Nanofabrication with focused electron and ion beams

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Cursus

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<tr>
<th>Manufacturing</th>
<th>Sem.</th>
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<td>Science et génie des matériaux</td>
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Language: English
Credits: 2
Session: Multiple
Exam: 60h
Workload: 60h
Hours: 28
Lecture: 12
Exercises: 8
Practical work: 8
Number of positions: 20

Frequency
Every 2 years

Summary
Nanofabrication with focused charged particle beams (SEM, FIB) and their applications such as lithography, gas assisted deposition / etching, and milling are discussed and the limitations of these processes are developed based on the acquired understanding of the interactions.

Content
• Introduction to Scanning Electron / Ion Microscopes: SEM, Ga-FIB, He-FIB, AuSi-FIB
• Electron / Ion interaction with solids: concepts and simulations
• Analysis with focused electron and ion beams: EDX, EBIC, EBSD, tomography
• Nanofabrication with FIB and FEB: milling, deposition, etching, lithography
• Novel Add-Ons for Nanomanipulation and Nanoanalysis inside electron microscopes: 4-point electrical measurements, positioning systems for nanostructures, magnetic bead detection, mechanical measurements: tensile, bending, and compressive loading of nanostructures, 3D topography with in-situ atomic force microscopy, chemical depth profiling by combined FIB-mass spectroscopy. Live demonstrations: Add-ons, SEM, Dual Beam.

Keywords
FIB, FEB, nanofabrication, integrated setups for in-situ measurements (chemical, mechanical, structural, electronical) of nanostructures and their in-situ synthesis (gas injection)

Learning Prerequisites
Recommended courses
Physics and Chemistry at university level, general concepts of NanoSciences and Fabrication