No.	Name (Model Number)	Use	Manufacture	Adviser	Main Staff	Sub Staff	Billing Unit
1	Thin Layer XRD (RINT Ultima III)	Powder and thin film x-ray diffraction	Rigaku	Sakamoto	Koyama	Miyake	Half Day
2	Laser Microscope (VK-X3000)	Surface profile measurement	KEYENCE	Ishikawa	Ishikawa	Miyake	1 Hour
3	Shape Mesuring Instrument (VR-3200)	Shape measurement	KEYENCE	Ishikawa	Ishikawa	Hayakawa	1 Hour
4	Cross-section Polisher (IB-09020 CP)	Cross-sectioning of samples	JEOL	Ishikawa	Koyama	Ishikawa	Half Day
5	Ion Milling (EM RES101)	Processing of specimens for TEM using ion beam	LEICA	Murakami	Ishikawa	Hayakawa	Half Day
6	Soft Etching	Surface cleaning	meiwafosis	Murakami	Ishikawa	Miyake	1 Hour
7	Surface Area Analyzer (TriStarII Plus)	Surface area and porosity analysis	SHIMAD-ZU	Sakamoto	Hayakawa	Kusanagi	Half Day
8	Pt Sputter (JFC-1600)	Pt sputter for SEM	JEOL	Ishikawa	Miyake	Hayakawa	1 Hour
9	HR FE-SEM (SU8600)	High resolution surface morphology observation, Elemental analysis	Hitachi High-Tech	Suda	Ishikawa	Hayakawa	-
10	STEM (JEM-2100F)	Scanning transmission electron microscopy	JEOL	Sakamoto	Shimizu	Sakamoto	Half Day
11	Pt / Carbon Coater (SC701C)	Coater for SEM	Sanyu Electron	Ishikawa	Ishikawa	Miyake	1 Hour
12	GD-OES (GDA750)	Elemental analysis, Layer thickness determination	Rigaku, Spectruma	Kikuchi	Ishikawa	Hayakawa	-
13	Raman Spectroscopy (NRS-7100)	Material identification by visible light	JASCO	Ishikawa	Takasawa	Miyake Hayakawa	2 Hours
14	FT-IR (FT/IR-6300, IRT-7000)	Material identification by Infrared ray, Macro / Micro / Mapping measurement	JASCO	Ishikawa	Takasawa	Miyake Hayakawa	Half Day
15	Powder XRD (RINT2200)	Powder x-ray diffractometry	Rigaku	Okuya	Miyake	Ishikawa	2 Hours
16	Multi Function XRD (EMPYEAN)	X-ray diffractometry	Malvern Panalytical	Sakamoto	Miyake	Ishikawa	2 Hours
17	Micro XRF (M4 TORNADO PLUS)	X-ray fluorescence spectrometry	BRUKER	Sakamoto	Miyake	Ishikawa	1 Hour
18	Analytical FE-SEM (JSM-7001F)	High resolution surface morphology observation, Elemental analysis	JEOL	Murakami	Ishikawa	Hayakawa	2 Hours
19	On-site FE-SEM (JSM-7001F)	High resolution surface morphology observation, Elemental analysis, Crystal phase analysis	JEOL, etc.	Murakami	Ishikawa	Hayakawa	2 Hours
20	New Conventional SEM (SU3900)	Surface observation by secondary electron	Hitachi High-Tech	Iwata	Hayakawa	Ishikawa	1 Hour
21	FE-EPMA (JXA-8530F)	Trace elemental analysis	JEOL	Murakami	Koyama	Murakami	Half Day
22	FIB (JIB-4500)	Ion beam processing	JEOL	Sakamoto	Shimizu	Sakamoto	Half Day
23	Digital Microscope (KH-7700)	Observation at 35-2500x (3D observation is possible)	Hirox	Shimomura	Miyake	Shimizu	1 Hour
24	Atomic Absorption (Solar S4-AA)	Elemental analysis by absorption	Thermo Electron	Kohno	Kusanagi	Ishikawa Miyake	Half Day
25	ICP (Optima 2100DV)	Quantification of elements in solution	Perkin Elmer	Miyabayashi	Ishikawa Miyake	Ishikawa Miyake	Half Day

No.	Name (Model Number)	Use	Manufacture	Adviser	Main Staff	Sub Staff	Billing Unit
26	Simple AFM (VN-8010)	Surface observation of up to 200 µm square	KEYENCE	Iwata	Ishikawa	Ishikawa	1 Hour
27	XPS (AXIS ULTRA DLD)	Identification of surface atoms by photo-electron	SHIMADZU	Kawaguchi	Ishikawa	Miyake	Half Day
28	Ion Coater （SC-701AT）	Au coater for SEM	Sanyu Electron	Murakami	Ishikawa	Hayakawa	1 Hour
29	General Purpose AFM (SPI-3800)	Surface observation of up to 20 µm square	Seiko Instruments	Iwata	Miyake	Ishikawa	Half Day
30	UV-Vis Spectrophotometer （V-670）	Material identification using UV-Vis light	JASCO	Murakami	Takasawa	Miyake Hayakawa	2 Hours
31	Fluorescence Spectrophotometer （FP-8600, FP-8700）	Qualitative and quantitative analysis by fluorescence	JASCO	Kawai	Takasawa	Ishikawa	Half Day
32	Thermal Analysis （DTG-60A）	Measurement of heat resistance temperature and calorific value	SHIMADZU	Toda	Kusanagi	Ishikawa Miyake	Half Day
33	DSC (DSC-60Plus)	Differential scanning calorimetry	SHIMADZU	Neo	Kusanagi	Ishikawa Miyake	Half Day
34	Organic Trace Elemental Analysis (Flash EA)	Elemental analysis of organic trace elements	Thermo Electron	Toda	Kusanagi	Ishikawa Miyake	Half Day
35	Electrochemical Analysis System (HZ-Pro S4)	AC impedance cyclic voltammetry	HOKUTO DENKO	Murakami	Kusanagi	Murakami	Half Day
36	Battery Charge / Discharge System (HJ1001SD8)	Charging / discharging characteristics evaluation	HOKUTO DENKO	Murakami	Kusanagi	Miyake	Half Day
37	Zeta Potential Analyzer (Zetasizer Ultra)	Zeta potential and particle size measurements	Malvern Panalytical	Sakamoto	Hayakawa	Kusanagi	1 Hour
38	XRF （EDX-8000）	Elemental analysis	SHIMADZU	Murakami	Miyake	Hayakawa	1 Hour
39	ESCA (ESCA-3400)	Identification of surface atoms by photo-electron	SHIMADZU	Ishikawa	Ishikawa	Hayakawa	Half Day
40	W-SEM （JSM-6360LA）	Surface observation	JEOL	Ishikawa	Miyake	Shimizu	Half Day
41	XRD (RINT UltimaII)	X-ray diffractometry	Rigaku	Sakamoto	Koyama	Murakami	Half Day
42	Wide Area AFM (XE-70)	Surface observation of up to 45 µm square	Park Systems	Ishikawa	Miyake	Ishikawa	Half Day
43	Ion Slicer （EM-09100 IS）	Processing of specimens for TEM	JEOL	Sakamoto	Shimizu	Sakamoto	1 Hour
44	Solar Simulator (VK-SS-50, VK-IPCE-10)	Solar cell performance evaluation	SPD Laboratory, Inc.	Murakami	Shimizu	Ishikawa	Half Day
45	Handy Lapping Machine (HLA-2)	Sample polishing	JEOL	Sakamoto	Shimizu	Sakamoto	Half Day
46	Osmium Coater (Neoc-ST)	Osmium coating	meiwafosis	-	Shimizu	-	1 Hour
47	NMR (AvanceIII HD400)	Nuclear magnetic resonance	BRUKER	Tanaka Y	Hayakawa	Hirata	1 Hour
48	Mass sSpectrometer (micrOTOF)	Mass spectrometry	BRUKER	Sato	Hayakawa	Hirata	1 Hour
49	Circular Dichroism spectrometer (J-720)	Molecular circular dichroism measurements	JASCO	Tanaka Y	Hayakawa	Takasawa	Half Day
50	3D Printer （Bullulo200）	3D printer (Fused Deposition Modeling)	System-create	Ishikawa	Hayakawa	Shimizu	-

