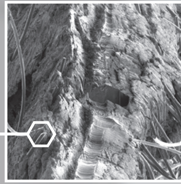
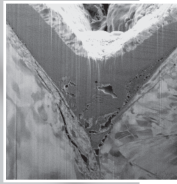
PRODUCT DATA



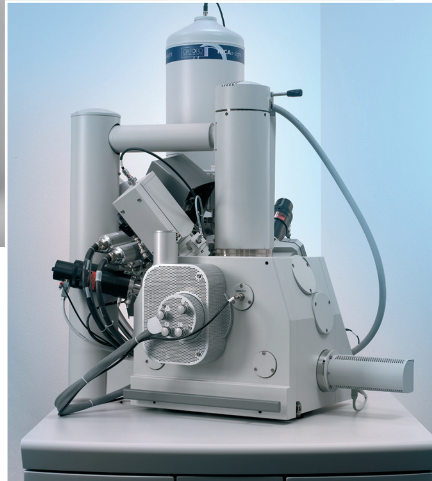


FEI COMPANY™

TOOLS FOR NANOTECH

Quanta™ 3D 200i

Explore a new world of sub-micron sample preparation, modification and 3D inspection



Any sample, all data, any dimension

The Quanta 3D 200i is a characterization instrument designed to examine materials, conduct failure analysis and prepare samples in an industrial or academic environment. Combining Quanta scanning electron microscope (SEM) with a high current focused ion beam (FIB), creates a versatile solution for characterizing and modifying materials that is easy to use and has the flexibility to handle any sample type.
The current-boosted tungsten SEM provides excellent imaging capability for sub-micron structures while the high current ion column can be used to precisely prepare a sample by removing or depositing material at a rapid rate in small defined areas. The Quanta 3D 200i will enable your laboratory to explore a new way of fast sample preparation, 3D nanoanalysis, TEM, EBSD & atom probe sample preparation or structural modification of sample surfaces at the nanometer scale.

The Quanta 3D is based on the experience of FEI engineering for ESEM and DualBeam™ systems. Integrating these two leading technologies, combined with FEI's automation software like; Auto*Slice and View*™ (automated serial slicing) application, AutoTEM™ for unattended preparation of multiple sections or thin sample and proprietary gas chemistries for high volume milling applications, deposition of insulators or conductors and customized detector geometries for imaging of FIB prepared sections makes Quanta 3D the ideal solution for 3D nanocharacterization, 3D nanoprototyping, and *in situ* nanoprocesses.

Featuring three imaging modes – high vacuum, low vacuum and ESEM™ it can accommodate the widest range of samples of any SEM system. A 'charge neutralization' mode is integrated for working with FIB on insulating samples.

Quanta 3D provides you with an easy to use solution for the investigation and preparation of all samples. Helping you to get more data from any sample.

Key benefits

- *Increase your imaging and analysis capabilities: collect surface and subsurface information and reconstruct imaging and analytical data in 3 dimensions*
- *Increase sample throughput and mill larger areas using Quanta's high current FIB for fast material removal*
- *Enhance nanocharacterization capabilities with 2 kV cleaning of TEM/atom probe/EBSD samples; reducing the amorphous region without argon cleaning*
- *Improve pattern registration/nanoprototyping of non-conductive samples with 'charge neutralization' mode*
- *Increase your sample thruput with automated recipes for unattended FIB sectioning or TEM sample preparation*
- *Explore a wider range of materials with the larger working distance at the coincidence point; enabling more detector options and system flexibility for odd-shaped samples or cutting edge experiments*
- *Increase flexibility characterizing specimens in a dynamic environment; keep samples wet or perform heating experiments with ESEM*

Some typical application examples are:

- TEM, atom probe or EBSD sample preparation
- Atom probe sample preparation
- Reveal the sub-surface cause of surface defects on finished metal surfaces (e.g. painted surfaces, galvanized surfaces)
- 3D porosity characterization and quantification
- Site specific sectioning for ex-situ characterization with other lab tools
- Volumetric reconstruction of the distribution of carbide inclusions in steel
- Crack tip 3D reconstruction
- Reveal the sub-surface cause of surface defects on finished metal surfaces (e.g. painted surfaces, galvanized surfaces)
- Characterization of strained materials along orthogonal sections
- Micro-volume sample biopsies
- Wetting behavior characterization and dihedral angle measurements
- Basic circuit edit
- Structural modification of surfaces at the nm-scale (nanoprototyping)

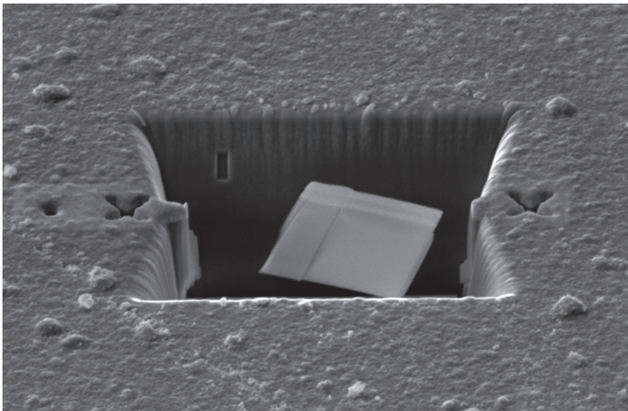


Figure 1: TEM lamella prepared from TiO_2/Au/Silical sample.

