HITACHI
Inspire the Next

Focused Ion and
Electron Beam System

ETHOS

HITACHI ETHOS *a new era for High-end Users*

Fundamental Performance with Unsurpassed Flexibility

An all-new SEM-FIB design platform that is essential for combining a variety of analytical applications in one system.
The Hitachi ETHOS SEM-FIB incorporates the latest-generation FE-SEM with superb beam brightness and stability affording high-resolution imaging and high-quality elemental analysis at low voltages combined with ion optics for nanoscale precision processing.

	Cold FE electron source	Schottky FE electron source
Source size (nm)	5	15 - 30
Energy spread (eV)	0.2 - 0.3	0.6 - 0.8
Brightness (A/cm^2 sr)	10^8	10^7

An ideal Cold Field Emission (CFE) gun for improved imaging and analytical performance

Key Features

1 High-Performance SEM Aquila α with Duo-lens Mode

High-resolution observation (HR mode: semi-in-lens and deceleration technology)
High-accuracy end-point detection (FF mode: real-time monitoring)

2 High-Throughput Material Processing

Ultra-fast processing with high ion-current density (Max beam current 100 nA)
User programmable script for processing and observation automation

3 Micro-Sampling System

Sample-orientation control for Anti-Curtaining Effects (ACE technology)
TEM sample preparation for uniformly-thick lamellas

4 Triple-Beam System for Ga FIB-induced Damage Reduction

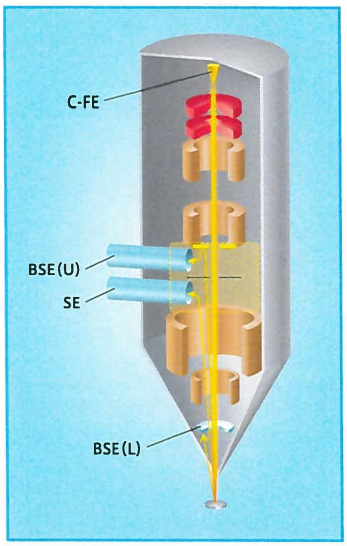
Low-acceleration noble-gas ion-beam material processing (Triple beam system)
Customizable ion species (argon/xenon)

5 Sample Chamber and Stage for Various Applications

Numerous specimen chamber ports (large and small ports)
Large sample size capable system combined with low-vibration stage with enhanced long-distance tracking(155 x 155 mm)

EM Design

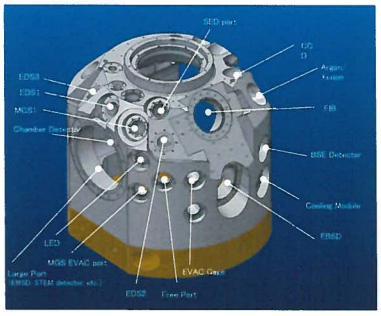
ETHOS Aquila α SEM is composed of a magnetic- and electrostatic-field compound objective lens system as two lens modes. HR mode achieves sample observation at ultimate resolution by immersing the sample in the magnetic field of the lens system.
FF (Field Free) mode offers real-time FIB processing for high-accuracy end-point milling.
Hyper switching between FIB irradiation and SEM imaging as fast as 10 nsec offers real-time fabrication and observation views with clarity that is damageless. Fast SEM and IM imaging aids users to find the area of interest rapidly and with ease.



Aquila α SEM

Multiple In-column detectors acquire various signals with superb contrast for identifying nanoscale structures with ease.

Signal images from multiple detectors can be displayed simultaneously on the GUI.
This enables multifaceted analysis of samples as well as accurate end-point detection.



Multi-Port Chamber

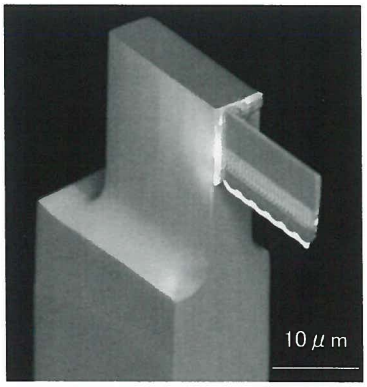
A multitude of analytical configurations are possible with optimum detector positioning via the newly designed sample chamber. The sample chamber is designed for users who are prepared for customization and upgradeability.

Application

■ TEM sample preparation using ACE technology

※ ACE: Anti Curtaining Effect

ETHOS offers powerful solutions integrated with ACE technologies that combine sample orientation control with low-acceleration argon-ion-beam processing when configured as a triple-beam ETHOS system for atomic-scale imaging for Cs-TEM analysis applications.



Backside Micro-sampling on NANOMESH

Low-energy Argon broad ion milling is less destructive and removes amorphous material left behind by Gallium ion milling.