No. 1

Name	Thin Layer XRD
Model No.	RINT Ultima III
Manufacture	Rigaku
Location	Joint Research Laboratory 101
Adviser	Sakamoto Naonori
Staff	Koyama Tadanobu

Features

The X-ray diffraction (XRD) is the technique which characterizes lattice constants, crystal structures, crystallinity , crystallite sizes, orientations with X-ray diffraction, which is caused by an incident X-ray and periodic structure of the substance. This instrument is equipped with a sample stage for thin films, and optimized for characterizing the structure of thin films. In-plane measurement, which characterizes crystal planes parallel to the sample surface, can be taken. Of course, so can out-of-plane measurement, which characterizes crystal planes perpendicular to the sample surface.

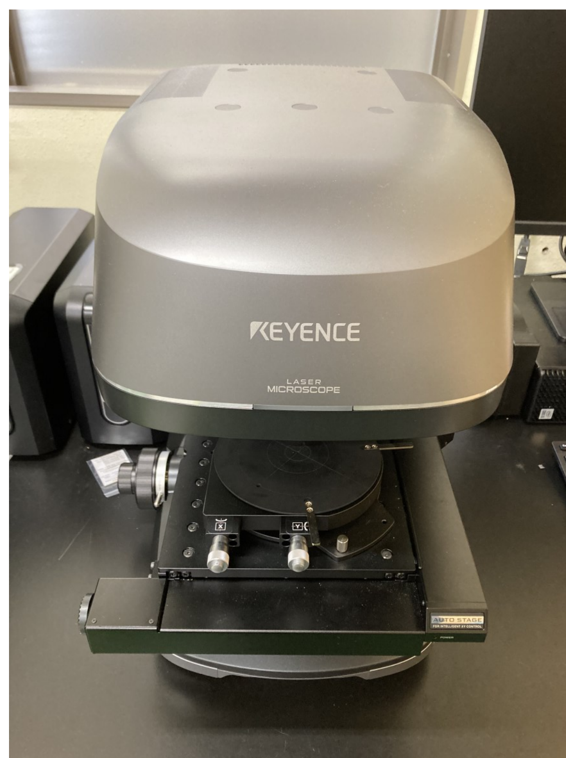
Incident X-ray	CuKα parallel beam collimated by multilayer mirror
Samples	thin films and powders
Measurement Method	profile measurement (Out-of-plane, In-plane) locking curve measurement
Miscellaneous	Database(PDXL) is introduced.

No. 2

Name	Laser Microscope
Model No.	VK-X3000
Manufacture	KEYENCE
Location	Joint Research Laboratory 101
Adviser	Ishikawa Makoto
Staff	Ishikawa Makoto

Features

The system can measure the surface topography of sample workpieces with nanometer-order height resolution using three different measurement methods: laser confocal, white interference and focus variation.



No. 3

Name	Shape Mesuring Instrument
Model No.	VR-3200
Manufacture	KEYENCE
Location	Joint Research Laboratory 101
Adviser	Ishikawa Makoto
Staff	Ishikawa Makoto

Features

Non-contact measurement of a wide range of 3D shapes.

No. 4

Name	Cross-section Polisher
Model No.	IB-09020 CP
Manufacture	JEOL
Location	Joint Research Laboratory 101
Adviser	Ishikawa Makoto
Staff	Koyama Tadanobu

Features

It's used to prepare a cross-sectional sample.

No. 5

Name	Ion Milling
Model No.	EM RES101
Manufacture	LEICA
Location	Joint Research Laboratory 101
Adviser	Murakami Kenji
Staff	Ishikawa Makoto

Features

It prepares TEM samples with ion beams.

No. 6

Name	Soft Etching
Manufacture	meiwafosis
Location	Joint Research Laboratory 101
Adviser	Murakami Kenji
Staff	Ishikawa Makoto

Features

It's used to remove a contamination layer on sample

No. 7

Name	Surface Area Analyzer
Model No.	TriStarII Plus
Manufacture	SHIMADZU
Location	Joint Research Laboratory 101
Adviser	Sakamoto Naonori
Staff	Hayakawa Toshihiro

Features

It can measure the specific surface area and pore distribution of solid and powder samples.

■spec

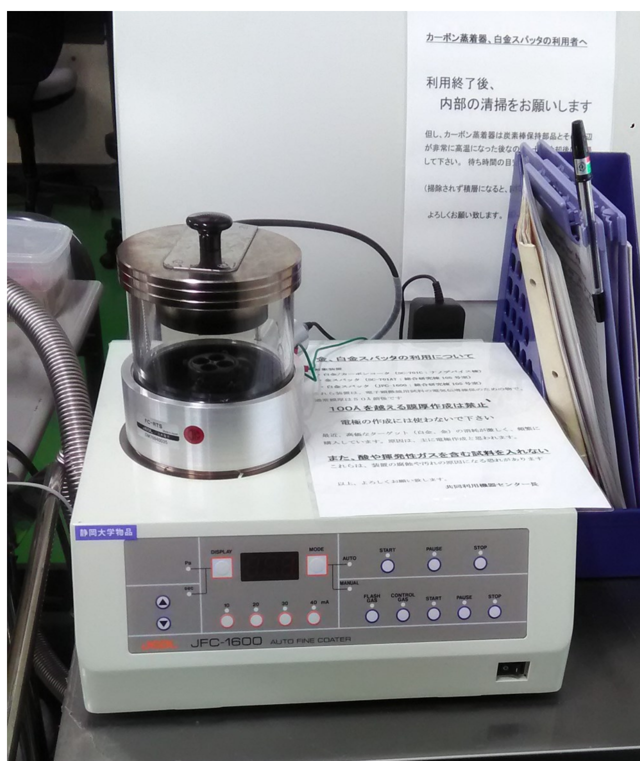
Adsorption gas	Nitrogen
Specific surface area range	0.01 m^2/g or more
Pore size range	1～100 nm

No. 8

Name	Pt Sputter
Model No.	JFC-1600
Manufacture	JEOL
Location	Joint Research Laboratory 101
Adviser	Ishikawa Makoto
Staff	Miyake Aki

Features

This is specimen coating device for SEM. You can use this machine to coat a non-conducting specimen with Pt.