Figure 2: Cross section of artifact buried below the surface.

Essential specifications

Electron optics

- Thermal emission SEM optics, with dual-anode source emission geometry, fixed objective lens final aperture and through the lens differential pumping
- Typical filament lifetime > 100 hours
- Resolution:
  - 3.0 nm @ 30 kV @ high vacuum mode
  - 3.0 nm @ 30 kV @ ESEM mode
  - < 12 nm @ 3 kV @ low vacuum mode
- Max. horizontal field width: 10 mm corresponds to approx. 10 x magnification in quad view
- Accelerating voltage: 200 V to 30 kV
- Probe current: up to 1 μA – continuously variable
- 'charge neutralization' mode for milling of non-conductive samples

Ion optics

- High current ion column with Ga liquid metal ion source
- Source lifetime: 1000 hours guaranteed
- Resolution at beam coincidence point: 9 nm @ 30 kV @ 1 pA
- Resolution at optimum FIB working distance: 7 nm @ 30 kV @ 1 pA
- Max. horizontal field width: 2.5 mm at 10 kV and beams coincidence point (corresponds to 50 x minimum magnification in quad view)
- Accelerating voltage: 2 to 30 kV
- Probe current: 1 pA to 65 nA in 15 steps
- Beam blanker standard, external control possible
- 15 position aperture strip

Vacuum system

- 1 x 250 l/s TMP oil free
- 2 x PVP oil free (scroll pumps)

- 1 x IGP (for ion column)
- Evacuation time (high vacuum): < 3.5 minutes
- Three vacuum modes: high vacuum, low vacuum and ESEM
- Seamless transition between high and low vacuum
- Through the lens differential pumping design for short beam gas path lengths and ultra-low chamber vacuum (2600 Pa)
- Imaging gas in low vacuum and ESEM: water vapor or other auxiliary gas (subject to FEI approval)

Detectors
- Everhart Thornley SED
- Large field Gaseous SED (used in low vacuum)
- Gaseous SED (used in ESEM mode)
- IR-CCD
- TV-rate solid-state BSED*
- STEM detector*
- Second IR-CCD*
- Gaseous analytical BSED (used for low vacuum analytical applications)*
- Ion detector (CDEM)*

Digital image processor
- Dwell: 50 ns to 25 ms adjustable in steps of 100 ns
- Up to 4096 x 3536 pixel resolution
- File type: TIFF (8, 16 or 24 bit), BMP, JPG or AVI
- Single frame or 4-quadrant image display
- 4-quadrant live with independant digital zoom per quadrant
- 256 frame average or integration
- Image mixing of 2 or 3 images live (grey or false color)
- Movie recorder (direct to AVI)
- Movie creator (to make movies from tiff series)

Chamber
- 379 mm left to right
- 16 ports
- 15 mm electron and ion-beam coincidence point = analytical WD
- Angle between e-column and I-column: 52 degrees

5-axis motorized stage
- Eucentric goniometer stage
- x = 50 mm
- y – 50 mm
- z = 25 mm
- Clearance = max. 30 mm to eucentric point
- T = -10 to 60 degrees
- R = n x 360 degrees

Gas chemistry*
- 'Zero-collision' GIS design concept
  - Individual gas injectors with separate injection systems reconfigurable in the future
  - 5 µm placing accuracy without user interaction
  - GIS control available for automation
- Up to 3 gas injectors for enhanced etch or deposition*
- Gas chemistry options:*
  - Platinum metal deposition*
  - Tungsten metal deposition*
  - Carbon deposition*
  - Gold deposition*
  - Insulator enhanced etch (XeF_2)*
  - Selective Carbon Mill*
  - Enhanced etch*

System control
- 32 bit graphical user interface with Windows XP, keyboard, optical mouse
- Image display: 19 inch LCD, SVGA 1280 x 1024
- Support computer
- Scripting interface for automation purposes*
- Multifunctional control panel*
- 2nd monitor (for support computer)*
- Joystick*

** optional*

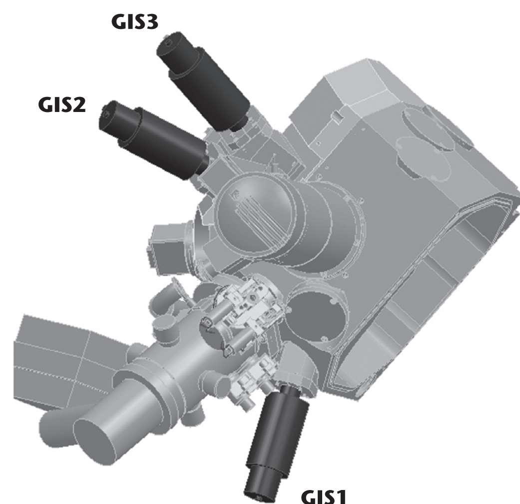


Figure 3: GIS injector port allocation.

