

Instruments List (Joint Research Laboratory / Innovation and Social Collaboration Building)

No.	Name (Model Number)	Use	Manufacture	Adviser	Main Staff	Sub Staff	Location	Billing Unit
1	General Purpose AFM (SPI-3800)	Surface observation of up to 20 μm square	Seiko Instruments	Iwata	Miyake	Ishikawa	102	Half Day
2	Simple AFM (VN-8010)	Surface observation of up to 200 μm square	KEYENCE	Iwata	Ishikawa	Ishikawa	102	1 Hour
3	SPM (JSPM-5200)	Surface observation by AFM and STM	JEOL	Iwata	Ishikawa	Ishikawa	102	Half Day
4	Digital Microscope (KH-7700)	Observation at 35-2500x (3D observation is possible)	Hirox	Shimomura	Miyake	Shimizu	102	1 Hour
5	UV-Vis Spectrophotometer (V-670)	Material identification using UV-Vis light	JASCO	Murakami	Takasawa	Miyake Hayakawa	102	Half Day
6	Fluorescence Spectrophotometer (FP-8600, FP-8700)	Qualitative and quantitative analysis by fluorescence	JASCO	Kawai	Takasawa	Ishikawa	102	Half Day
7	Laser Microscope (VK-X3000)	Surface profile measurement	KEYENCE	Ishikawa	Ishikawa	Miyake	102	1 Hour
8	Micro XRF (M4 TORNADO PLUS)	X-ray fluorescence spectrometry	BRUKER	Sakamoto	Miyake	Ishikawa	103	1 Hour
9	Powder XRD (RINT2200)	Powder x-ray diffractometry	Rigaku	Okuya	Miyake	Ishikawa	103	Half Day
10	Multi Function XRD (EMPYEAN)	X-ray diffractometry	Malvern Panalytical	Sakamoto	Miyake	Ishikawa	103	2 Hours
11	Raman Spectroscopy (NRS-7100)	Material identification by visible light	JASCO	Ishikawa	Takasawa	Miyake Hayakawa	103	2 Hours
12	FT-IR (FT/IR-6300, IRT-7000)	Material identification by Infrared ray, Macro / Micro / Mapping measurement	JASCO	Ishikawa	Takasawa	Miyake Hayakawa	103	Half Day
13	ICP (Optima 2100DV)	Quantification of elements in solution	PerkinElmer	Miyabayashi	Ishikawa Miyake	Ishikawa Miyake	104	Half Day
14	Thermal Analysis (DTG-60A)	Measurement of heat resistance temperature and calorific value	SHIMADZU	Toda	Kusanagi	Ishikawa Miyake	104	Half Day
15	DSC (DSC-60Plus)	Differential scanning calorimetry	SHIMADZU	Neo	Kusanagi	Ishikawa Miyake	104	Half Day
16	Organic Trace Elemental Analysis (Flash EA)	Elemental analysis of organic trace elements	Thermo Electron	Toda	Kusanagi	Ishikawa Miyake	104	Half Day
17	Atomic Absorption (Solar S4-AA)	Elemental analysis by absorption	Thermo Electron	Kohno	Kusanagi	Ishikawa Miyake	104	Half Day
18	Electrochemical Analysis System (HZ-Pro S4)	AC impedance cyclic voltammetry	HOKUTO DENKO	Murakami	Kusanagi	Murakami	104	Half Day
19	Battery Charge / Discharge System (HJ1001SD8)	Charging / discharging characteristics evaluation	HOKUTO DENKO	Murakami	Kusanagi	Murakami	104	Half Day
20	Zeta Potential Analyzer (Zetasizer Ultra)	Zeta potential and particle size measurements	Malvern Panalytical	Sakamoto	Hayakawa	Kusanagi	104	1 Hour
21	XRF (EDX-8000)	Elemental analysis	SHIMADZU	Murakami	Miyake	Hayakawa	104	1 Hour
22	ESCA (ESCA-3400)	Identification of surface atoms by photoelectron	SHIMADZU	Ishikawa	Ishikawa	Hayakawa	104	
23	General Purpose SEM (S-3000N)	Surface observation by secondary electron	Hitachi High-Tech	Ishikawa	Hirata	Miyake	104	Half Day
24	Ion Coater (SC-701AT)	Au coater for SEM	Sanyu Electron	Murakami	Ishikawa	Hayakawa	104	1 Hour
25	Ion Milling (EM RES101)	Processing of specimens for TEM using ion beam	LEICA	Murakami	Ishikawa	Hayakawa	104	Half Day