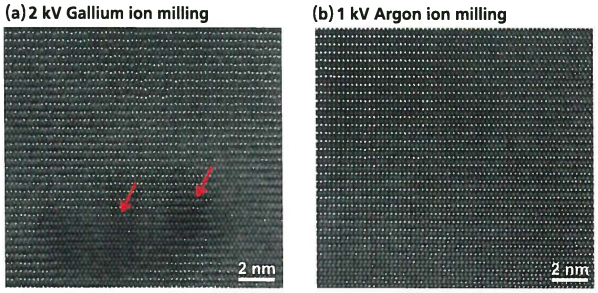


Fig.1; High resolution TEM images of Al_2O_3 single crystal

Fig. 1 shows Al_2O_3 single crystal in the <110> plane. Dark contrast (red arrow) indicates Ga ion induced damage at 2 kV (Fig. 1a). The right image (Fig. 1b) shows the same single crystal structure intact by applying 1 kV-Ar ion milling revealing clear crystal lattice fringes.

Specifications

FIB	
SIM Resolution	4 nm @30 kV, 60 nm @2 kV
Accelerating Voltage	0.5 kV – 30 kV
Max. Beam Current	100 nA
Ion Source	Ga Liquid Metal Ion Source

SEM (CFE Version)	
SEM Resolution @CP	1.5 nm @1 kV, 0.7 nm @15 kV
Accelerating Voltage	0.1 kV – 30 kV
Beam Current	5 pA – 10 nA
Electron Source	Cold cathode FE source

Detectors	
SEM In-Column	SE BSE(U) with energy filter BSE(L)
Chamber Port	SE

STAGE	
Stroke	X,Y 155 mm Z 16.5 mm
(5-Axis motorized)	R n×360° T -10 to +59°

OPTION (House Made)	
Ar / Xe Gun	Low energy broad-focused ion beam
Mechanical Probe System	For Micro-sampling
Gas Injection system	Carbon / Tungsten / Platinum
Auto sample loader	Auto Load-lock
A-TEM	Software for auto TEM sample Prep

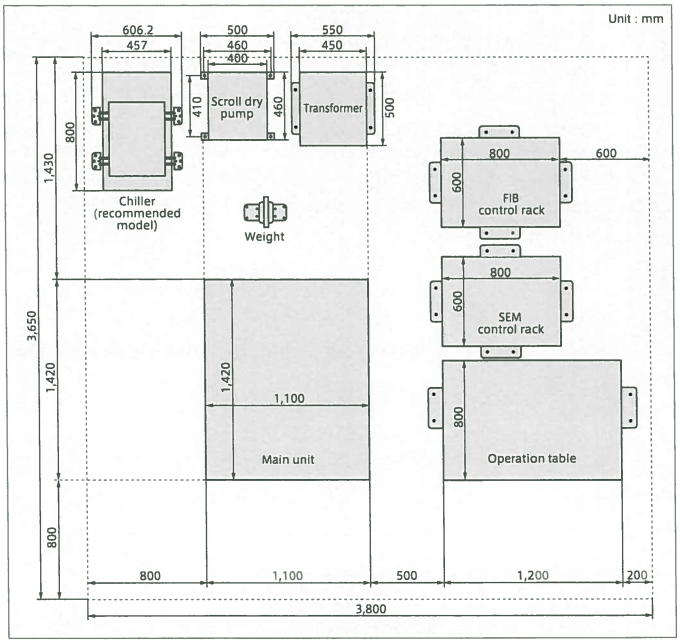
OPTION (3rd Vender)	
EDS	
EBSD	

Utilities

Items	Description
Room Temperature	Set Value 22 ℃±3 ℃ Tolerance SV±1 ℃ Fluctuation 0.5 ℃ / h or less
Humidity	35 – 60% no condensation
Power	Single phase AC (50 / 60 Hz) 200-230 V ±10% 30 A
Grounding	D-class 100 Ω or less
Cooling Water	Flow 0.7 L / min or less Pressure 50 – 100 kPa Temperature 15-20 ℃ Temperature Fluctuation ±0.5 ℃ or less / 10 min
N_2 gas (for gas leak)	Purity 99.95% or more Pressure 0.5 – 0.7 MPa
Air (for valve control)	0.5 – 0.7 MPa

Layouts

Unit	Size & Weight
①Main	1,100×1,420×1,900 mm,1,600 kg
②Operation Table	1,200×800×720 mm, 60 kg
③SEM Control Rack	600×800×1,800 mm, 350 kg
④FIB Control Rack	600×800×1,800 mm, 350 kg
⑤Transformer	450×500×450 mm, 70 kg
⑥Weight	200×150 φmm, 23 kg
⑦Scroll dry pump	400×460×340 mm, 35 kg
⑧Chiller Model recommended	460×800×620 mm, 45 kg



Science for a better tomorrow

*This logo is the trademark of Hitachi High-Technologies Corporation throughout the world.

Notice: For correct operation, follow the instruction manual when using the instrument.

Specifications in this catalog are subject to change with or without notice, as Hitachi High-Technologies Corporation continues to develop the latest technologies and products for our customers.

Hitachi High-Technologies Corporation

Tokyo, Japan
http://www.hitachi-hitec.com/global/em/
24-14, Nishi-shimbashi,1-chome, Minato-ku Tokyo,105-8717, Japan

For technical consultation before purchase, please contact:contact@nst.hitachi-hitec.com