BNC, Toyo Univ.
(Revised:September 1th 2013)

List of Facilities and equipment

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Table 1. Facilities for EB lithography and UV lithography in Alpha Building.

No	Name	Company	Model number	Specifications, Performance	Remarks
	Electron beam(EB) lithography system (No.1') (Ultra-high precision type)	ELIONIX (Japan)	ELS-7000	***125[kV]*** 6inch-wafer ***Resolution 5[nm]*** L&S min.30-80[nm]	Direct writing of ultra fine patterns ***(just installed in August 2013!)***
	Electron beam (EB) lithography system (No.2)	ELIONIX (Japan)	ELS-3700	20[kV] 3inch- photo masks Resolution 100[nm]	Fabrication of Masks for UV lithography
	Manual Aligner (UV-Exposure)	SUSS Micro Tec (Germany)	MA6BSA	**i-line,** Two-sided type 30mmx30mm, 2inch, 3inch	UV lithography
	Spin coating system			500-3000[r.p.m]	Coating of resist films
	Usher			O2,N2	Ushing of resist films
	Ovens			Temp.60-200℃	Baking of resist films
	Wet station	DALTON (Japan)			Wet etching process with organic solvent

Table 2-1. Facilities for device fabrication process in Alpha Building (1/2).

No	Name	Company	Model number	Specifications, Performance	Remarks
	Reactive ion Etching (RIE) system (No.1)	SAMCO (Japan)	RIE-200iP	ICP(Inductively Coupled Plasma), L&S 0.5[um], HBr,CHF3,Cl2,CH4,O2,N2,Ar	Plasma etching for **sub-micron gates** of Si MOSFETs Plasma etching for **deep trenches** in Si or quartz substrates
	Reactive ion Etching (RIE) system (No.2)	ULVAC (Japan)	ECR–310E	L&S 2[um], Cl2,SF6,CH4,O2,N2,Ar	Plasma etching for GaAs devices
	Reactive ion Etching (RIE) system (No.3)	ULVAC (Japan)	RIE-200iP	ICP(Inductively Coupled Plasma), L&S 0.5[um], HBr,CHF3,Cl2,CH4,O2,N2,Ar	Plasma etching for **sub-micron gates** of Si MOSFETs Plasma etching for **deep trenches** in Si or quartz substrates
	Reactive ion Etching (RIE) system (No.4)	ULVAC (Japan)	RIE-200iP	ICP(Inductively Coupled Plasma), L&S 0.5[um], HBr,CHF3,Cl2,CH4,O2,N2,Ar	Plasma etching for **sub-micron gates** of Si MOSFETs Plasma etching for **deep trenches** in Si or quartz substrates
	Sputtering system	CANON ANELVA (Japan)	E-400TY	Magnetron Sputtering 3 targets, Temp. RT-300℃ Power supplies(DC, AC, and Pulse)	Formation of thin films SiO2,Si3N4,ITO,Au,Al,Ni,Fe etc. Surface roughness of films : Ra 1.0 [nm]
	Sputtering system	CANON ANELVA (Japan)	SPF – 210A	Magnetron Sputtering	Formation of thin films SiO2,Si3N4,ITO,Au,Al,Ni,Fe etc.
	Evaporator (Resistance heating)	Showa-Shinku (Japan)	93 – 4050		Formation of metal films Au,Al, etc.
	Evaporator (Electron beam (EB))	ULVAC (Japan)	Custom-made	Three-crucible type	Formation of metal films Ti,Ni,Au etc.
	Ion implantor	ULVAC (Japan)	IMX – 3500	30[kV]-200[kV], B (solid source), P (solid source), Si (SiF4 gas source) etc.	+ **5[kV]**-30[kV] for formation of shallow junctions

Table 2-2. Facilities for device fabrication process in Alpha Building (2/2).

