구 매 규 격 서

COMMODITY DESCRIPTION

			structure		
1	9012.10.1090	41111721	Microscope for high-resolution	System	1
			300kV Cryo Bio-Transmission Electron		
		Code(eight-digit)	r		~ 5
Item No.	HSK No.	Commodity Classification	Description	Unit	O'tv
품목번호	관세분류번호	Korean Government	품 명	단위	수량
		정부물품분류번호(8자리)		• ••	

I. 용도(End-user's Use)

- 1. The system should be a 300kV FEG Field Emission Transmission Electron Microscopes, uniquely designed for performance across a wide range of applications, such as 2D and 3D imaging of proteins and macromolecular assemblies and cells, cell organelles and soft materials at liquid-nitrogen temperature.
- 2. The system should be integrated with Cryo box fixed to the objective lens, providing temperature stability and preserving cryo specimen quality.
- 3. The system is equipped with autoloading system for automated and contaminated-free loading of cassettes. The Cryo Autoloader TEM can be figured for Single Particle Analysis(SPA) screening, data acquisition and Tomography.
- 4. The system includes tomography software for TEM and STEM modes so that three-dimensional reconstruction can be acquired as tilting along sing axis for a large angular range automatically.
- 5. The system has Phase Plate positioned in holder and installed in the automated objective aperture mechanism. It induces a phase difference between the un-scattered and scattered parts of the electron wave function, resulting in an improved in-focus phase contrast in the image plane. This improvement is particularly beneficial for the imaging of weak phase objects, such as frozen hydrated organic specimens.
- 6. The system has two sets of cameras fully integrated in TEM. One is a 16 mega pixel CMOS camera for large field of view images with high sensitivity and the other one is for the direct detection of electrons in low-dose imaging applications dedicated to 300kV TEM.
- 7. The software equipped to the system can maximize throughput as decreasing aberration effect & Fresnel fringes on the edge of the beam.

- 8. Cryo Sample preparation system is included for a high throughput of vitrified samples. The process of plunging, blotting or spray type and vitrification is fully automated.
- 9. The system can be monitored remotely to check the microscope performance and perform basic microscope operations.

표. 장비의 구성(Configurations of Goods)

1. 주장비

1)	TEM basic unit	1set
	① FEG Electron Source	1set
	 Environmental Enclosure 	1set
	③ 300kV Alignment	1set
	④ Automated Imaging Acquisition System for SPA	1set
	(5) Integrated cryo box	1set
	6 Low Dose Exposure Technique	1set
	⑦ Automatic Aperture System	1set
	⑧ Autoloader for 12 auto-grids per one insertion	1set
2)	16M pixel CMOS Electron Diffraction camera	1set
3)	Direct detection camera with post-column energy filter or in-column energy filter	1set
4)	Automated Imaging Acquisition System for SPA	1set
5)	Aberration Free Image Shift Software	1set
6)	Fringe Free Imaging Software	1set
7)	TEM Tomography Software	1set
8)	Phase plate; phase contrast improving system	1set
9)	Cryo Sample preparation system	1set
10)	Autoloading system accessories	
	① Capsules	3ea
	 Cassettes 	3ea
	③ C-clip Ring (100x)	5ea
	④ C-clip (100x)	5ea
	(5) C-clip insertion Tools	12ea
	6 Loading Station	3ea
	⑦ AutoGrid Alignmnt Tool	3ea
	⑧ AutoGrid Tweezers	4ea
	(9) AutoGid Container(20x)	5ea
	10 Cassette Tweezers	3ea
	1) AutoGrid Assembly Workstation	2ea
	12 Grid Container Tool	1ea
11)	Workstation with 2x24" LCD Monitor	1set

12) Network Computer	1set
13) Remote Monitoring System	1set
14) STEM System	
① STEM Detector (BF/DF & HADDF)	1set
 Microprobe STEM Alignment Software 	1set
3 4k x 4k STEM Data Acquisition Software	1set
15) STEM Tomography Software	1set
1. 부속장비	
1) Compressor 220V, 50/60Hz	1set
2) Water cooling Chiller	2set
3) UPS 20kV	1set
4) UPS 30kV	1set
5) Gas Accessories (SF6, LN2, Dewar, and etc)	1set
6) Glow Discharger	1set
7) 3D reconstruction software	1set
8) Cryo Sample preparation system	1set

표. 성능 및 규격(Performance and Specification)

1. TEM basic unit

The system is a 300kV, FEG Cryo Transmission Electron Microscope (Cryo-TEM), which has autoloading systems so that it can be configured for Single Particle Analysis high resolution data acquisition and same quality assessment, Tomography, and other applications.

