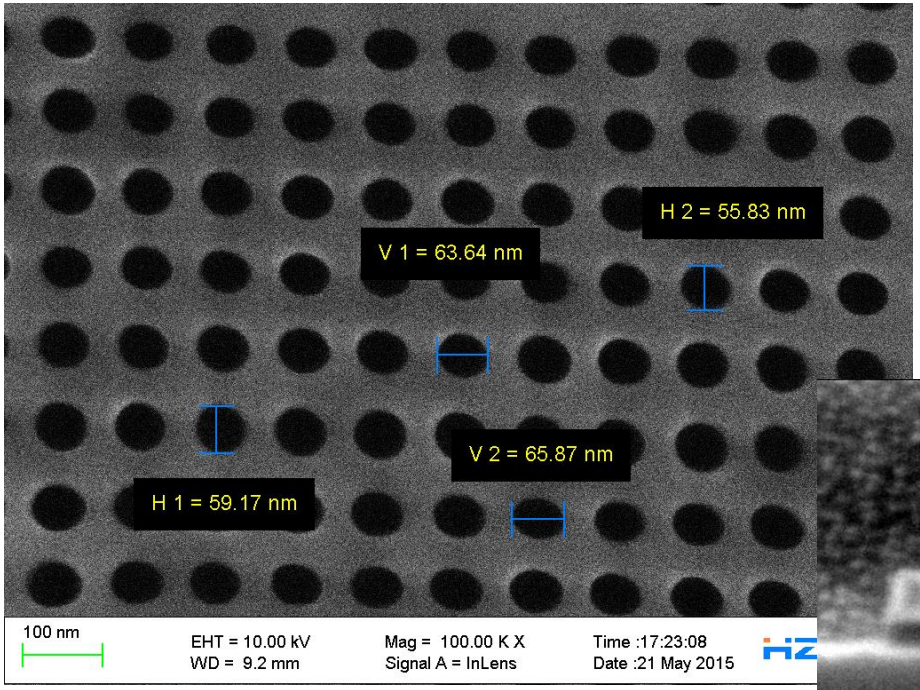


9 nm width
200 nm pitch

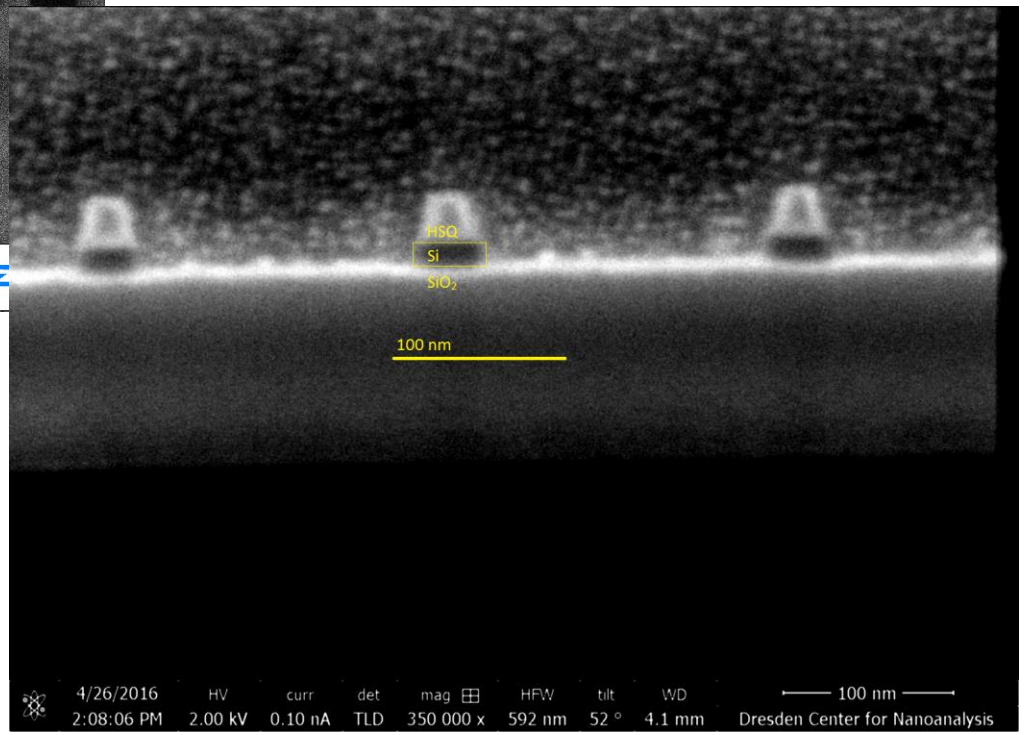


10 nm HSQ lines | 9 nm HSQ lines | 7 nm HSQ lines

Lithographic nanofabrication



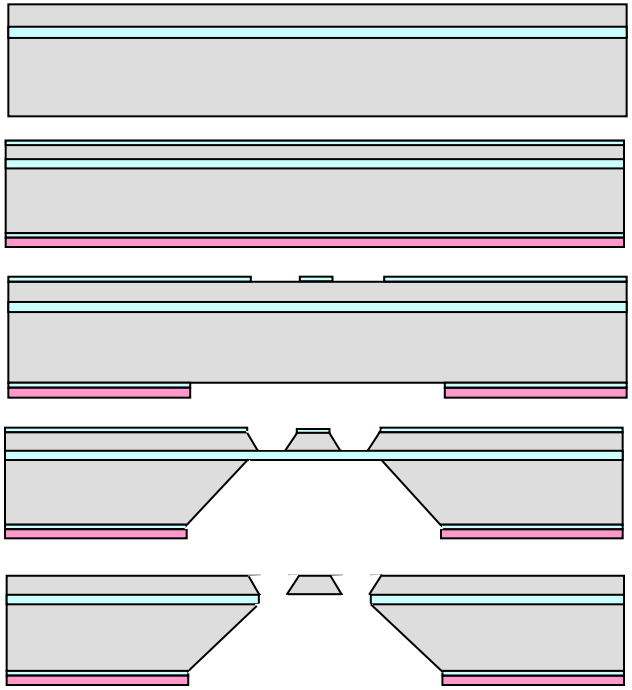
Array of Pt nanodots

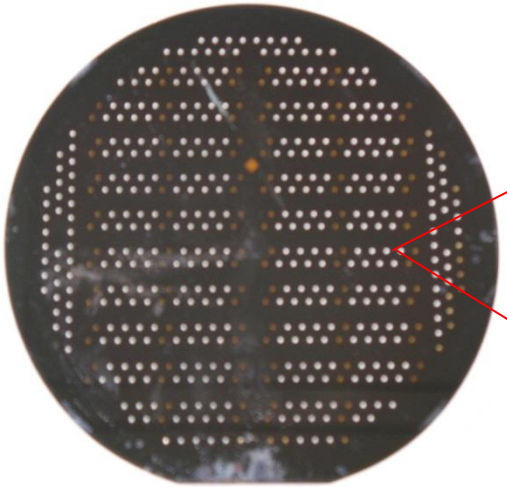


Si nano-structures

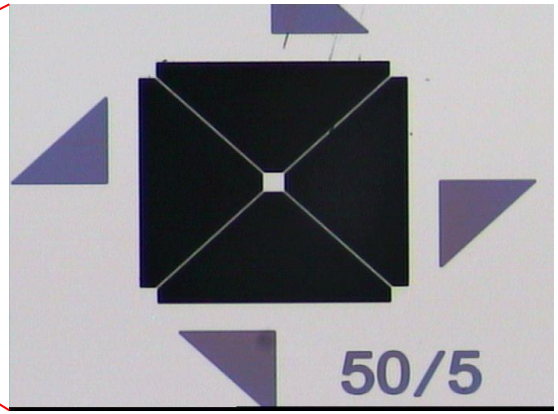
Silicon micromachining for reduced mass targets

- silicon substrate (usually SOI)
- thermal oxydation & LPCVD Si_3N_4 deposition
- photolithographic patterning on both sides
- deep etching (wet on back side and dry plasma on front side)
- buried oxide removing