No	Name	Company	Model number	Specifications, Performance	Remarks
	Ultra pure water production system (No.1)	Nomura Micro Science (Japan)	TW-600RU	17-18[M ohm m],600 [l/h]	
	Ultra pure water production system (No.2)	Nomura Micro Science (Japan)	TW-300RU	17-18[M ohm m],300 [l/h]	
	Wet station	DALTON (Japan)			Wet etching process
	Furnace (No.1)	Pure-Create (Japan)	Custom-made	300-1150C,O2,N2 Si wafer(30mmx30mm)	Dry oxidation of Si wafers for gate electrodes
	Furnace (No.2)	Pure-Create (Japan)	Custom-made	300-1150C,O2,N2 Si wafer(30mmx30mm)	Dry oxidation of Si wafers
	Furnace (No.3)	Pure-Create (Japan)	Custom-made	300-1150C,O2,Steam Si wafer(30mmx30mm)	Wet oxidation of Si wafers
	Furnace (No.4)	Pure-Create (Japan)	Custom-made	300-1150C,N2,H2 Si wafer(30mmx30mm)	Annealing for ohmic contact formation
	Furnace (No.5) Rapid Thermal Annealing (RTA)	ULVAC-Riko (Japan)	QH – P610	RTA,800-1100C,N2 2inch- Si wafer	Activation annealing after ion implantation
	Furnace (No.6) Low pressure (LP) Chemical vapor deposition (CVD)	Pure-Create (Japan)	Custom-made	Thermal CVD, 800-1100C, SiH4,TEOS,NH3,N2 Si wafer(30mmx30mm)	Formation of poly Si films or SiN films
	Furnace (No.7) Low pressure(LP) Chemical vapor deposition (CVD)	ULVAC (Japan)	CNT-CVD-200 RD	Remote plasma (ECR plasma) CVD, 800C, CH4,N2,O2,H2	CVD for CNTs

Table 3. Facilities on the Second floor in Alpha Building.

No	Name	Company	Model number	Specifications, Performance	Remarks
	Discovery Studio	accelrys	ver. 3.5	Simulations in Discovery Studio ・Energy calculations ・Energy minimization ・Molecular dynamics ・Solvent models ・Trajectory analysis ・Force field-based docking ・Electrostatic calculations	
	Electrospinning machine	MECC	NANON		ULTRA CO-AXIAL SPINNERET DRUM COLLECTOR
	Thermal cycler (PCR)	ABI	veriti 96-well	Block format: 0.2 ml, Alloy Max block ramp rate: 3.90℃/sec Max sample ramp rate: 3.35℃/sec Temperature range: 4.0～99.9℃	
	DNA sequencer,	ABI	310 genetic analyzer	Performanc: 98.5% basecalling accuracy, Throughput (per 24 h): 5,000 base calls (10 runs x 500 base calls per run)	
	DNA sequencer,	ABI	8Q5500E		

Table 4-1. Facilities on the First floor in Beta Building (1/4) -TEM-.

No	Name	Company	Model number	Specifications, Performance	Remarks
	Transmission electron microscope (TEM) (No.1) (**FE-TEM)**	JEOL (Japan)	JEM-2200FS +JE-D-2300F	EB-gun, 200[kV], (Cold-type Field emission) In-column omega type energy filter, **Resolution 0.1-0.19 [nm]**	+ Scanning TEM (STEM), + Energy dispersion spectroscopy (EDS) B(5)～U(92), + Electron energy loss spectroscopy (EELS)
	Transmission electron microscope (TEM) (No.2)	JEOL (Japan)	JEM2100	EB-gun (LaB6) **40[kV]**-200[kV], Resolution 0.14-0.25[nm]	Electron diffraction ***3D Electron Tomography System***
	Transmission electron microscope (TEM) (No.3) (**FE-TEM)**	JEOL (Japan)	JEM-ARM200F +JED-2300F	EB-gun, ***80-200[kV],*** (Shottky Field emission) ***Resolution 0.08nm(STEM-HAADF), 0.19nm(TEM), 0.11nm(Cs Correction)***	+ Scanning TEM (STEM)+HAADF, + High Sensitive Energy dispersion spectroscopy (EDS) B(5)～U(92),(100mm2) + Electron energy loss spectroscopy (EELS) ***(will be installed in near future.)***
	Focused ion beam (FIB)	SII Nano Technology (Japan)	SMI-2050	Ga+,10[kV]-30[kV]	Formation of nanostructures Preparation of ultra thin cross-sectional samples for TEM observation (for **semiconductors and related materials**)
	Cryo ultra microtomes system	Leica microsystems (Germany) / JEOL (Japan)	UC6i・FC6		Preparation of ultra thin cross-sectional samples for TEM observation (for **bio-related materials**)

Table 4-2. Facilities on the First floor in Beta Building (2/4) -SEM-.