1) Microscope Column

- (1) Gun
 - 1 FEG field emitter or cold FEG with four or more lens system
 - ② FEG Probe Current: 1.2nA spot size \leq 1 nm or better
 - ③ fully aligned at 300kV
- (2) Aperture System : Automatic condenser, Objective and SA apertures or equivalent specification
 - 1) Selected area apertures 10, 40, 200, 800 μm
 - (2) C1 condenser apertures 30, 50, 700, 2000 μm
 - 3 C2 condenser apertures 50, 70, 100, 150 μm
 - ④ Objective apertures 30, 70, 100
- (3) Four or more lens system: for automation & continuous parallel sample illumination
- (4) Wide pole piece gap: high tilt
- (5) Cryo Autoloading System
 - ① Automated and contamination-free loading of Cassettes containing up to 12 AutoGrids or more
 - ② Robotic sample handler; transferring AutoGrids automatically into and out of EM.

- $\ensuremath{\textcircled{3}}$ Cryo Box is integrated, fixed to the objective lens
- ④ Ice growth: Transmission loss 0.5nm/ hour or better
- ⑤ The lifetime of a frozen-hydrated specimen: 1 day or more in the microscope column
- 6 Temperature is managed by software including LN2 autofill, and scheduling of cool down after cryo cycle
- ⑦ Low-dose exposure Technique
- ③ Compatible to use other Autoloader equipped EM; enable to transfer the specimens in a cassette to other autoloading TEMs without additional sample preparation.
- (6) High voltage range : 80-300kV or wider
- (7) Specification
 - ① Information Limit: \leq 0.14 nm or better at zero specimen tilt
 - 2 Guaranteed resolution for 3D modeling data: 0.35 nm or better
 - ③ Probe current: Spot size at 2nA current \leq 1nm or less
 - ④ Spot drift;

60 minutes after specimen exchange: \leq 2 nm/min or better

- (5) STEM Resolution: \leq 0.24 nm
- 2) Specimen stage
 - (1) Cryo-stage with Single-axis holder for \pm 70 tilt and 90 in plane rotation without removing the specimen from the column which is better for stability and drift performance
 - (2) Tilt axis to intersect optical axis midway between pole piece.
 - (3) Computerized 4-axes eucentric goniometer
- 3) Vacuum system
 - (1) High vacuum system
 - (2) Differential pumping on the electron column, in combination with cryo shielding, ensures a clean environment for the sample
 - (3) The Autoloader is pumped separately, and contains additional cryo shielding to protect the samples stored in the cassette.
 - (4) For the Autoloader, a minimum sample storage time of three days or more without visible contamination or degradation is guaranteed.

2. Camera Analyzer system

1) 16M CMOS Camera for Surveying specimen

It is retractable and mounted under the microscope in an on-axis position. The camera sensor provides large field of view images with high sensitivity even under low dose conditions. The camera is fully embedded in system and can easily switch between fast screening and the recording of high quality and high resolution images.

- (1) Sensor : 4,096 x 4,096 CMOS or better
- (2) Pixel size : 14 x 14 $\mu m2$ or better
- (3) Digitization : 16 bit or better
- (4) Binning : 1x, 2x, 4x, 8x or better
- (5) Acquisition speeds : 4k x 4k : 1fps or more

2k x 2k : 8fps or more 1k x 1k : 18fps or more 512 x 512: 25fps or more

2) Direct Detection Camera for acquiring high resolution images

It is fully integrated in EM system and dedicated protection software prevents over-exposure and ensures that the camera for direct detection is only illuminated under low-dose conditions.

- (1) Chromatic distortion; RMS (%): <0.25, Chromatic distortio; Maximum (%): <0.50
- (2) Non-isochromaticity; RMS (%): <0.69, Non-isochromaticity; Maximum (%):<2.75
- (3) DQE Super resolution (peak): >0.7
- (4) DQE Super resolution (0.5 of physical Nyquist): >0.50
- (5) DQE Super resolution (1.25 of physical Nyquist): >0.060
- (6) Field of view: 5,760 x 4,092
- (7) Speed: 1,500 full frames per second
- (8) Post-column or in column energy filter with the direct detection camera
- (9) The software for the camera can be operated within the main cryo TEM user interface
- (10) Server storage should be included more than 200TB

3. Tomography System

The system includes a full in house tomography solution for both TEM and STEM images which provide automated image acquisition, alignment of a tomography series of images, 3D reconstruction of the data and visualization and analysis of reconstructed tomography data.