Common system options

- Serial sectioning automation software (Auto*Slice and View*™)
- Automation software for multi-site milling (AutoFIB™)
- Automation software for unattended TEM sample preparation (AutoTEM)
- 3D reconstruction software
- Image analysis and archive software
- SW controlled Peltier cooled specimen stage
- SW controlled WetSTEM system
- SW controlled 1000 °C heating stage
- Remote control SW
- Video printer
- Specimen holder kit, TEM specimen holder kit
- Gas injectors
- BSED detector
- STEM detector
- Fast electrostatic electron beam blanker
- Supplies (compressor, mains matching transformer, UPS)
- Omniprobe for *in situ* TEM sample lift-out
- Cryo system
- Quick Loader (load lock)
- EDX
- EBSD
- WDX

Consumables

- Replacement Ga ion source
- Aperture strip for ion column
- Tungsten filaments
- Final lens apertures
- Gas chemistry refill packages

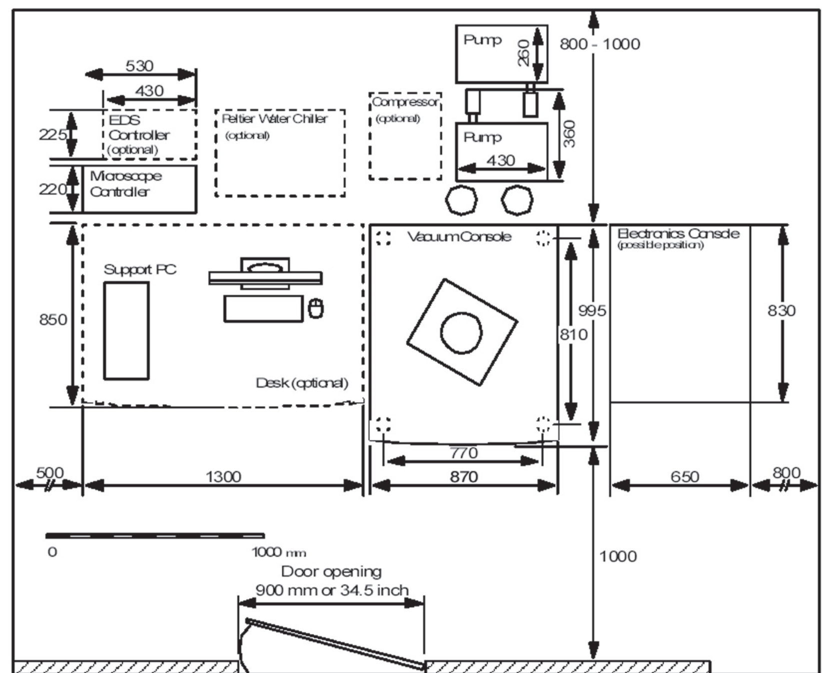
Installation requirements

- Power: voltage 230 V (-6 % + 10 %)
- Frequency: 50 or 60 Hz (+/- 1%)
- Power consumption: < 3.0 kVA for basic microscope
- Environment: temperature 20 °C +/- 3 °C, temperature stability < 1 degree/hour, relative humidity below 80%, stray AC magnetic fields < 100 nT a-synchronous, < 300 nT synchronous
- Door width: 90 cm
- Weight: column console 550 kg
- Compressed air 4 to 6 bar, clean, dry and oil free

Documentation

- Operating instructions on CD
- On-line help

Floorplan



WORLD HEADQUARTERS
5350 NE DAWSON CREEK DRIVE
HILLSBORO, OREGON 97124 USA
PH: +1.503.726.7500

FEI EUROPE
PH: +31.40.23.56000

FEI JAPAN
PH: +81.3.3740.0970

FEI ASIA PACIFIC
PH: +86.21.5027.8805

fei.com

TÜV Certification for design, manufacture, installation and support of focused ion- and electron-beam microscopes for the NanoElectronics, NanoBiology, NanoResearch and Industry markets.

FEI COMPANY™
TOOLS FOR NANOTECH

©2008. We are constantly improving the performance of our products, so all specifications are subject to change without notice. The FEI logo, AutoTEM, AutoFIB, DualBeam, ESEM, Auto*Slice & View*, Quanta and Tools for Nanotech are trademarks of FEI Company. Windows is a trademark of Microsoft Corporation.

04DS-DB0114 08/08