No	Name	Company	Model number	Specifications, Performance	Remarks
	Scanning electron microscope (SEM) (No.1) (**Semi in-lens FE-SEM**)	JEOL (Japan)	JSM7-400F +JED-2300F	EB-gun, 0.1[kV]-30[kV], (Cold-type Field emission) Semi In-lens type, Resolution 1.0[nm] (@15(kV)) **1.5[nm] (@1(kV))** Sample size Max.150mm	Secondary electron image (SEI)+ Backscattered Electron Image(BEI), + Scanning TEM (STEM), + Energy dispersion spectroscopy (EDS) B(5)～U(92), Detector, 30mm2 ***+ Micro prober system***
	Scanning electron microscope (SEM) (No.2) (**In-lens FE-SEM**)	Hitachi (Japan)	S5000	EB-gun, 5[kV]-30[kV], (Cold-type Field emission) In-lens type, Resolution **0.5[nm] (@30(kV))** 1.8[nm] (@5(kV)) Sample size Max.5mm x 10 mm	Secondary electron image (SEI)+ Backscattered Electron Image(BEI),
	Scanning electron microscope (SEM) (No.3) (**Semi in-lens FE-SEM**)	Hitachi (Japan)	SU-8030	EB-gun, 0.1[kV]-30[kV], (Cold-type Field emission) Semi In-lens type, Resolution 1.0[nm] (@15(kV)) ***1.3[nm] (@1(kV))*** Sample size Max.150mm	Secondary electron image (SEI)+ Backscattered Electron Image(BEI), + Scanning TEM (STEM), + Energy dispersion spectroscopy (EDS) B(5)～U(92), **Detector, 80mm2** **+Electron Beam Induced Current(EBIC)**
	Scanning electron microscope (SEM) (No.4) (**Semi in-lens FE-SEM**)	Hitachi (Japan)	SU-6600	EB-gun, 0.5[kV]-30[kV], ***1[pA]-200[nA]*** (Shotttky Field emission) Semi In-lens type, Resolution **1.2[nm] (@30(kV))** 3.0.[nm] (@1(kV)) *High Pressure ：<7×10^{-4} [Pa]* ***Low Pressure ：10～300[Pa]*** Sample size Max.150mm	Secondary electron image (SEI)+ Backscattered Electron Image(BEI), + Scanning TEM (STEM), + Energy dispersion spectroscopy (EDS) B(5)～U(92), **Detector, 50mm2** **+Wave dispersion spectroscopy (EDS)** **+Cathode Luminescence**
	Scanning electron microscope (SEM) (No.5) **(Atmospheric Scanning Electron Microscope)**	JEOL (Japan)	JASM-6200 ClairScope ***(Customized by BNC)***	Resolution 8nm @30kV Accelerating Voltage 10, 20, 30kV Magnification X100~X100,000 Detector High Sensitivity Solid State BSE	Backscattered Electron Image(BEI), ***+AFM*** ***+Raman for wet samples and/or samples in solutions***

Table 4-3. Facilities on the First floor in Beta Building (3/4) -SPM-.

No	Name	Company	Model number	Specifications, Performance	Remarks
	Scanning Probe Microscope (No.1)	Asylum Research (USA)	MFP-3D-SA	DFM, MFM, KFM, Cell for liquid (temperature-controlled) Nano-lithography	**Total reflection** fluorescence microscope for **single molecule measurement** ((BX2WI-TIRFM) Olympus (Japan))
	Scanning Probe Microscope (No.2)	Asylum Research (USA)	MFP-3D-BIO-J	DFM, SNOM	+ Inverted fluorescence microscope for **SNOM (Scanning near field microscope)**
	Scanning Probe Microscope (No.3)	Asylum Research (USA)	Cypher S	DFM, MFM, KFM, STM Cell for liquid	Faster scanning with **Atomic resolution** **Search for biological cells in solutions**
	Scanning Probe Microscope (No.4)	SII Nano Technology (Japan)	SPA-500	DFM, MFM, KFM **Automatic stage (4inch size)**	Search for CNTs on substrates
	Scanning Probe Microscope (No.5)	JEOL (Japan)	JSPM-5200	DFM, High-vacuum(10^{-4}Pa) SSRM	SSRM for Potential contour in Si devices
	Scanning Probe Microscope (No.6)	JEOL (Japan)	JSPM-4610	STM, AFM, KFM, **(in ultra high vacuum 10^{-9}Pa)**	**Atomic images** of surface structures of Si, CNT and other materials