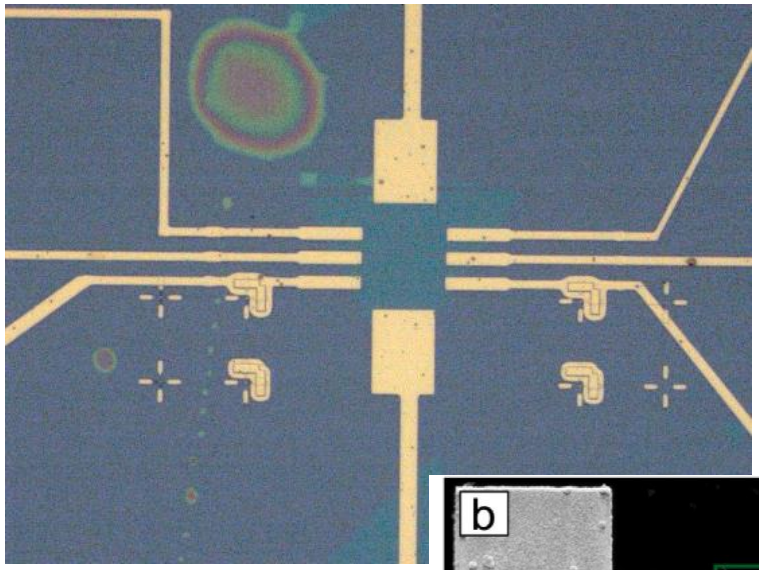
Processed 100 mm SOI wafer

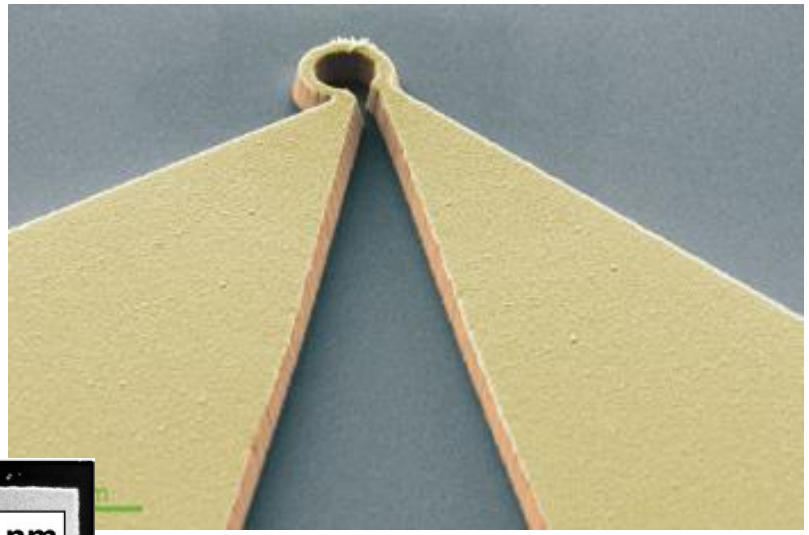


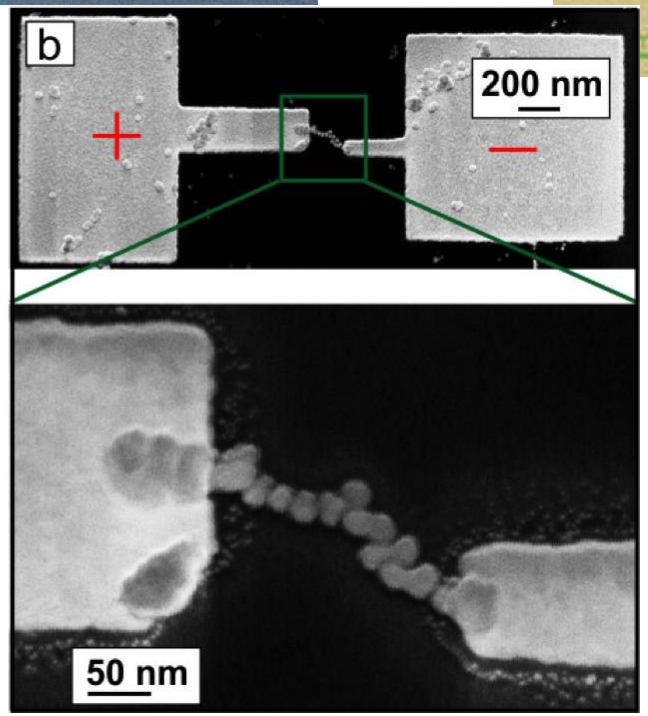
central target:
area 50x50 µm,
thickness 2 µm