No. 9

Name	HR FE-SEM
Model No.	SU8600
Manufacture	Hitachi High-Tech
Location	Joint Research Laboratory 101
Adviser	Suda Seiichi
Staff	Ishikawa Makoto

Features

Observation capabilities with high spatial resolution and diverse signal detection enable observation and analysis in a wide range of fields, from device and materials analysis to life sciences. A high-brightness cold FE electron gun and detection signal control function enable high-contrast images to be acquired with high resolution.

SE resolution	0.6nm@15kV, 0.7nm@1kV
Magnification	20~2,000,000 x
Electron gun	Cold cathode field emission electron gun
Acceleration voltage	0.5~30kV
Detector	Upper detector (UD), Lower detector (LD), Top detector (TD)
Sample size	Max. 150 mm dia.

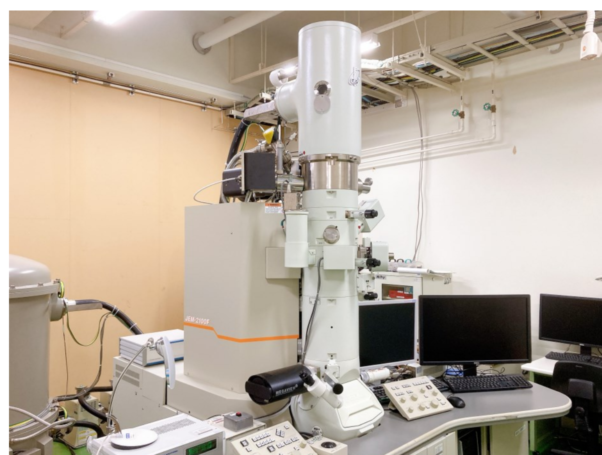
No. 10

Name	STEM
Model No.	JEM-2100F
Manufacture	JEOL
Location	Joint Research Laboratory 102
Adviser	Sakamoto Naonori
Staff	Shimizu Hikaru

Features

STEM is a transmission electron microscope equipped with a field-emission electron gun. It enables ultra-high resolution image observation and analysis at the nanoscale. A high-sensitivity scanning transmission imaging system (STEM) and an energy-dispersive X-ray analyzer (EDS) are incorporated to obtain various data efficiently and easily. It is also equipped with CCD cameras, which enables image observation on the monitor and saving of images in electronic file format.

Specifications	Resolution: 0.1 nm (lattice image) 0.23 nm (particle image) 0.2 nm (STEM image)
	Magnification: 50 ~ 6,000x (low) 2,000 ~ 1,500,000x (high)
Electron Gun	Thermal field-emission electron gun Accelerating voltage 200 kV
Type of Image	TEM image, STEM image, SE image, Electron diffraction pattern, etc.
EDS	Detectable elements: B - U Resolution: 138 eV
Analysis Function	*Qualitative analysis *Standardess quantitative analysis *High-speed X-ray mapping



No. 11

Name	Pt / Carbon Coater
Model No.	SC701C
Manufacture	Sanyu Electron
Location	Joint Research Laboratory 101
Adviser	Ishikawa Makoto
Staff	Ishikawa Makoto

Features

It forms carbon and platinum thin films on the surface of non-conductive samples for SEM observation.

No. 12

Name	GD-OES
Model No.	GDA750
Manufacture	Rigaku, Spectruma
Location	Joint Research Laboratory 102
Adviser	Kikuchi Shoichi
Staff	Ishikawa Makoto

Features

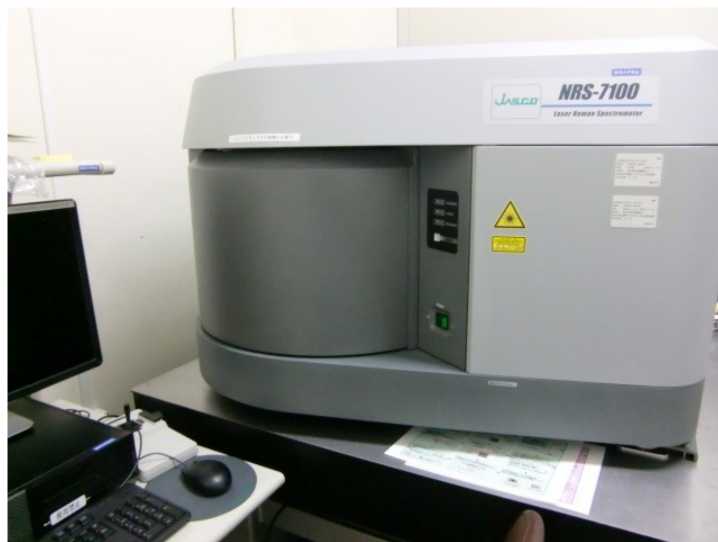
By cathoding the sample, the sample itself is sputtered and the luminescence phenomenon associated with the energy change is used for measurement. Bulk and depth profile measurements are possible. Not only intensity and time calculations, but also concentration and depth calculations (calibration required).

No. 13

Name	Raman Spectroscopy
Model No.	NRS-7100
Manufacture	JASCO
Location	Joint Research Laboratory 103
Adviser	Ishikawa Makoto
Staff	Takasawa Taishi

Features

This is the laser Raman microspectrograph with 4 lasers of wavelength 325, 532, 785 and 1064 nm and a fast mapping function. Accessories include stretching, cooling and heating stages.



Measuring Wavenumber Range	50～8000 cm^{-1}
Max Resolution	0.7 cm^{-1} / pixel (excitation at 532 nm)

No. 14

Name	FT-IR
Model No.	FT/IR-6300, IRT-7000
Manufacture	JASCO
Location	Joint Research Laboratory 103
Adviser	Ishikawa Makoto
Staff	Takasawa Taishi

Features

FT-IR is an instrument for measuring the infrared absorption spectrum of a substance and evaluating its substructure (e.g. functional groups) and compositions. Both micro- and macro- measurements are possible. It is equipped with a mapping function.

No. 15

Name	Powder XRD
Model No.	RINT2200
Manufacture	Rigaku
Location	Joint Research Laboratory 103
Adviser	Okuya Masayuki
Staff	Miyake Aki

Features

This is a X-ray diffractometer for powder samples. The sample holder is a glass sample plate. For small sample quantities, a silicon non-reflective sample plate can also be used.