Table 4-4. Facilities on the First floor in Beta Building (4/4) -Others-.

	X-ray photo electron spectroscopy (XPS) (No.1)	Kratos (UK)/ Shimazu (Japan)	AXIS-Hi	Mg/Al dual anode, **Al monochromator**,	Auto neutralizer with magnet lens Ion gun for sputtering (Ar+) Zalar rotation,
	Scanning Auger electron spectroscopy (AES)	JEOL (Japan)	JAMP-9500F	EB-gun, (Thermal-type Field emission), EBSD(Electron Back Scattering Diffraction)	Ion gun for sputtering (Ar+), Zalar rotation,
	Time- of-flight secondary ion mass spectrometer	ION-TOF (Germany)	TOF.SIMS 5	Bi^{+}-gum	Time of Flight mass analysis in different operational modes (surface spectroscopy, surface imaging, depth profiling)
	Vibrating Sample Magnetometer	Lake Shore Cryotronics, Inc. (USA)	7407	Hysteresis Loops Initial magnetization curve DC remanence AC remanence Vector measurements Magnetization data as a function of time	Maximum 2.12 T Dynamic range 10^{-7}~10^{3} emu Sample mass 0~10 g (bulk, powder, solution)
	SQUID				will be installed in March 2014

Table 5-1. Facilities on the Second floor in Beta Building (1/4).

No	Name	Company	Model number	Specifications, Performance	Remarks
	High Resolution Microscope Raman Spectrometer	JobinYvon (France) / HORIBA (Japan)	LabRAM HR-800	f-800[mm] **Spatial resolution 1[um]** He-Cd laser (325.0[nm]) Ar+ laser (457.9[nm], 488.0[nm], 514.5[nm]) He-Ne laser (632.8[nm])	+ PL measurement (InGaAs detector) + Cryostat (77[K]-300[K]) with terminals for electric measurement
	SNOM-Raman	WITec (Germany) / LUCIR (Japan)	JSPM-4300	**Spatial resolution 0.5[um] for Raman measurement** 355 [nm] solid-state laser 532 [nm] solid-state laser	Raman, AFM measurement, and Scanning near field microscope (SNOM) measurement
	Near infrared photo luminescence excitation (NIR-PLE)	Shimazu (Japan)	NIR-PL	Excitation 500W Xe lamp 400[nm]-1000[nm] Detector InGaAs 850[nm]-1600[nm]	Characterization of chirarity of CNTs
	Picosecond Fluorescence Lifetime Measurement System	Hamamatsu Photonics (Japan)	C4780	5 ps temporal resolution	Streak Scope
		Coherent (USA)	Chameleon	<140fs,1W,90MHz, +Pulse picker 9200, 9.5[kHz]-4.75[MHz] +HG9300, SHG, THG	Ti Sapphire laser
	Refractometer	Shimadzu (Japan)	KPR-2000	Refractive index: 1.25-2.00 Measurement wavelength: 486.1, 587.6, 656.3 and 632.8 nm Temperature range: 10-70 °C	Measurement of refractive index for glasses, transparent materials and liquid samples
	Microplate reader	DAINIPPON SUMITOMO PHARMA BIOMEDICAL	POWERSCAN HT(TRF•DISP)	Absobance: Xenon lamp (200-999nm) Fluorescence & TRF: Tungusten Halogen lamp (EX;360, 485, 530, 595[nm], EM; 460, 528, 590, 620[nm])	Supported plate: 6, 12, 24, 48, 96, 384 well plate, PCR tube Injector, Incubator and Shaker are installed.