supporting beam dimensions
wxt = 5x2 µm

Electrical wiring and contacting



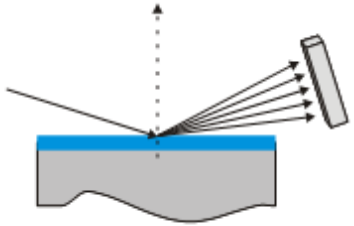


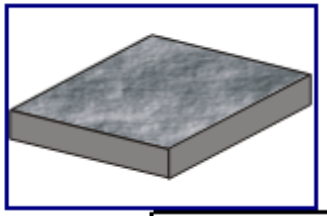


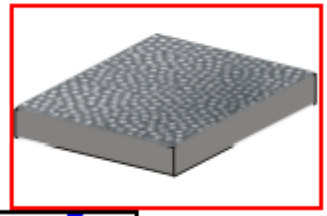
Structural Characterization

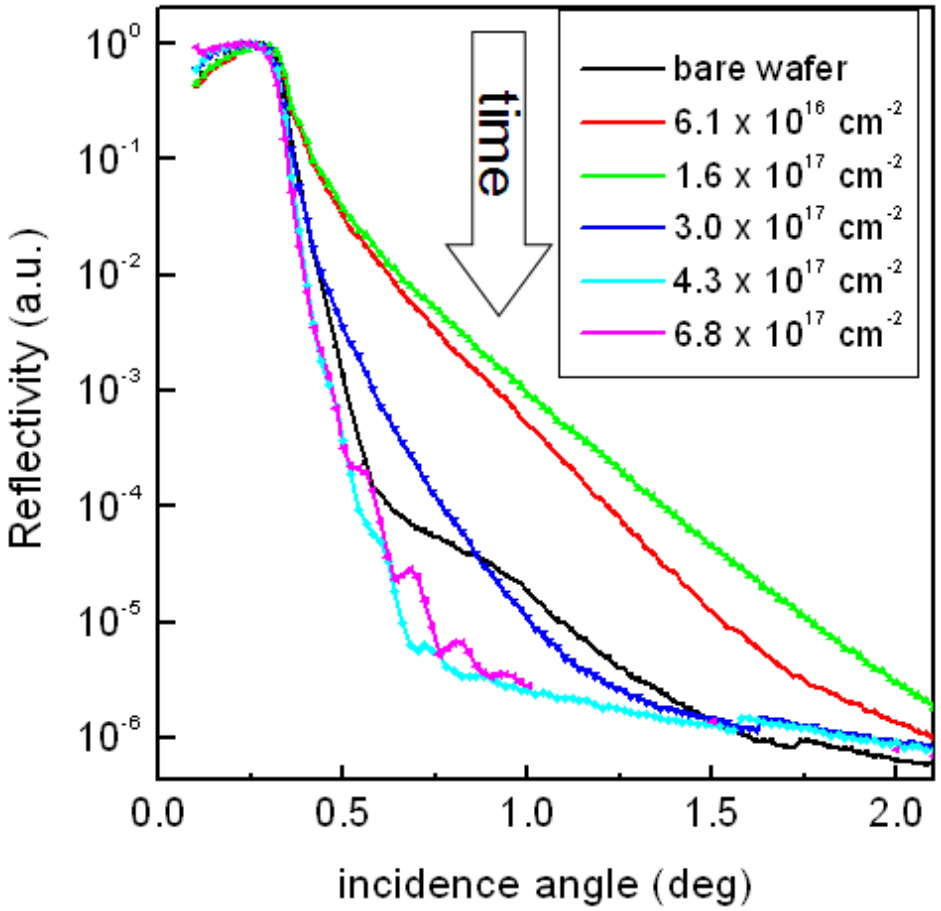
Vertical structural information – XRR

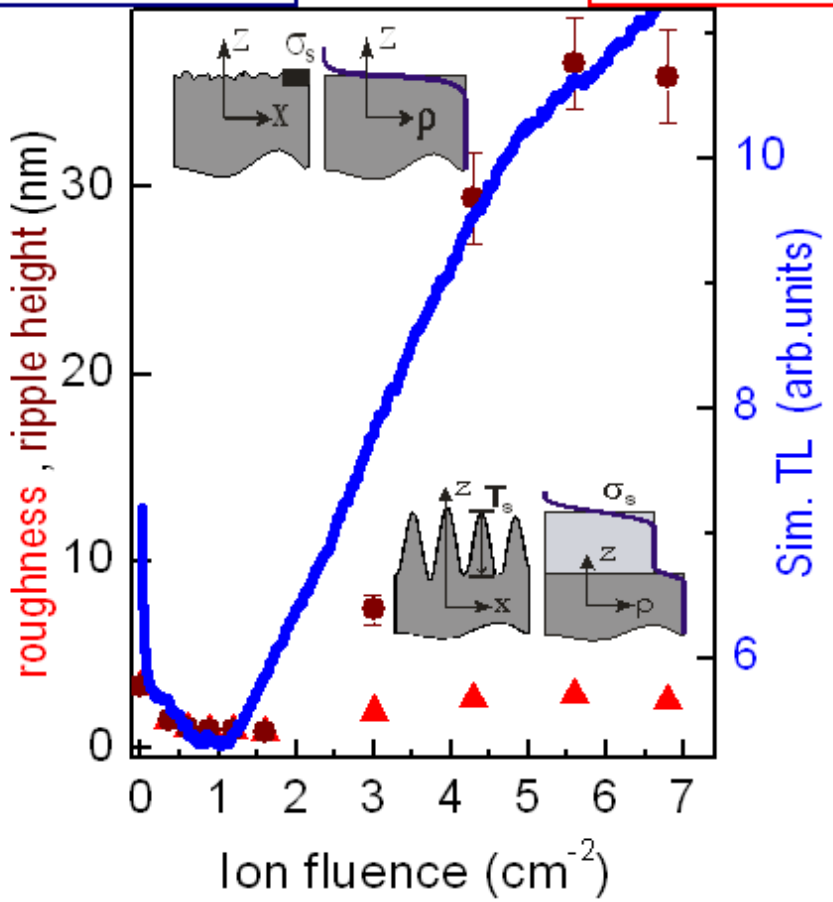
GaSb







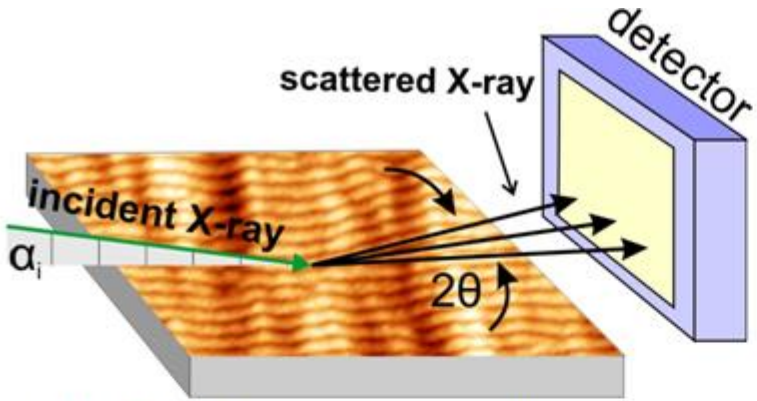




