1. Main advantages

1) FEI Quanta 450FEG SEM High-resolution field emission SEM with environmental scanning technology

2) Analyze conductive and non-conductive samples in various operating modes to obtain secondary electron images and backscattered electron images

3) Greatly reduce sample preparation requirements: Low vacuum/ambient vacuum technology allows non-conductive samples and/or water-containing samples to be directly imaged and analyzed without conductive treatment, and there is no charge accumulation on the sample surface

4) Professional "through the lens" differential pressure vacuum system, EDS/EBSD analysis can be performed on both conductive and non-conductive samples, whether in high vacuum mode or low vacuum mode. Stable large beam current (maximum 200 nA) ensures fast and accurate energy spectrum and EBSD analysis

5) The FEI Quanta 450FEG scanning electron microscope can be used as a microscopic laboratory. After installing a special in-situ sample stage, dynamic in-situ analysis can be performed on a variety of samples in their original state in the temperature range from -165 °C to 1500 °C.

6) For conductive samples, the deceleration mode can be used to obtain surface and composition information

7) Intuitive, easy-to-use software that even electron microscopy novices can easily get started

2. Typical Applications

1. Nano Characterization

1) Metals and alloys, oxidation/corrosion, fracture, solder joints, polished sections, magnetic and superconducting materials

2) Ceramics, composite materials, plastics

3) Film/coating geological sample cross section, mineral

4) Soft matter: polymers, pharmaceuticals, filter membranes, gels, biological tissues, wood

5) Particles, porous materials, fibers

2. In-situ process analysis

1) Humidification/dehumidification

2) Wetting behavior/contact angle analysis

3) Oxidation/Corrosion

4) Stretching (with heating or cooling)

5) Crystallization/phase change

3. Nanoprototype preparation

1) Electron beam lithography (EBL)

2) Electron beam induced deposition (EBID)

3. Main parameters

1. Electron optics

1) High-resolution Schottky field emission electron gun

2) Optimized high brightness, large beam tube

3) 45° cone objective pole piece, "through the lens" pressure difference vacuum system, heated objective aperture

4) Accelerating voltage: 200 V - 30 kV

5) Beam current: Maximum 200 nA and continuously adjustable

6) Magnification: 6 x 1,000,000 x (four images displayed)

2. Resolution

1) High vacuum

0.8 nm at 30 kV (STEM)*

1.0 nm at 30 kV (SE)

2.5 nm at 30 kV (BSE)*

3.0 nm at 1 kV (SE)

2) Deceleration mode under high vacuum*

3.0 nm at 1 kV (BSE)*

2.3 nm at 1 kV (ICD)*

3.1 nm at 200 V (ICD)*

3) Low vacuum

1.4 nm at 30 kV (SE)

2.5 nm at 30 kV (BSE)

3.0 nm at 3 kV (SE)

4) Environmental vacuum (ESEM)

1.4 nm at 30 kV (SE)

3. Detector

1) ET secondary electron probe

2) Large field of view low vacuum gas secondary electron detector (LFD)

3) Gas Secondary Electron Detector (GSED)

4) Sample chamber infrared CCD camera

5) High sensitivity, low voltage solid backscatter probe*

6) Gas backscatter probe*

7) Quartered solid backscatter probe*

8) Scintillator backscatter detector/CLD*

9) vCD (low voltage, high contrast probe)*

10) In-column detector (ICD) for secondary electron detection in deceleration mode*

11) Electron beam current detector*

12) Analytical Gas Backscatter Detector (GAD)*

13) STEM probe*

14) Nav-Cam optical camera color imaging for sample navigation*

15) Cathodoluminescence detector*

16) Energy spectrum*

17) Spectrum*

18) EBSD*

19) Four-ring separated directional backscattered electron probe (DBS) installed at the bottom of the pole piece*

4. Vacuum system

1) 1 250 l/s turbomolecular pump, 2 mechanical pumps

2) Professional "through the lens" differential pressure vacuum system

3) Electron beam travel in the gas region: 10 mm or 2 mm

4) Can be upgraded to oil-free mechanical pump

5) 2 ion pumps

6) Sample chamber vacuum (high vacuum mode) < 6e-4 Pa

7) Sample chamber vacuum (low vacuum mode) < 10 to 130 Pa

8) Sample chamber vacuum (ambient vacuum mode) < 10 to 4000 Pa

9) Typical sample change time: High vacuum mode $\leq$ 150 seconds; Low vacuum and ambient vacuum mode $\leq$ 270 seconds (FEI standard test procedure)

5. Sample room

1) Left and right inner diameter 284 mm

2) 10 mm analytical working distance

3) 8 detector/accessory interfaces

4) EDS acquisition angle: 35°

6. Sample stage

1) X/Y = 100 mm

2) Z = 60 mm

3) Z-direction clearance 75mm

4) Tilt: -5° - +70°

5) Continuous rotation 360°

6) Repeatability: 2 µm (X/Y direction)

7) Pseudo fully centered sample stage

7. Sample holder

1) Multiple sample holders

2) Single sample holder

3) Universal Sample Holder Kit*

4) Suitable for silicon wafer or other sample holders with special requirements*

8. Image Processor

1) Maximum 6144 x 4096 pixels

2) Image file format: TIFF (8,16 or 24 bit), BMP or JPEG

3) Single window or four window image display

4) Four active windows

5) Real-time or static mixing of color or grayscale signals

6) 256 frame average or integration

7) Digital animation recording (.avi format)

8) Histogram and image measurement software

9) DCFI (Drift Compensation Integral)

9. Support software

1) SmartSCAN intelligent scanning technology

2) Montage image navigation

3) Software temperature control

4) FEI animation generation tool