Table 5-2. Facilities on the Second floor in Beta Building (2/4).

	UV-VIS-NIR Spectrum photometer	Hitachi (Japan)	U-3500	Deuterium lamp (D2), Iodine tungsten lamp 187[nm]-3200[nm] Transmittance, Reflectance	
	UV-VIS-NIR Spectrum photometer	Jasco (Japan)	V-570	Deuterium lamp (D2), Halogen tungsten lamp 200[nm]-2500[nm] Transmittance, Reflectance	
	Fluorescence spectrophotometer	Jasco (Japan)	FP-6500	Excitation Xe lamp 220[nm]-750[nm] Detector 220[nm]-750[nm]	
	Fluorescence spectrophotometer	Hitachi (Japan)	F-4500	Excitation Xe lamp 200[nm]-890[nm] Detector 210[nm]-900[nm]	
	Micro-FT-IR/FT-Raman	Thermo Fisher Scientific (USA)	Nicolet iS50 / Nicolet Continuum	IR microscope FT-Raman (1064 nm excitation) ATR module PM-IRRAS module	Near-IR to Far-IR
	Thermal analysis -FTIR **simultaneous measurement** system (TG-DTA/FTIR)	Shimadzu (Japan)	DTG-60	Ambient to 800 °C (stand-alone use: 1100 °C)	Simultaneous thermogravimetry/differential thermal analysis (TG/DTA) measurements
		Shimadzu (Japan)	IRPrestige-21	Detector (TGS, MCT) Transmission+Reflection	Infrared Spectrophotometers(IR/FTIR)
	Thermal analysis - GC/MS **simultaneous measurement** system (TG-DTA/GC-MS)	Rigaku (Japan)	Thermo Plus 2/TG-DTA		differential thermogravimetric analysis system
		Shimadzu (Japan)	GCMS-QP2010 Plus		Gas Chromatograph-Mass Spectrometer(GC/MS)
	Thermal Analysis Instrument (1)	Shimadzu (Japan)	DTG-60H	Ambient to 1500°C	Simultaneous thermogravimetry/differential thermal analysis (TG/DTA) measurements
	Thermal Analysis Instrument (2)	Shimadzu (Japan)	TGA-50	Readability,0.001mg Ambient to 1000°C	Thermogravimetric Analyzers With Advanced Thermobalance Design

Table 5-3. Facilities on the Second floor in Beta Building (3/4).

	MALDI-TOF Mass Spectrometer	Brucker Daltonics (Germany)	Autoflex II TOF/TOF		
	High performance liquid chromatography (HPLC)	Shimadzu (Japan)		System controller：CBM-20A Degasser：DGU-20A Pump：LC-20A Injector：SIL-10AF Column oven：CTO-20AC Fraction collector：FRC-10A Detector：Refractive Index Detector (RID-10A), UV-Vis detector (SPD-M20A)	
	Centrifugation evaporator	EYELA	CVE-3100	Rotating soeed：100~2000rpm Temperature：5~80℃	
	LC-MS	Bruker	amaZon speed-TYU	Type：Ion trap MS/MS efficiency：2000 fg Reserpine @ S/N 100:1 Mass range：50 - 3,000m/z, 200 - 6,000m/z mass resolution@scan speed：0.58u @ 52,000u/s, 0.50u @ 32,000u/s, 0.30u @ 8,100 u/s, 0.10u @ 4,600 u/s	

Table 5-4. Facilities on the Second floor in Beta Building (4/4).

	Mercury porosimeter	Quantachrome (USA)	Poremaster 60	Double low-pressure pretreatment port, Single high-pressure measurement port,	Pore size, pore volume, bulk and apparent density, porosity, particle size and related properties, in particular, for macro-pore samples.
	Gas adsorption measurement system	Quantachrome (USA)	AUTOSROB iQ-MP	Nitrogen gas adsorption at 77 K, 2-measurement ports, 2-degassing ports Turbo molecular pump and 1 Torr transducer	Meso-pore to micro-pore
	Water vapour sorption measurement system	Quantachrome (USA)	Hydrosorb 1000	1-measurement port, 1-degassing port 12 ^{o}C to 47 ^{o}C measurement temp. range	
	Chemisorption measurement system	Quantachrome (USA)	ChemBET PULSER	Temperature programmed reduction (TPR), Temperature programmed oxidation (TPO), Temperature programmed desorption (TPD) Pulse titration	
	3D laser microscope	Keyence (Japan)	VK-8500	685 nm laser (0.45 mW), x10 – x100 microscope objective Resolution (in height): 10 nm	Surface profile, Surface roughness (Ra, Rz,…), 3D image
	Contact angle measurement system	Kyowa Interface (Japan)	DM-701	Automatic dispenser, Sessile drop method, Extension/Contraction method, Sliding method, Dynamic sliding method, Three-state method	