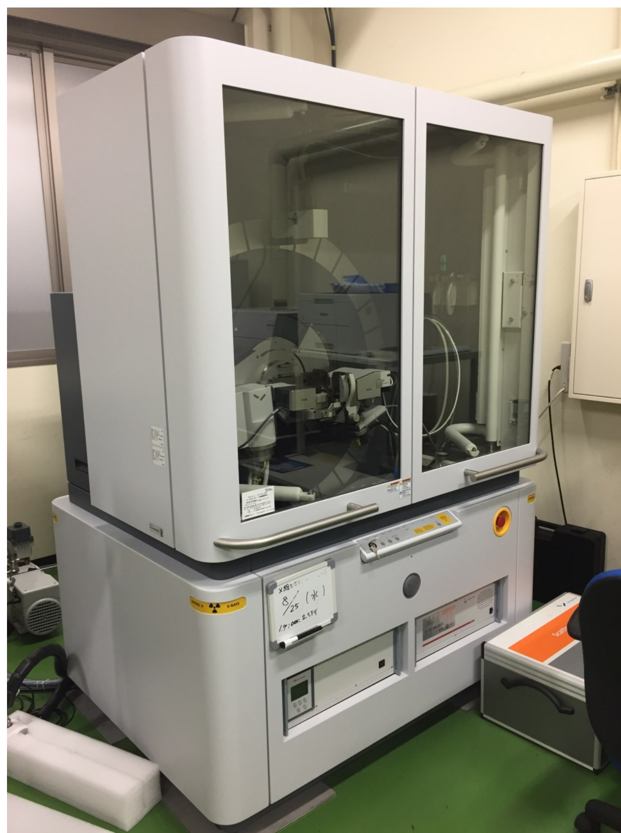
X-ray Tube	Cu
Optical System	focusing beam
Scan Mode	2θ/θ linked, θ, 2θ alone
Goniometer Radius	185 mm

No. 16

Name	Multi Function XRD
Model No.	EMPYREAN
Manufacture	Malvern Panalytical
Location	Joint Research Laboratory 103
Adviser	Sakamoto Naonori
Staff	Miyake Aki

Features

Multipurpose X-ray diffractometer for special use. It is adapted to many optional measurements, such as a thin film measurement, a residual stress measurement, a variable temperature measurement(-190℃ to 600℃).
You can use Cu or Cr as an anode target. A 2D solid-state hy-

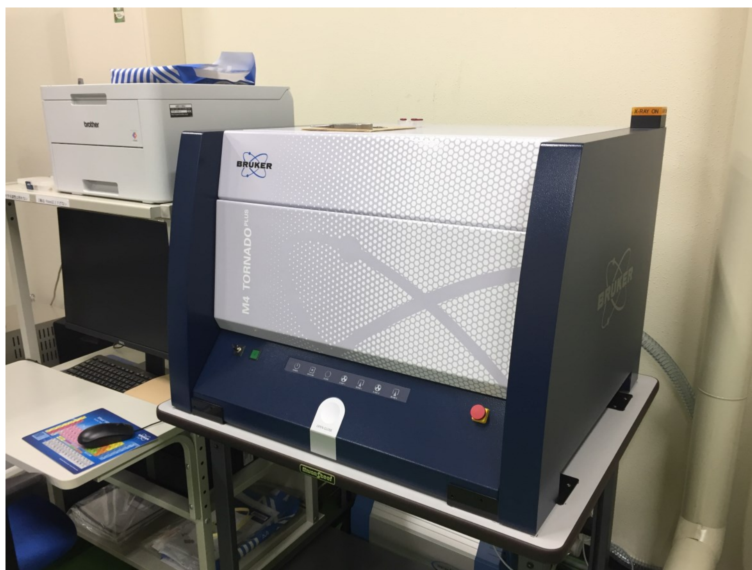


No. 17

Name	Micro XRF
Model No.	M4 TORNADO PLUS
Manufacture	BRUKER
Location	Joint Research Laboratory 103
Adviser	Sakamoto Naonori
Staff	Miyake Aki

Features

This is the Micro XRF for detection and analysis of all elements form C to Am. It uses 20 µm diameter X-rays and allows local analysis and elemental map-



No. 18

Name	Analysical FE-SEM
Model No.	JSM-7001F
Manufacture	JEOL
Location	Joint Research Laboratory 104
Adviser	Murakami Kenji
Staff	Ishikawa Makoto

Features

It is a scanning electron microscope equipped with a field-emission electron gun and an energy dispersive X-ray spectrometer. It enables not only high-resolution surface morphology observation in the low- and medium-voltage regions, but also elemental analysis of samples and orientation analysis of crystalline samples.

Specifications	Resolution: 1.2 nm (at 30kV), 3.0 nm (at 1 kV)
	Magnification: 10 - 1,000,000x
Sample	Max 150 mmφ, height limit 10 mm
Electron Gun	Cold field-emission electron gun Accelerating voltage 0.2 ~ 30 kV
Type of Image	SE image BSE image (COMPO image, TOPO image)
EDS	Resolution: 123 eV Detectable elements: Be - U

No. 19

Name	On-site FE-SEM
Model No.	JSM-7001F
Manufacture	JEOL, etc.
Location	Joint Research Laboratory 104
Adviser	Murakami Kenji
Staff	Ishikawa Makoto

Features

The field-emission electron gun enables observation at ultra-high magnification.
It also enables the high magnification observation at low voltage by using a TTL (Through The Lens) detector.

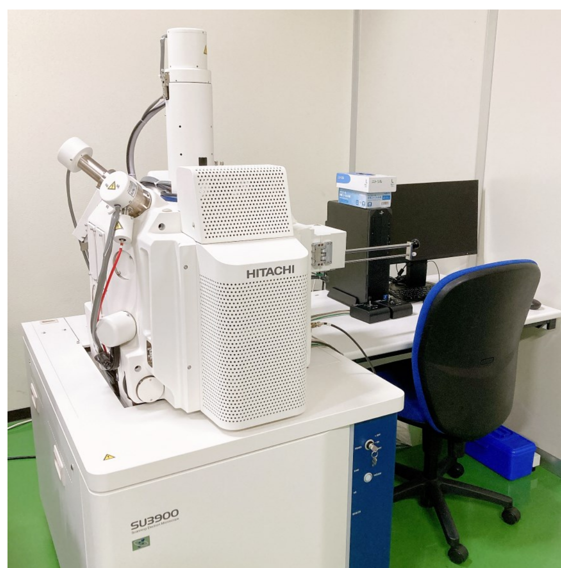
Magnification	SEI: 10 - 1,000,000x (under the best conditions)
Electron Gun	In-lens thermal FEG
Observation Mode	SE image, BSE image, TTL
Analysis	EDS (Energy Dispersive X-ray Spectroscopy) EBSD (Electron Backscatter Diffraction)

No. 20

Name	New Conventional SEM
Model No.	SU3900
Manufacture	Hitachi High-Tech
Location	Joint Research Laboratory 104
Adviser	Iwata Futoshi
Staff	Hayakawa Toshihiro

Features

A general-purpose SEM for the observation of large, heavy specimens, where everything from electron beam irradiation after specimen setting to image adjustment is automated, enabling SEM images to be acquired immediately after the start of observation.