No.	Name (Model Number)	Use	Manufacture	Adviser	Main Staff	Sub Staff	Location	Billing Unit
26	Soft Etching	Surface cleaning	meiwafosis	Murakami	Ishikawa	Miyake	104	1 Hour
27	Pt Sputter (JFC-1600)	Pt sputter for SEM	JEOL	Ishikawa	Miyake	Hayakawa	104	1 Hour
28	Cross-section Polisher (IB-09020 CP)	Cross-sectioning of samples	JEOL	Ishikawa	Koyama	Ishikawa	104	Half Day
29	On-site FE-SEM (JSM-7001F)	High resolution surface morphology observation, Elemental analysis, Crystal phase analysis	JEOL, etc.	Murakami	Ishikawa	Hayakawa	104	2 Hours
30	FE-EPMA (JXA-8530F)	Trace elemental analysis	JEOL	Murakami	Koyama	Murakami	104	Half Day
31	W-SEM (JSM-6360LA)	Surface observation	JEOL	Ishikawa	Miyake	Shimizu	10F	Half Day
32	XRD (RINT UltimaII)	X-ray diffractometry	Rigaku	Shimomura	Koyama	Murakami	10F	Half Day
33	NMR (AvanceIII HD400)	Nuclear magnetic resonance	BRUKER	Tanaka Y	Hayakawa	Hirata	Innov.	1 Hour
34	Mass sSpectrometer (micrOTOF)	Mass spectrometry	BRUKER	Tanaka Y	Hayakawa	Hirata	Innov.	1 Hour
35	Shape Mesuring Instrument (VR-3200)	Shape measurement	KEYENCE	Ishikawa	Ishikawa	Hayakawa	102	1 Hour
36	3D Printer (Bullulo200)	3D printer (Fused Deposition Modeling)	Systemcreate	Ishikawa	Hayakawa	Shimizu	101	

Instruments List (Center for Nanodevice Fabrication and Analysis)

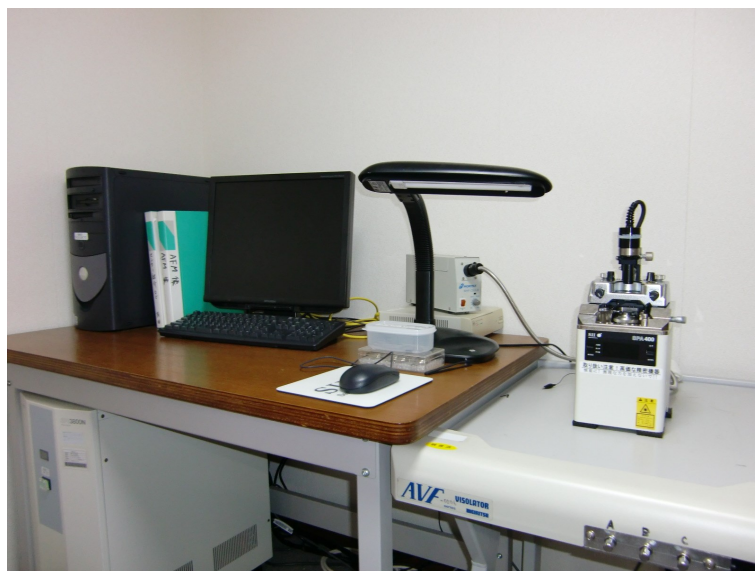
No.	Name (Model Number)	Use	Manufacture	Adviser	Main Staff	Sub Staff	Location	Billing Unit
N1	Thin Layer XRD (RINT Ultima III)	Powder and thin film x-ray diffraction	Rigaku	Shimomura	Koyama	Shimomura	Nano device	Half Day
N2	Pt / Carbon Coater (SC701C)	Coater for SEM	Sanyu Electron	Ishikawa	Ishikawa	Miyake	Nano device	1 Hour
N3	Wide Area AFM (XE-70)	Surface observation of up to 45 μm square	Park Systems	Ishikawa	Miyake	Ishikawa	Nano device	Half Day
N4	FE-SEM (JSM-6335F)	High resolution surface morphology observation	JEOL	Murakami	Ishikawa	Hayakawa	Nano device	1 Hour
N5	Analytical FE-SEM (JSM-7001F)	High resolution surface morphology observation, Elemental analysis	JEOL	Murakami	Ishikawa	Hayakawa	Nano device	2 Hours
N6	FIB (JIB-4500)	Ion beam processing	JEOL	Sakamoto	Shimizu	Sakamoto	Nano device	Half Day
N7	Ion Slicer (EM-09100 IS)	Processing of specimens for TEM	JEOL	Sakamoto	Shimizu	Sakamoto	Nano device	1 Hour
N8	XPS (AXIS ULTRA DLD)	Identification of surface atoms by photoelectron	SHIMADZU	Shimomura	Miyake	Ishikawa	Nano device	Half Day
N9	STEM (JEM-2100F)	Scanning transmission electron microscopy	JEOL	Sakamoto	Shimizu	Sakamoto	Nano device	Half Day
N10	Carbon Evaporator (JEC-560)	Carbon deposition machine for SEM	JEOL	Ishikawa	Miyake	Ishikawa	Nano device	1 Hour
N11	Solar Simulator (VK-SS-50, VK-IPCE-10)	Solar cell performance evaluation	SPD Laboratory, Inc.	Murakami	Shimizu	Ishikawa	Nano device	Half Day
N12	Surface Area Analyzer (TriStarII Plus)	Surface area and porosity analysis	SHIMADZU	Sakamoto	Hayakawa	Kusanagi	Nano device	Half Day

