<별지서식 11 : 규격서>

(연구장비)규격서

품 명	영 문	W-Cs TEM for Low kV analysis	수 량	1	구분	국내물품( ) 국외물품(○)
	국 문	저가속전압 분석용 수차보정 투과전자현미경				
모델명						
원산지						
제조 회사						

주요구성 부분 및 SPECIFICATION

1. 용 도

1. The Atomic Resolution Analytical Microscope for the multi-purpose analytical works should be transmission electron microscope (TEM) for scanning electron probe in scanning transmission electron microscope (STEM), to reveal sub-angstrom atomic structure and chemical information.

2. The diameter of the electron column should be large enough to deliver its mechanical and thermal stability, while the base frame should be designed to isolate the whole system from external mechanical noise. Furthermore, magnetic and heat-insulation shields are optimally placed on the column, to obtain the best performance by blocking the external disturbance.

3. This system should be equipped with TEM&STEM Cs corrector which provides extremely small probe size, enabling TEM&STEM imaging, EDS analysis and EELS analysis. In addition, this Cs corrected TEM should be able to equipped Cold type field emission gun to increase the probe current density, allowing for enhanced analysis with a higher signal-to-noise ratio.

4. The W-Cs TEM should be able to provide bright-field(BF) and dark-field(DF) TEM images and High angle, medium angle, and low angle annular dark field scanning transmission (STEM) image, simultaneously linked with the chemical information mapping from the same region of the specimen.

5. A imaging-detection chamber enables at least 3 different STEM image detectors in the electron beam path. Thus both the BF and DF image should be obtained at that time under the optimum optical condition.

6. To analyze samples that are sensitive to beam damage, this STEM system should be able to acquire aberration-corrected TEM and STEM images at an accelerating voltage of 30 kV.

2. 세부규격(성능 및 사양)

1. Performance

1) Resolution	TEM Point image:	0.10nm or better
	TEM Lattice image:	0.07nm or better
	STEM BF image:	0.078nm or better
	STEM DF image:	0.78nm or better (@200kV)
2) Size for Ronchigram		More than 50mrad at all Acc. Volt.
3) Accelerating Voltage:		30 ~ 200kV or wider
4) Cs corrector tuning :		200kV, 80kV, 60kV, 30kV or wider
5) Probe current :		1.0nA for 0.136nm probe dia.
6) Power Stability		Acc. Voltage : 5 x 10^{-7}/minorbetter
		OL current : 5 x 10^{-7}/minorbetter
7) Spot size :		Min. 0.1nm dia. or smaller
8) Magnification		TEM mode : x50 ~ x2,000,,000 or wider
		TEM SA MAG mode : x8,000 ~ x800,000 or wider
		STEM mode : x200 ~ x15,000,000 or wider
		STEM MAG mode : x20,000 ~ x150,000,000 or wider
9) Specimen movement		X, Y : ±1mm
		Z : ± 0.1mm
		Tilt angle : ± 25°

2. Electron Gun

1) Emitter:	Cold field emission type
2) Brightness:	8 x 10^{8}A/㎠ · sr or higher
3) Energy resolution:	0.3 eV or less at analytical condition.
4) Acc. tube & stage :	7 stages Accelerating tube or better

3. Condenser Lens

1) Lens system :	3 stage (1st CL, 2nd CL, Condenser mini lens)
2) Variable apertures :	Motor drive, metal bellow
	10, 20, 30, 40, 50, 70, 100, 150 um in dia. or better.
	Emission noise canceller function
3) Stigmator :	Two-fold astigmatism correction circuit
4) Beam tilting:	±5°
5) Alpha Selector :	TEM mode : 2 steps or better
	Probe mode : 4 steps or better
6) Hard X-ray aperture:	Motor drive, Mo aperture 200um in diameter

4. Specimen Chamber

1) Specimen stage :	Full 6-axis control side-entry eucentric
	with Z-axis and bake-out heater
2) Specimen exchange :	Airlock and , automatic double-stage pre-evacuation system.
3) Anti-contamination device (ACD) system :	