Features	SE resolution: 3.0nm (Acc. voltage 30 kV, WD = 5 mm, high vacuum mode) BSE resolution: 4.0 nm (Acc. voltage 30 kV, WD = 5 mm, low vacuum mode) Magnification: 5 ~ 300,000 x
Electron optics	Electron gun: W hairpin filament Acceleration voltage: 0.3 kV ~ 30 kV
Stage	Max. sample size: 300mm dis. Max. observation range: 200mm dia. Max. mountable height: 130 mm

No. 21

Name	FE-EPMA
Model No.	JXA-8530F
Manufacture	JEOL
Location	Joint Research Laboratory 104
Adviser	Murakami Kenji
Staff	Koyama Tadanobu

Features

The FE-EPMA is an instrument which tells us which elements compose a substance, their composition ratios, and their distribution, by detecting characteristic X-rays derived by irradiated with a focused electron beam. Additionally, you can also obtain the surface shape with SE (secondary electron) images and BSE (backscattered electron) images.

Accelerating Voltage	1 - 30 kV (0.1 kV step)
Probe Current	1 x 10^{-11} - 5 x 10^{-7} A (25 kV)
X-ray Spectrometry Range	0.087 - 9.3 nm
Number of X-ray Spectrometers	Up to 5

No. 22

Name	FIB
Model No.	JIB-4500
Manufacture	JEOL
Location	Joint Research Laboratory 104
Adviser	Sakamoto Naonori
Staff	Shimizu Hikaru

Features

FIB enables microfabrication at the nanoscale by irradiating a sample with a convergent Ga ion beam and stripping away atoms from a sample surface. It is also used to cut out samples for STEM. In addition to an ion gun for FIB, this system is also equipped with an electron gun for SEM and an EDS detector, allowing surface morphology observation and elemental analysis to be performed simultaneously with microfabrication.

Specifications of FIB Part	Ion source: Ga liquid metal ion source Accelerating voltage: 1 - 30 kV Magnification: 100 ~ 300,000x Imaging resolution: 5nm (at 30 kV) Beam current: 0.5 pA - 30 nA (at 30 kV)
Specifications of SEM Part	Accelerating voltage: 0.3 - 30 kV Magnification: 5 - 300,000x Imaging resolution: 2.5nm (at 30 kV)

No. 23

Name	Digital Microscope
Model No.	KH-7700
Manufacture	Hirox
Location	Joint Research Laboratory 104
Adviser	Ishikawa Makoto
Staff	Miyake Aki

Features

This is the digital microscope which enables 35 - 2500x and 3D observation. You can conduct observation, measurement and recording smoothly. Not only 2D measurement and image processing, but also depth synthesis, 3D image construction and image linking can be done.

Specifications	35 - 2500x observation can be done
	2D / 3D observation

No. 24

Name	Atomic Absorption
Model No.	Solar S4-AA
Manufacture	Thermo Electron
Location	Joint Research Laboratory 104
Adviser	Kohno Yoshiumi
Staff	Kusanagi Hiroki

Features

Sample solutions are sprayed into the flame and target elements are converted into atomic vapors. When the sample is irradiated with light of a wavelength specific to the target element, the ground state atom absorbs the light and transitions to an excited state. The concentration of the target element can be determined from the absorption of this light (=absorbance).

No. 25

Name	ICP-OES
Model No.	Optima 2100DV
Manufacture	PerkinElmer
Location	Joint Research Laboratory 104
Adviser	Miyabayashi Keiko
Staff	Ishikawa Makoto / Miyake Aki

Features

It allows quantitative analysis of trace elements (ppb to ppm order) in aqueous solutions. Atomised liquid samples are introduced into the plasma and the emission observed in the plasma is spectroscopically analysed for each element using a spectrometer for qualitative and quantitative analysis of the elements. Around 70 elements, mainly metallic elements, can be analysed.

Specifications	Analysable elements: Most of elements except H, O and F
	Sequential type

No.26

Name	Simple AFM
Model No.	VN-8010
Manufacture	KEYENCE
Location	Joint Research Laboratory 104
Adviser	Iwata Futoshi
Staff	Ishikawa Makoto

Features

It enables to observe the nano-region by selecting from optical microscope image by mouse operation. You can specify the AFM measurement area with nanometer precision because the positioning can be done under the optical microscope. From the AFM data obtained, it is possible to analyse the surface

Specifications AFM Part	XY direction: 200 nm - 200 µm, Z direction: ± 10 µm
	Scanner: Voice Coil Motor (VCM) using Vertical resolution: 0.3 nm
	Self-sensing system, Contact / DFM / SS
Specifications Optical Microscope Part	Magnification: 250 - 1250x
	Observation range: 1000(H) x 750(V) µm - 200(H) x 150(V) µm
	motorised zoom, motorised focus, motorised lighting aperture

No. 27

Name	XPS
Model No.	AXIS ULTRA DLD
Manufacture	SHIMADZU
Location	Joint Research Laboratory 104
Adviser	Kawaguchi Takahiko
Staff	Ishikawa Makoto

Features

In an ultra-high vacuum, the sample is irradiated with X-rays from the anode (Al, Mg) and the energy of the knocked-out electrons (photoelectrons) is measured to determine the type and bonding state of the atoms at the top surface of the sample (within a few nm). Mapping and depth analysis with the cluster ion gun are also possible. The Al ion gun is equipped with a monochromator. It also has a neutralisation gun to avoid sample charging.

No. 28

Name	Ion Coater
Model No.	SC-701AC
Manufacture	Sanyu Electron
Location	Joint Research Laboratory 104
Adviser	Murakami Kenji
Staff	Ishikawa Makoto

Features

It applies a thin coating of Au onto a non-conducting specimen for SEM observation.
The Au coating films typically have a thickness range

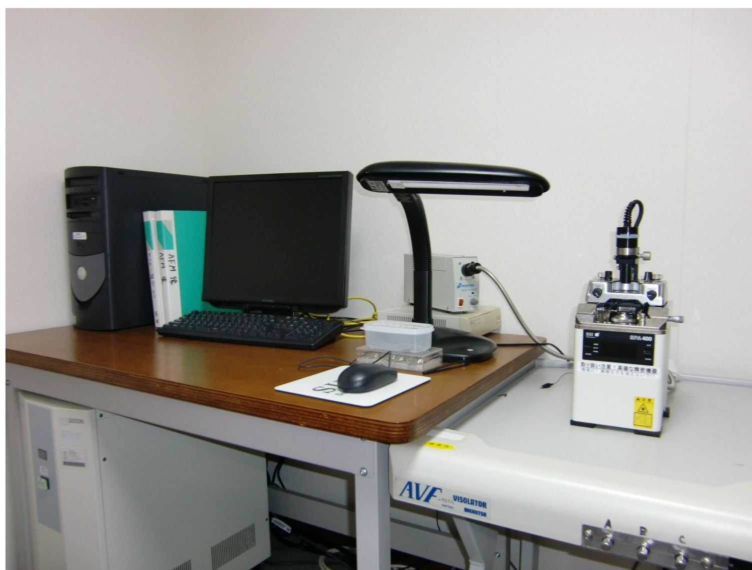
Specifications	The discharge gas : Air
	Standard ion current : 5 mA

No. 29

Name	General Purpose AFM
Model No.	SPI-3800
Manufacture	Seiko Instruments
Location	Joint Research Laboratory 304
Adviser	Iwata Futoshi
Staff	Miyake Aki

Features

A probe (cantilever) scans a few nm away from the surface of the sample to measure sample shape. The resolution in the height direction is so high that steps of a single atomic layer can be observed.