No.1

Name	General Purpose AFM
Model No.	SPI-3800
Manufacture	Seiko Instruments
Location	Joint Research Laboratory 102
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.2

Name	Simple AFM
Model No.	VN-8010
Manufacture	KEYENCE
Location	Joint Research Laboratory 102
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 roughness and the cross-sectional shape.



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 Micro- scope 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. 3

Name	SPM
Model No.	JSPM-5200
Manufacture	JEOL
Location	Joint Research Laboratory 102
Adviser	Iwata Futoshi
Staff	Ishikawa Makoto

Features

This is the Scanning Probe Microscope (SPM) which can measure not only the surface profile but also various physical quantities such as friction forces, viscosity, magnetic force, etc. And they can be visualised.



Specifications	Scan range: X, Y = max 10 μ m, Z = max 3 μ m
	Sample size: 10 mm x 10 mm x 3 mm (T)
	Measurement mode: AFM Contact mode AC mode Non-Contact mode (FM mode) STM mode (Topography image, Current image)
	Detection: Optical lever

No. 4

Name	Digital Microscope
Model No.	KH-7700
Manufacture	Hirox
Location	Joint Research Laboratory 102
Adviser	Shimomura Masaru
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. 5

Name	UV-Vis Spectrophotometer
Model No.	V-670
Manufacture	JASCO
Location	Joint Research Laboratory 102
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. 6

Name	Fluorescence Spectrophotometer
Model No.	FP-8600, FP-8700
Manufacture	JASCO
Location	Joint Research Laboratory 102
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. 7

Name	Laser Microscope
Model No.	VK-X3000
Manufacture	KEYENCE
Location	Joint Research Laboratory 102
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.

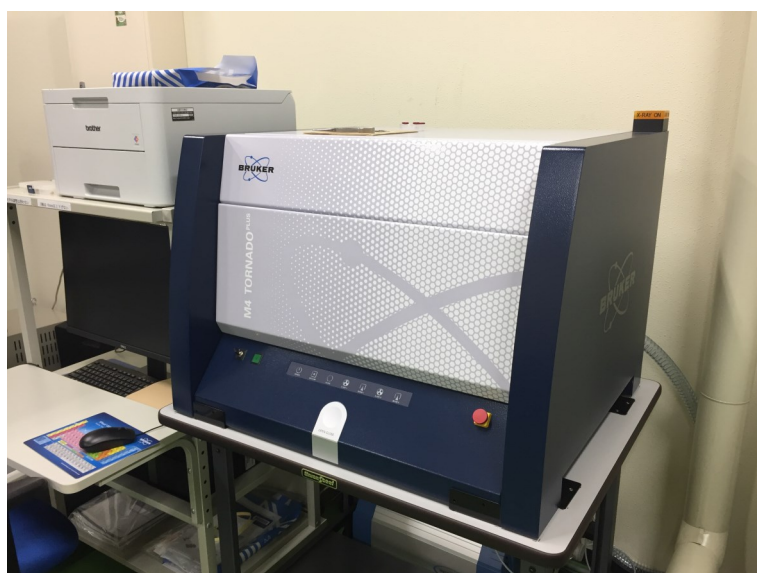


No. 8

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 from C to Am. It uses 20 μm diameter X-rays and allows local analysis and elemental map-



