FEI Nova 600 Nanolab

The Nova 600 NanoLab has a very unique configuration for its class, optimized for state-of-the-art materials research, nanotechnology and electronics prototyping on one hand and containing a whole range of fabulous tools for life sciences and biomedical research on the other hand.

Description

The Nova 600 NanoLab is a Dual-Beam system (combining ultra-high resolution SEM and Focused Ion Beam). This is a complete nanotechnology lab in a single tool, which enables nanoscale chemical synthesis, top-down machining, deposition, nanoscale prototyping, 2D and 3D-characterization and analysis of nanostructures below 100 nm. It combines ultra-high resolution field emission scanning electron microscopy, precise focused ion beam etch and deposition and analysis.

The Nova 600 NanoLab is a FIB (Focused Ion Beam)/SEM workstation capable of Nano-chemistry, Nano-prototyping, Nano-machining, Nano-characterization and Nano-Analysis. The key enabling technologies are all integrated onto a single platform:

- A fully integrated cryo transfer system with nitrogen cold stage allowing for high-resolution imaging of liquid and wet specimen, soft polymers and tissues, including cell cultures. No need of fixing and staining the cells for obtaining high-resolution images, 3D tomography and reconstruction.
- Automated, unattended TEM sample preparation and in-situ TEM sample lift-out. The Nova is equipped with a micromanipulator for TEM sample preparation (“lift-out process”) or other manipulations of specimen.
- High-resolution STEM Bright field and Dark field detector.
- Ultra-high resolution electron optics (magnetic

immersion lens with ultra-high brightness Sirion emitter) with SE and BSE in-lens detection and STEM imaging - High-resolution (field emission) Ion Optics (Magnum™ column)
- Advanced control of Gas Chemistries including gasses such as Delineation Etch, Selective Carbon Mill, Au and Co depositions (8 different chemistries).
- High-precision specimen goniometer with full 150 mm travel along the x and y axes
- A high-resolution 4k digital patterning engine
- Automation with full access to E-beam, I-beam, patterning and gas chemistry functionality
- A fully integrated EDS system that is capable of point analysis, and elemental mapping with pattern recognition.

A fully integrated, EBSD system, capable of acquiring, indexing and displaying high resolution 3D EBSD data.

System architecture is optimized for automation, AutoFIB, AutoTEM, Auto-Slice-and-View, with availability of custom scripting to suit particular application needs.

Comprehensive beam chemistries for deposition and etch, along with automation, enable creation of structures such as:

- nanotube-based nano-structure assembly;
- nano-bridge creation;
- photonic array prototyping;
- laser prototyping;
- nano-stamping;
- AFM tip modification;
- MEMS modification,

- Patterning of surfaces for directional cell growth and selective protein deposition, lab-on-chip architectures.

3D tomography and reconstruction

The FIB acts as a ‘nano-scalpel’, enabling high precision cutting and slicing into samples to reveal their 3D internal structures. The SEM provides high resolution imaging of the freshly cut surfaces. Sequential repetition of cutting and imaging (Slice and View) yield a set of data that replicates the 3D reconstruction of the material or even complex structure:

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Co-existence of two oppositely charged beams (e- and Ga+) along with availability of a completely integrated cryo transfer system allows for high-resolution tomography of biological specimen, from tissue level down to cell and cell organelle level.

An additional value of this instrument is that the FIB 'nano-scalpel' can be used to swiftly and easily produce Transmission Electron Microscope (TEM) samples from any given material without the compression and knife mark artefacts common to mechanical sample preparation techniques.

Infrastructure/Methods

Nova 600 Nanolab is a new state-of-the-art facility made available with support from Knut och Alice Wallenbergs Stiftelse. The system is being installed at the Department of Materials Science and Engineering, KTH. It will be fully up and running before end of 2006. This facility is the first of its kind in Sweden and probably among the few in Europe.

Practical information

We are looking for researchers, especially with an interdisciplinary approach, interested in exploiting the capabilities of this new facility to designing materials (including complex hybrid bio/inorganic materials and interfaces), patterning, prototyping, 2D and 3D visualization and analysis of materials and tissues for various biological and biomedical applications.

Along with our other facilities for comprehensive physical properties studies we would be very interested in collaborations with both domestic and international research groups through our newly established "International Centre for Advanced Materials" (ICAM) in interdisciplinary projects. Please contact us for more information!

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