Detection	Optical lever
Measurement Modes	AFM (contact mode) DFM (tapping mode)
Scan Range	X, Y = 20 μm, Z = 1.5 μm

No. 30

Name	UV-Vis Spectrophotometer
Model No.	V-670
Manufacture	JASCO
Location	Joint Research Laboratory 304
Adviser	Murakami Kenji
Staff	Takasawa Taishi

Features

This is an UV-VIS-NIR spectrophotometer. Measurements from 190 - 3200 nm are possible. An automatic absolute reflectance measuring device is also equipped.

No. 31

Name	Fluorescence Spectrophotometer
Model No.	FP-8600, FP-8700
Manufacture	JASCO
Location	Joint Research Laboratory 304
Adviser	Kawai Hideki
Staff	Takasawa Taishi

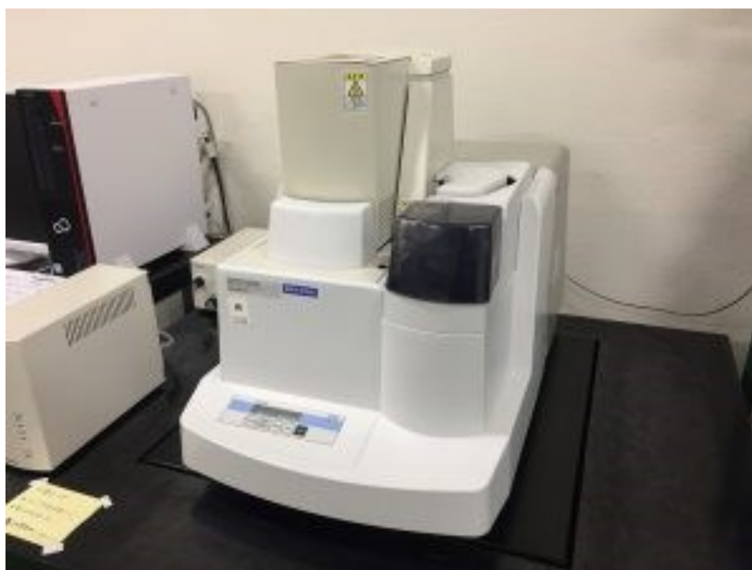
Features

It is an instrument for qualitative and quantitative analysis using fluorescence.

Specifications	Light source: 150W, shielded house xenon lamp
	Sensitivity: S/N > 150 (P-P), S/N > 600 (RMS)
Measuring Wavenumber Range	200 - 850 nm (ex) and zeroth-order light 100 - 1010 nm (em) and zeroth-order light
Band Width	1, 2.5, 5, 10, 20, L5, L10 nm (ex) 2, 5, 10, 20, 40, L5, L10, L20 nm (em)
Wavelength Scanning Speed	10～60000 nm/min (ex) 20～120000 nm/min (em)
Resolution (at 546.1 nm)	1.0 nm (ex), 2.0 nm (em)

No. 32

Name	Thermal Analysis (TG-DTA)
Model No.	DTG-60A
Manufacture	SHIMADZU
Location	Joint Research Laboratory 1304
Adviser	Toda Mitsuo
Staff	Kusanagi Hiroki



Features

Thermal analysis is a method of measuring the properties of a substance as a function of temperature or time while changing the temperature of the substance according to a set program. This machine can measure thermo gravimetry (TG) and differential thermal analysis (DTA) simultaneously. TG data indicate the amount of components changed from the sample. DTA data show the transition temperature of the sample and whether it is an exothermic or endothermic phenomenon.

Measuring temperature range	room temperature～1000°C
Measuring range (TG)	±500mg
Measuring range (DTA)	±1～±1000μV

No. 33

Name	DSC
Model No.	DSC-60Plus
Manufacture	SHIMADZU
Location	Joint Research Laboratory 304
Adviser	Neo Yoichiro
Staff	Kusanagi Hiroki

Features

By detecting the heat flow difference between a reference material and a sample, Differential Scanning Calorimetry (DSC) obtain a DSC signal with the vertical axis being the calorific value (mW), which can be used to determine the temperature (melting point, glass transition temperature) and calorific value (reaction energy) of endothermic and exothermic reactions of the material. It is also equipped with optional software for specific heat analysis. The DSC measurement has the additional measurement requirement of a temperature range at which the sample does not decompose.

Measuring temperature range	-140°C～600°C
Heat flow sensing range	±150mW

No. 34

Name	Organic Trace Elemental Analysis
Model No.	Flash EA
Manufacture	Thermo Electron
Location	Joint Research Laboratory 304
Adviser	Toda Mitsuo
Staff	Kusanagi Hiroki

Features

It can determine the proportions of C, H, N and S components in organic compounds. Sample is combustion-cracked and oxidised at temperatures above 900°C and in an oxygen atmosphere. Then the combustion gases are reduced and become CO2, H2, N2 and SO2 at last. They are passed through a separation column to separate the peaks and determined the content of each component.

Analytical principle	Gas chromatography
Combustion method	Dynamic flash-burning method
Analyte	CHNS
Detection limits	Less than 1μg

No. 35

Name	Electrochemical Analysis System
Model No.	HZ-Pro S4
Manufacture	HOKUTO DENKO
Location	Joint Research Laboratory 304
Adviser	Murakami Kenji
Staff	Kusanagi Hiroki

Features

HZ-Pro is a modular multi-channel electrochemical analysis system for all electrochemical measurements, including battery evaluation tests, corrosion tests and analytical tests. The most commonly used measurement methods in our center are chronoamperometry (CA), cyclic voltammetry (CV), constant potential AC impedance (IMP) and TAFEL extrapolation (TAFEL). Charge and discharge measurements (CDC) are also possible.

Maximum output current	±500mA
Control voltage	±10V
Current detection range	±500mA～±50nA
Measuring frequency range	10μHz～1MHz

No. 36

Name	Battery Charge / Discharge System
Model No.	HJ1001SD8
Manufacture	HOKUTO DENKO
Location	Joint Research Laboratory 304
Adviser	Murakami Kenji
Staff	Kusanagi Hiroki

Features

This system automatically performs 'charging' and 'discharging' to evaluate battery performance, and is suitable for a wide range of measurements, from basic battery research and development to life and evaluation tests. The independent format of each channel allows individual condition settings. It can also be used for long-term measurements of up to 100 days.