- 1) TEM Tomography Software
 - (1) a specimen is tilted along a single axis over a large angular range (typically +/- 70°) with small angular tilt increments (typically 1°), and an image is recorded at every tilt angle.
 - (2) Possible to generate a grid overview, providing an easy way to identify the regions of interest. Tracking after (correction on the basis of the latest acquired image)
 - (3) Predefined acquisition parameters help with the navigation on the specimen across different magnification levels
 - (4) Auto functions are included such as focus, ucentric hight, drift.
 - (5) Tilt series can be acquired one by one, but regions of interest can also be stored for later, unattended, data acquisition.
- 2) STEM Tomography Software : support STEM tilt series acquisition

3) Tilt-series Alignment Software

4. Aberration Free Image Shift Software

- 1) The software can reduce abberations such as coma without moving mechanical stage to decrease long settling time.
- 2) The software can enhance the resolution limit.
- 3) The software can increase throughput from the typical 3 images per a stage move to 27 images per a stage move.

5. Fringe Free Imaging Software

- 1) The software can reduce fringes which causes artifacts in the images which are more pronouced at the edge of the beam.
- 2) Fringe free illumination removes fringes and the illumination area can be smaller.
- 3) The software can make more images per a hole possible to increase throughput as many as 4 times.

6. Phase Plate

The Phase Plate induces a phase difference between the unscattered and scattered parts of the electron wave function, resulting in an improved in-focus phase contrast in the image plane. This improvement is particularly beneficial for the imaging of weak phase objects, such as frozen hydrated organic specimens.

7. 3D Reconstruction Software

- 1) including dedicated data import filters for loading EM data
- 2) supporting image to image alignment with pixel accuracy
- 3) supporting variety of semi-automatic and interactive tools for segmentation, providing the ability to construct 3D models of structures present in the image data, and defining complex regions of interest for analysis purposes.
- 4) providing a comprehensive digital lab for advanced 2D and 3D life sciences data analysis, especially aimed at scientists and researchers in cellular or structural biology, who want to get more insight in complex data and systems

8. Cryo Sample prep tool

1) Operating parameter:

- (1) Working Temperature- 4-60°C (at an ambient temperature range between 18-25°C)
- (2) Relative Humidity
 - Optimized for operation at 90%-100% RH (no condensation at RH<85%)
 - Ultrasonically controlled humidification
- (3) Peltier controlled heating/ cooling
- (4) Humidification is ultrasonically controlled
- 2) Number of Max Blotting: 8 times per grid
- 3) Sample loading direction: left and/or right selectable
- 4) Blotting direction: One-way blotting or more
- 5) A multi-step plunging process, liquid level, blot offset (max 2mm/min 6mm), wait and drain time adjustable
- 6) Touch screen control and setup
- 7) Blotting or spray type

9. Remote Monitoring System

The Remote Monitoring option allows operators to monitor the microscope performance from a remote

location and perform basic microscope operations.

- 1) It supports both software and hardware, including the remote computer, a 24" LCD monitor, and two microscope panels (with trackball, knobs and buttons).
- 2) The software is structured in such a way that only one operator (either local or remote) can operate the microscope panels at the time.

10. STEM System

- 1) HAADF Detector
 - (1) Includes High Angle Annular Dark-Field & segmented and on-axis disk and annular detectors.
 - (2) Both the disk and annular detectors are annularly and radially partitioned into 8 segments resulting in a total of 16 segments over the two detectors
- 2) On-axis BF/DF Detector:
 - (1) composited of a bright-field detector and three types of dark-field detectors
 - (2) Imaging by different annular segmentation of the annular detector and HAADF imaging
- 3) 4k x 4k STEM Images can be acquired, using software.
- 4) Microprobe STEM alignment is included for imaging thick specimen such as biological samples.

IV. 기타 조건(Remarks)

1. Training

General Cryo TEM application training especially for SPA should be performed at site.

2. CWAT (Customer Witnessed Acceptance Test) should be carried out in the factory before shipping.

3. Installation

Installation and test - run should be carried out by qualified engineers at free of charge.

4. Warranty

Over two years of warranty after installation

5. Payment Terms

1st Payment 10% of the contract amount after the L/C open.2nd Payment 60% of the contract amount after shipping.3rd Payment 30% of the contract amount after complete of the final acceptance of the Microscopes.

6. Delivery

Within 6 months after PO acceptance