A. Keller, A. Biermanns, G. Carbone, J. Grenzer, S. Facsko, O. Plantevin, R. Gago, and T. H. Metzger, APL 94, 193103 (2009).

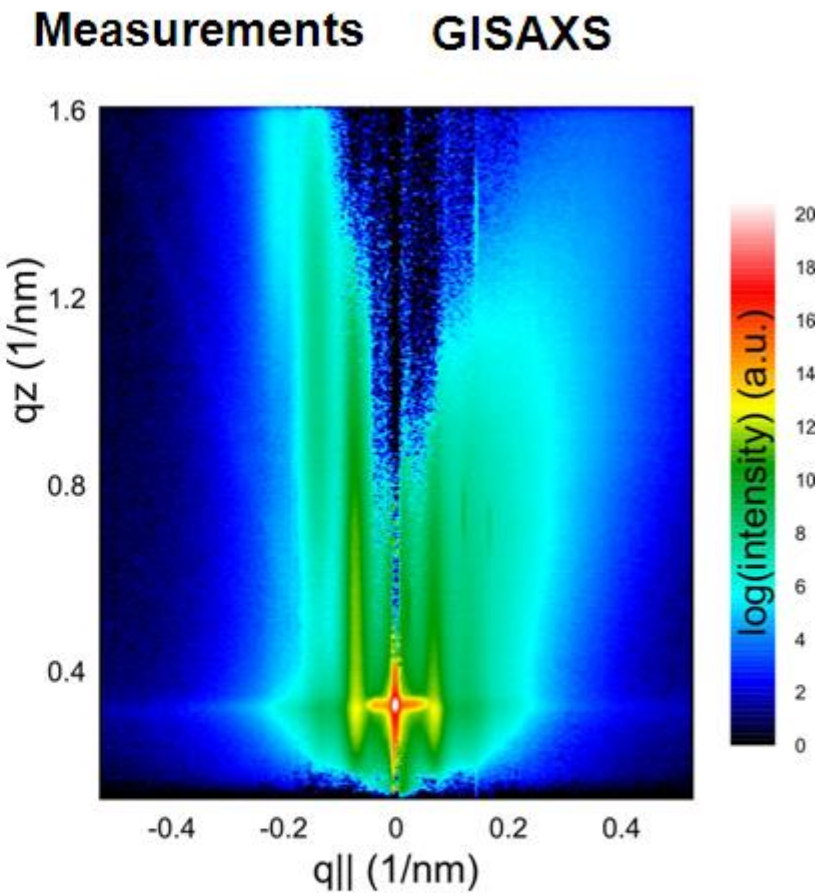
Analysis of the Surface Morphology using GISAXS Data

Si



GISAXS measurements:

- Satellite peaks indicating ordered ripples
- Peak position and width related to ripple wavelength and ordering
- Asymmetric facet streaks indicating asymmetric ripple shape



more GID & Si: A. Biermanns et al., J. OF APPLIED PHYSICS, 104(20), (2009).

IBC Team