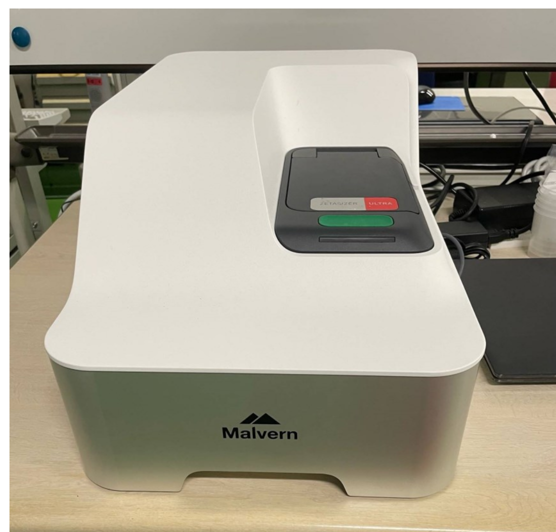
Channel	8 channels, Independent format, extensible
Voltage range	10V
Current range	1A～100μA、AUTO
Control mode	Constant current (CC), constant current/ constant voltage (CC/CV), etc.

No. 37

Name	Zeta Potential Analyzer
Model No.	Zetasizer Ultra
Manufacture	Malvern Panalytical
Location	Joint Research Laboratory 304
Adviser	Sakamoto Naonori
Staff	Hayakawa Toshihiro

Features

The particle size and zeta potential of particles dispersed in solution can be measured



■particle size

Measuring principles	Non-Invasive Back-Scatter (NIBS), Dynamic light scattering (90 and 13 degree), Multi-Angle Dynamic Light Scattering (MADLS)
Measuring angle	173, 13, 90 degree
Measuring range	Diameter: 0.3 nm～15 µm
Concentration range	Min: 0.1 mg/mL (15 kDa protein) Max: 40 %w/v

■zeta potential

Measuring principle	Combination of mixed-mode measurement methods and light scattering phase analysis.
Size range	3.8 nm～100 µm
Concentration range	1 mg/mL～40 %w/v
Sample conductivity range	Max: 260 mS/cm

No. 38

Name	XRF
Model No.	EDX-8000
Manufacture	SHIMADZU
Location	Joint Research Laboratory 304
Adviser	Murakami Kenji
Staff	Miyake Aki

Features

It is an Energy dispersive X-ray fluorescence analyser (EDX-XRF). It can also measure light elements by evacuating its sample chamber. Not only for the qualitative and quantitative determination of elements in samples, but also for the measurement of plating thickness.

Detectable Elements	Vacuum mode: C ~ U Atmosphere: Al ~ U

No. 39

Name	ESCA
Model No.	ESCA-3400
Manufacture	SHIMADZU
Location	Joint Research Laboratory 304
Adviser	Ishikawa Makoto
Staff	Ishikawa Makoto

Features

ESCA (Electron Spectroscopy for Chemical Analysis), which is also known as XPS, is an effective method to analyse elements in the very surface layer of solids 5 to 50 Å. This is the way to determine the binding energy of core electrons on a solid surfaces based on the measurement of the kinetic energy of photoelectrons emitted by soft X-ray irradiation.

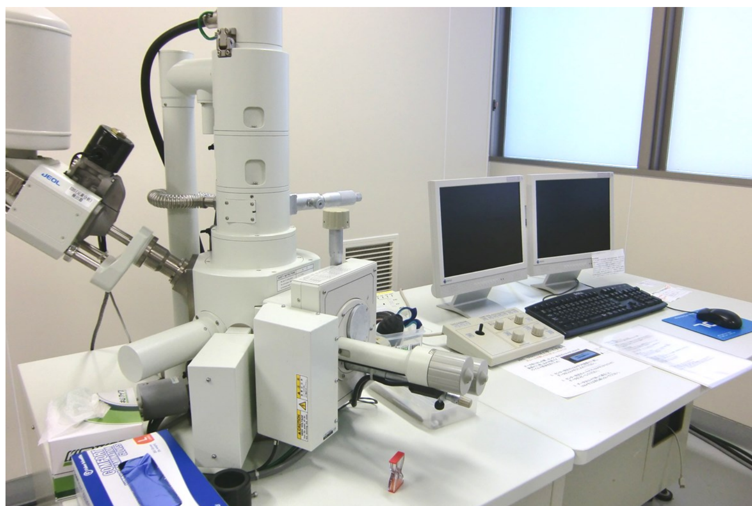
Specifica-tions	Sensitivity: 700000 cps at half-width 1.15 eV in Ag 3d 5/2 (Mg 300 W equivalent)
	Resolution: FWHM 0.8 eV at Mo 3d 5/2
Sample	Max 10 mmφ, Thickness 5 mm, Max 10 loading possible
X-ray Gun	Conical type, Anode Mg, Voltage 0 - 12 kV
Analyser	Retarding field analyser, Pass energy 25, 75, 150 eV
Energy	Scanning -10 - 1150 eV (Mg), Accuracy ±0.2 eV

No. 40

Name	W-SEM
Model No.	JSM-6360LA
Manufacture	JEOL
Location	Joint Research Laboratory 1010
Adviser	Ishikawa Makoto
Staff	Miyake Aki

Features

It is a general-purpose SEM. Its filament is tungsten (W). Observation at magnifications of up to 10,000x is possible. Low vacuum mode is equipped.



Specifications	Resolution: 3.0 nm (at High Vacuum Mode and 30 kV) 4.0 nm (at Low Vacuum Mode and 30 kV)
	Magnification: 5 - 300,000x (5x possible)
Sample	Max 32 mmφ
Electron Gun	Accelerating voltage: 0.5 -30 kV
Type of Image	SE image (HV mode), BSE image (LV mode)
Sample Exchange	Stage draw out type

No. 41

Name	XRD
Model No.	RINT Ultima II
Manufacture	Rigaku
Location	Joint Research Laboratory 1010
Adviser	Sakamoto Naonori
Staff	Koyama Tadanobu

Features

This is a previous model of the Thin Layer XRD (No.N1), which is optimized for thin film analysis. It can measure as well as No.N1.

No. 42

Name	Wide Area AFM
Model No.	XE-70
Manufacture	Park Systems
Location	Research Institute of Electronics 243
Adviser	Ishikawa Makoto
Staff	Miyake Aki

Features

This is the Atomic Force Microscope (AFM), which allows even beginners to make high magnification and high quality observations. The included optical microscope allows direct observation of the sample surface from above with the cantilever attached, making it highly accessible and extremely easy to adjust the optical path. True non-contact observation is possible because of the mechanical independence of the XY and Z scans and the high response frequency of the wide-area Z-axis drive (liner movement mechanism).