	LN2 cooled fin and large LN2 tank
	LN2 Holding Time : 14h or more
4) Specimen Holder :	Specimen size : 3mm dia. Grid
	No. of Specimen Loadable : one (1)
5) Goniometer :	Intelligent type
	Piezoelectric element
6) Specimen Movements	
-. For X/Y direction :	Motor drive and piezo drive ±1 mm
-. For Z direction :	Motor drive and piezo drive ±0.1 mm
-. Tilt-X/Y :	Motor drive
5. Objective Lens	
1) Lens system :	Two- stage lens system (OL lens and OL mini-lens)
2) Pole pieces:	Ultra High resolution Pole piece
3) OL High contrast aperture :	Motor drive, 5, 20, 60, 120 um in diameter
4) Electromagnetic field shift :	± 2um(X/Y)
6. Image-Forming lens :	Intermediate Lens (IL) and Projector Lens (PL)
1) Lens system :	4-stage (1st, 2nd, 3rd IL and PL)
2) Imaging :	Rotation-free , distortion-free
3) Selected-area aperture :	Motor drive, Mo disc aperture
	10, 20, 50, 100 um in diameter
4) Axis alignment :	Mechanical and electromagnetic
5) Shutter:	Built into Projector Lens
6) Airlock valve :	Built-in
7. Viewing Chamber	
1) Viewing window :	Front, 178 mm in diameter
2) Fluorescent screen :	Large screen : 160 mm diameter
	Small screen : 25 mm diameter
	Binoculars : 10x
8. Image Detection chamber	Port for BF STEM detector & STEM image aperture
	Port for Beam stopper
9. STEM Image Acquisition Unit	
1) Image acquisition detector :	BF TEM detector & DF TEM detector
2) Beam Scanning :	Digital scan
	Scan-signal external input possible
3) Scanning modes:	Surface scan , Line scan , Spot , Externally controlled scan
10. Vacuum System	
1) Evacuation:	Differential pumping
2) Control:	Fully automatic sequential control
3) Bake-out system:	Automatic control

4) Vacuum pumps	Electron gun chamber : 300L/s NEG pump
	Electron gun acceleration tube : 200L/s SIP
	Intermediate chamber : 20L/s SIP
	2nd intermediate chamber : 30L/s SIP
	Column : 150 L/s SIP
	Viewing chamber/Image detection chamber : 420 L/s DP
5) Vacuum gauges :	Pirani gauges and Penning gauges
6) Electron gun chamber :	$1x10^{-8}$Pa orless
7) Specimen chamber :	$2x10^{-5}$Pa orless
8) Venting by gas :	Dry nitrogen gas automatic termination mechanism
11. Operation Control System	
1) Operation computer:	PC , Windows® 64 bit or later
2) Operation :	Operation panel and graphical user interface (TEM Center)
12. Safety Device	
1) Protective devices :	Against power and water failures
2) Self-diagnosis function :	Pneumatic failure
	Cooling water failure
	Rotary pump rotation failure
	Temperature rise of oil-diffusion pump
	Pirani gauge failure
	Increased pressure of reservoir tank
13. EDS for TEM	
1) SDD Detector:	100mm^2ActiveareaX2(Dualdetectorsystem)
	Windowless , peltier cooling type (No LN2)
2) Solid angle :	1.24sr or better
3) Energy resolution :	133eV or better
4) Detectable elements :	5B to 92U or wider
5) Application software :	EDS spectral analysis
	Line analysis
	Elemental Mapping with Probe tracking
	Quantitative mapping
14. TEM Camera	
1) Type :	16M pixels One view Camera
2) Sensor active area :	61.4 X 61.4 mm
3) Sensor size :	4096 X 4096 pixels
4) Pixel size :	15um
5) Full sensor read-out speed :	25fps
6) Image display :	25fps
7) Image Capture modes :	Exposure time
	Signal-to-noise
	Specimen dose

8) GIF compatible :	possible
9) System Configuration	16M pixel TEM CCD camera
	In-situ up-grade
	DIFPack software
	PC for TEM Camera
	Installation & Training