Table 6-1. Facilities on the Third floor in Beta Building (1/5).

No	Name	Company	Model number	Specifications, Performance	Remarks
	Zeta potential measurement Instrument (1)	Otsuka Electronics (Japan)	ELS-6000	Laser Doppler method	High salt concentration sample (~ $8x10^{-2}$ S/cm) is available.
	Zeta potential measurement Instrument (2)	Malvern(UK)	Zetasizer NS	Static/Dynamic Light Scattering (SLS/DLS) with Non-Invasive Back-Scattering (NIBC)	Simultaneous measurement of zeta potential, size and molecular weight of particles, Size Diameter:0.6nm～6,000nm 2℃～90℃
	Thermal cycler (PCR)	ABI	veriti 96-well	Block format: 0.2 ml, Alloy Max block ramp rate: 3.90℃/sec Max sample ramp rate: 3.35℃/sec Temperature range: 4.0～99.9℃	
	2D electrophoresis system / Fluorescent gel image analyzer	SHARP	BM-100 BM-A100LD	2D electrophoresis system ・Fast separation ・High reproducible ・High resolution Fluorescent gel image analyzer ・3-laser (473nm, 532nm, 635nm) ・High-accuracy matching	Automated 2D electrophoresis system
	QCM-D	MEIWAFOSIS		Sensor: Au, HA, SiO, TiO_2, ZrO_2, AlO_3, SUS, Cr, Cu, PMMA, PS, …etc. range of frequency: 1 – 70MHz Maximum Resolution: 200data points / min	
	Jar fermenter	ABLE		5L / 10L jar fermenter rotating speed：100～1000rpm temperature range：10～50℃ instrumentation control : revolving speed, temperature, pH, DO, antiform, feed solution	

Table 6-2. Facilities on the Third floor in Beta Building (2/5).

	FPLC	GE healthcare	AKTA avant 25	Flow rate system pump : 0.001～25 ml/min sample pump：0.01～25 ml/min Pressure range system pump：0～20 MPa sample pump：0～10MPa UV detector 190～700nm conductance meter 0.01～999.99 mS/cm	
	Ultracentrifuge	HITACHI	CS150NX	Maximum speed: 150,000 rpm Rotor temperature: 0-40 °C Ultimate vacuum: below 0.6 Pa Rotor: S110AT, S50A	The CS150NX is designed to separate liquid-suspended materials having different densities and particle size. S110AT (Maximum speed: 110,000rpm, Capacity: 4 ml×8) S50A (Maximum speed: 50,000 rpm, Capacity: 30 ml×6)
	Cell Sorter	Bay Bio Science(Japan)	JSAN (Japan made sort analyzer)	Droplet Sortnig, 3-laser system, (488nm,638nm,375nm) Max. 60,000 ivents/s	
	HTFC screening system	Bay Bio Science			
	Induction heating system				

Table 6-3. Facilities on the Third floor in Beta Building (3/5).