No. 9

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

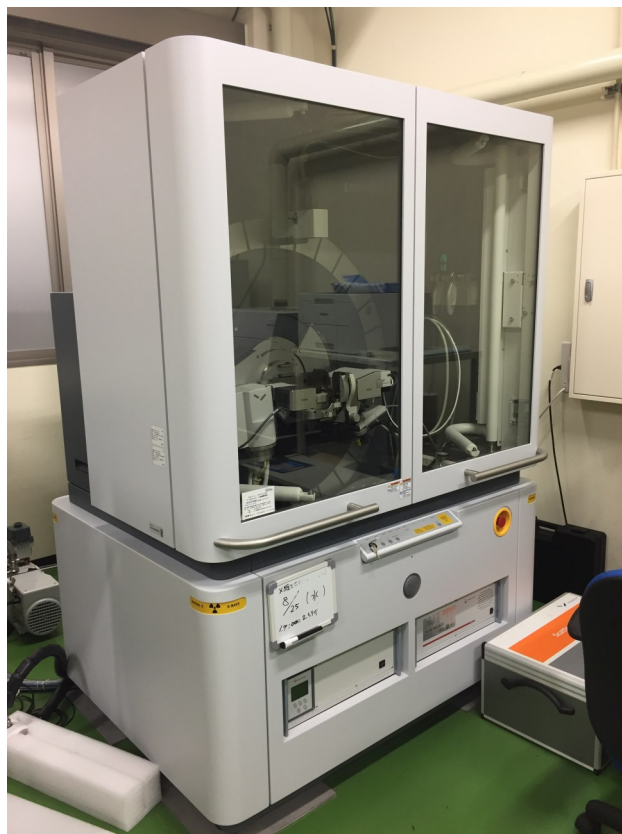
No. 10

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°C to 600°C).

You can use Cu or Cr as an anode target. A 2D solid-state hybrid pixel X-ray detector (PIXcel3D) is installed.

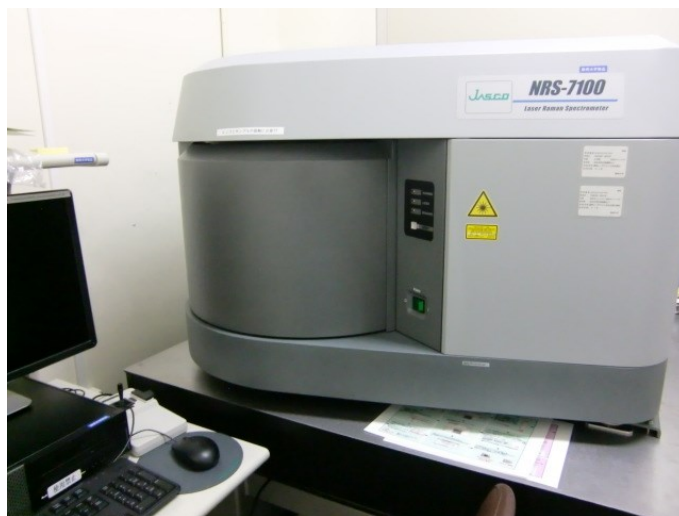


No. 11

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 (excitation at 532 nm, with standard rejection filter)
Max Resolution	0.7 cm ⁻¹ / pixel (excitation at 532 nm)

No. 12

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. 13

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.



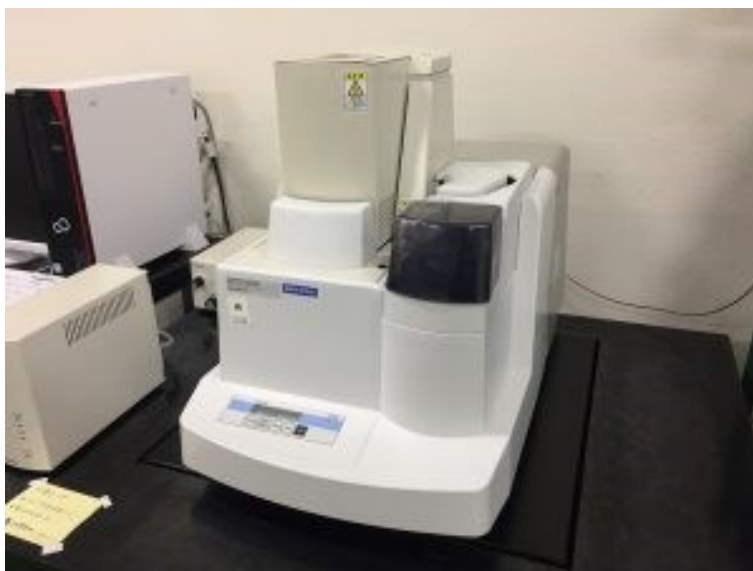
Specifications	Analysable elements:
	Sequential type