15. Electron energy loss spectroscopy for Cs-FE TEM

1) GIF Quantum ER System	
2) Entrance aperture size :	9.0/ 5.0/ 2.5mm
3) Min. slit width :	2.0 eV (200kV)
4) Max. Slit width :	100eV (200kV)
5) Mask image distortion RMS (%) :	0.50%
6) Mask image distortion max. (%) :	0.75%
7) System Configuration	STEM Pack Up grade
	Dual-EELS Up grade
	Software Suite for DualEELS
	High Speed Up grade
	Charge for each additional voltage (60kV, 30kV)
	Advanced AutoFilter Suite
	EELS Advisor Suite
	EDS Acquisition Online Suite
	Test Specimen (NIO&BN)

3. 표준 및 부속품(주요 자재 및 설비)

1. 주장비

1)	Electron Microscope Basic Unit	1 set
2)	Cold Field Emission Gun with HT tank	1 set
3)	Noise Canceller system	1 set
4)	Double corrector HT Cable	1 set
5)	Ultra High Resolution Pole-piece	1 set
6)	Beam Stopper	1 set
7)	ASCOR UHR STEM Cs Corrector	1 set
8)	UHR TEM Cs Corrector	1 set
9)	STEM & TEM Cs Corrector assembly parts	1 set
10)	Objective lens	1 set
11)	Double Cs corrector column cover	1 set
12)	Computer Unit with main monitor	1 set
13)	Electrode Short Switch	1 set
14)	Foot Switch Pedal	1 set
15)	Power Supporter	1 set

16) Dry pumping station		1 set
17) Ion cleaner		1 set
18) BF STEM detector system		1 set
19) Dark Field Image Observation Device		1 set
20) Reinforced Specimen Tilting Holder		1 set
21) Reinforced Specimen Tilting Beryllium Holder		1 set
22) 60 kV STEM & TEM Cs Corrector Data		1 set
23) 30kV Electron source data		1 set
24) 30kV STEM & TEM Cs corrector Data		1 set
25) Energy dispersive Spectrometer system		1 set
-. 100mm^{2}windowlessDrySDDetector	2 set	
-. SD100 UHR Accessory	2 set	
-. Digital Pulse Processor 5	2 set	
-. Standard Software with Mapping	1 set	
-. Personal Computer for EDS system	1 set	
-. Dual Detector Mixer with adapter	1 set	
26) TEM Camera system		1 set
-. 16megapixel TEM camera system	1 set	
-. In-situ up-grade	1 set	
-. True-Align software	1 set	
-. DIFPack Software	1 set	
27) Electron energy loss spectrometer system		1 set
-. GIF Quantum ER system	1 set	
-. Data for low kV analysis (30kV, 60kV)	1 set	
-. High speed STEM pack upgrade	1 set	
-. GIF Quantum upgrade for Dual EELS	1 set	

2. 부속장비

1) UPS for W-Cs STEM	1 set
2) Cooling Water circulator	1 set
3) UPS for cooling Water circulator	1 set
4) Air compressor	1 set

4. 선택부속 또는 추천부속품(주요 공사)

5. A/S기간 등 기타사항

1. Installation and Supervision

Installation, Supervision and test-run will be carried out by a qualified engineer.
At that time of installation the engineers shall provide such service as installation, adjustment and adequate tuition for the operator.

2. Warranty of Equipment.
Warranty service for the goods manufactured by maker will be provided within twelve(12) calendar months from the date of installation or fifteen(15) calendar months from the date of dispatch, whichever comes first.

3. Operation Training
Operation training of equipment will be carried out by a qualified engineer at that time of installation free of charge.

※ 작성 요령

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① 품명 및 수량 : 구매 요청한 물품의 이름 등을 기재하되 하나의 시스템 안에 제작사나 제조업체가 다른 독립된 기능을 갖는 물품이 여러 개인 경우에는 각각의 품명을 구분하여 작성

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② 규격 : 규격은 되도록 상세하게 작성, 각 부속이 있다면 단위(개,대)까지 작성(되도록 국문으로 작성)