	Laser manipulation system	SIGMA KOKI (Japan)	Special specification for Toyo University	Two beam IR laser, Inverted microscopy with motorized XY stage, Stage incubation system	Bright field, phase contrast, dark field and Epi-fluorescence microscope
	Confocal microscope	Seika Corp.(Integration and CMOS camera), Olympus Corp.(Microscope), Yokogawa Electric Corp.(Confocal scanner unit) and Andor technology Japan (EMCCD Camera)	Microscope: IX-81 Confocal scanner unit: CSU-X1 EMCCD camera: DU-897 CMOS camera: Mi-4000	Laser: 405nm, 488nm and 561nm in wavelength Other observation: Brightfield, Phase contrast, Epi-fluorescence, Total internal reflection fluorescence	High frame rate scanning (Max: 2000fps)
	Confocal microscope	Nikon Instech Co., Ltd.	C1-si ready	Laser: 405nm, 488nm and 543nm in wavelength Other observation: Brightfield, Differential interference contrast, Epi-fluorescence	Conventional system
	Upright Microscope	Nikon Instech Co., Ltd.	Microscope: Eclipse 80i	Observation: Brightfield and Epi-fluorescence	
	Inverted Microscope	Nikon Instech Co., Ltd.	Microscope: TE-2000U	Observation: Brightfield and Epi-fluorescence	
	Metallurgical microscope	Nikon Instech Co., Ltd.	Microscope: L150	Observation: Brightfield and Darkfield	
	Spectral confocal laser microscope	Nikon Instech Co., Ltd.	A1+	Laser: 405nm, 457nm, 488nm, 514nm, 561nm and 640nm in wavelength Other observation: Brightfield, Differential interference contrast, Epi-fluorescence Option: Fluorescence resonance energy transfer Spectral range: 400-750 nm	

Table 6-4. Facilities on the Third floor in Beta Building (4/5).

	Rheometer	Malvern (UK)	Bohlin Gemini HR nano	Parallel and Cone and plate Torque range: 10nNm to 200mNm Torque resolution: Better than 1nNm Controlled speed range: 0.01 nrad/s to 600 rad/s Temperature Control: -30 to 200 ℃ ER fluid measurement system	Measurements for viscosity, viscoelasticity , relaxation, creep and recovery, and multiwave.
	Excimer laser system	COHERENT	COMPexPro 50 ArF	Wavelength and power are 193 nm, and 4W.	Wavelength is in vacuum ultraviolet region.
	CO_2 laser system	COHERENT	GEM-100L	Wavelength and power is 10.6 μm and 100W.	Continuous high power laser.
	Freeze dryer				
	Cell homogenizer	SMT	LAB2000	Maximum pressure: 200 MPa Nominal capacity: 11 l/h Minimum sample size: 200 ml	Disruption of cell (animal tissues, plant tissues, yaest, and bacteria) can be achieved by passage through high-pressure homogenizer.
	Digital microscope	Leica(Germany)	LEICA DM5000B	Size: W450×D505×H352mm Transmitted-light axis: Illumination, 12V 100W halogen lamp; Contrast techniques, BF/PH/DF/POL/ICT(automated) Fluorescence axius: Illumination, 100W halogen lamp	Digital microscope
	Chromatography chamber	TAITEC	M-600FN	Size: W900×D810×H1905mm Operating temperature limit:0-+45℃ PS: AC100V, 6.5A	Chromatography chamber

Table 6-5. Facilities on the Third floor in Beta Building (5/5).

	Mini Jar fermenter	ABLE	BMJ-01	Volume: 250ml, 1L Temperature range :feed-water control, +5℃～50℃ agitation rate :100～1000rpm/10～120rpm (for cell culture) Size:250ml, 1L:W120×D330×H193mm PS:AC100V	Mini Jar fermenter
	Pure water production	Millipore	Elix Advantage3	Size（main unit）: W332×D484×H500mm, PS: 100-230V 50/60Hz 1.6A	Pure water production
	Nd: YAG laser	Quantel	Brilliant B	1064, 532, 355, 266 and 213 nm wavelength are available.	High power and easy to change the wavelength.
	Digital force gauge	NDEC-SHIMPO	FGS-100VC	Power range, moving speed and range of movement are 2-2500 N, 10-400 mm/min and 400 mm.	It is easy to change the digital force gauge units.
	Automatic Birefringence measurement system	Uniopt (Japan)	ABR-10A/22-E X	Approx. 1 sec./measurement point Birefringence retardation: 0.01 nm Principal axis direction: 0.1 deg. Rotation angle: 0.1 deg.	Internal stress in optical materials and orientation properties in polymer membranes can be evaluated.
	ultracentrifuge				

Director: Prof.Dr. T.Maekawa,
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