Specifications	Horizontal resolution: less than 1.5 nm Vertical resolution: less than 0.05 nm
	Z-axis coarse resolution: 0.08 µm (stroke: 27.5 mm)
Sample	Max 100 mm x 100mm x T 20 mm
Scanning Range	Max 50 µm x 50 µm x 12 µm
Optical Microscope	XGA 1024 x 768 pixel CCD (flame max 20 Hz)
Field of View	480 µm x 360 µm

No. 43

Name	Ion Slicer
Model No.	EM-09100 IS
Manufacture	JEOL
Location	Research Institute of Electronics 243
Adviser	Sakamoto Naonori
Staff	Shimizu Hikaru

Features

This is a thin film sample preparation equipment. It irradiate the masking belt set on the sample surface with an ion beam to form a thin area.

No. 44

Name	Solar Simulator
Model No.	VK-SS-50, VK-IPCE-10
Manufacture	SPD Laboratory, Inc.
Location	Research Institute of Electronics 243
Adviser	Murakami Kenji
Staff	Shimizu Hikaru

Features

This device measures the I-V characteristics, etc. of solar cells by exposing them to LED-simulated sunlight.
In addition, IPCE characteristics can be measured.

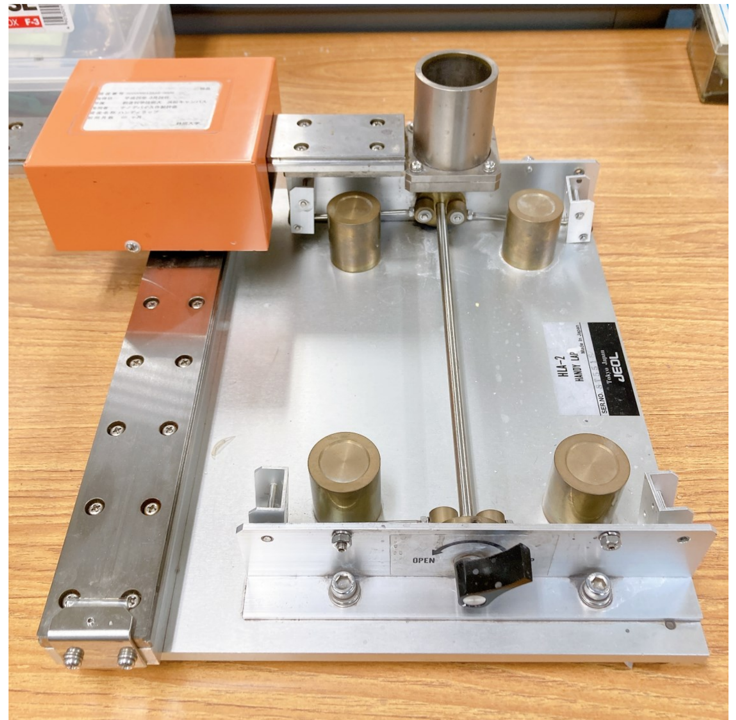
Light source	22 LEDs (70mW/cm^2, 0.01SUN～1SUN)
Exposure area	50mm×50mm
Spectral response measuring instrument	Constant energy or constant photon irradiation (10mm×10mm), 100μW
Measurements	I-V measurement (±10V, ±1A(1pA possible)), optimum operating point, maximum output operating voltage, maximum output operating current, open circuit voltage, short circuit current, curve factor, conversion efficiency, maximum power point tracking (MPPT) function, IPCE measurement, spectral response (A/W) (350nm～1000nm)

No. 45

Name	Handy Lapping Machine
Model No.	HLA-2
Manufacture	JEOL
Location	Research Institute of Electronics 243
Adviser	Sakamoto Naonori
Staff	Shimizu Hikaru

Features

Sample polishing



No. 46

Name	Osmium Coater
Model No.	Neoc-ST
Manufacture	meiwafosis
Location	Research Institute of Electronics 243
Staff	Shimizu Hikaru

Features

Osmium metal film is deposited by a CVD deposition method in which osmium tetroxide sublimation gas is introduced into the vacuum chamber and plas-

No. 47

Name	NMR
Model No.	Avance III HD400
Manufacture	BRUKER
Location	Innovation and Social Collaboration Building 208
Adviser	Tanaka Yasutaka
Staff	Hayakawa Toshihiro

Features

Nuclear Magnetic Resonance

No. 48

Name	Mass sSpectrometer
Model No.	micrOTOF
Manufacture	BRUKER
Location	Innovation and Social Collaboration Building 208
Adviser	Sato Kohei
Staff	Hayakawa Toshihiro

Features

Mass Spectrometer

No. 49

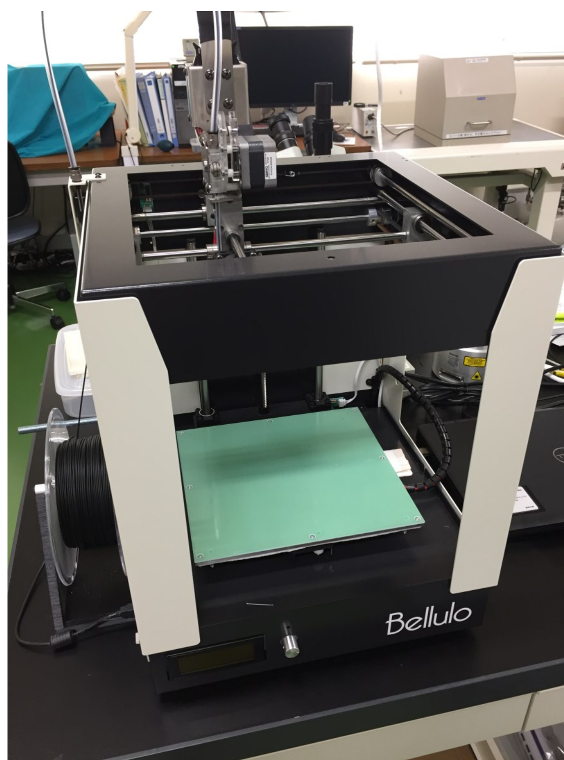
Name	Circular Dichroism spectrometer
Model No.	J-720
Manufacture	JASCO
Location	Innovation and Social Collaboration Building 208
Adviser	Tanaka Yasutaka
Staff	Hayakawa Toshihiro

Features

Determination of stereo-chirality of optically active molecules and determination of the secondary structure of biopolymers such as proteins and nucleic acids can be carried out using samples in solution. Standard measuring wavelength: 165-900 nm.

No. 50

Name	3D Printer
Model No.	Bellulo200
Manufacture	Systemcreate
Location	Joint Research Laboratory 204
Adviser	Ishikawa Makoto
Staff	Hayakawa Toshihiro



Features

It is an FDM 3D printer. The filament types are PLA and ABS. A software "Simplify3D" attaches. You can start 3D printing soon by bringing your STL data.