No. 14

Name	Thermal Analysis (TG-DTA)
Model No.	DTG-60A
Manufacture	SHIMADZU
Location	Joint Research Laboratory 104
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.



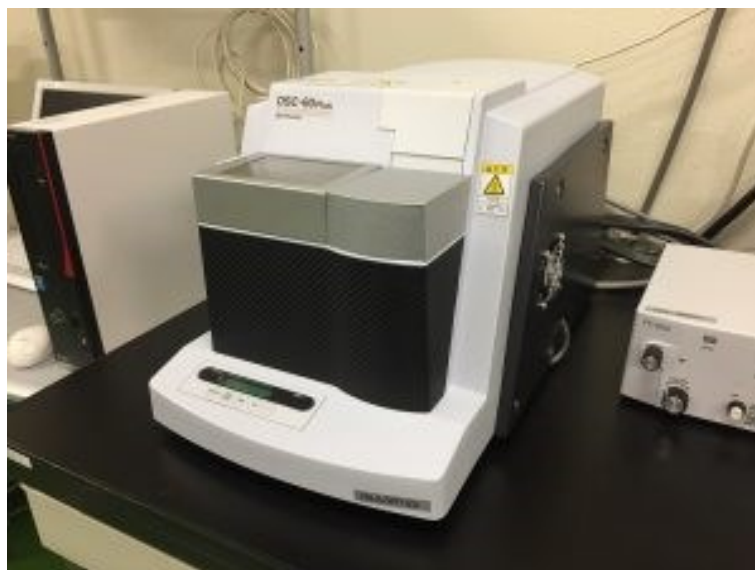
Measuring temperature range	room temperature~1000°C
Measuring range (TG)	± 500mg (minimum read: 0.001mg)
Measuring range (DTA)	± 1~ ± 1000μV

No. 15

Name	DSC
Model No.	DSC-60Plus
Manufacture	SHIMADZU
Location	Joint Research Laboratory 104
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. 16

Name	Organic Trace Elemental Analysis
Model No.	Flash EA
Manufacture	Thermo Electron
Location	Joint Research Laboratory 104
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. 17

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. 18

Name	Electrochemical Analysis System
Model No.	HZ-Pro S4
Manufacture	HOKUTO DENKO
Location	Joint Research Laboratory 104
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 AUTO
Measuring frequency range	10μHz ~ 1MHz

No. 19

Name Battery Charge / Discharge System

Model No. HJ1001SD8

Manufacture HOKUTO DENKO

Location Joint Research Laboratory 104

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. 20

Name Zeta Potential Analyzer

Model No. Zetasizer Ultra

Manufacture Malvern Panalytical

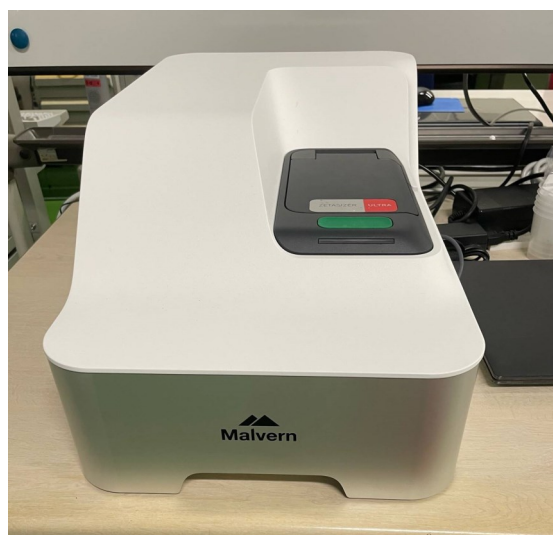
Location Joint Research Laboratory 104

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. 21

Name	XRF
Model No.	EDX-8000
Manufacture	SHIMADZU
Location	Joint Research Laboratory 104
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. 22

Name	ESCA
Model No.	ESCA-3400
Manufacture	SHIMADZU
Location	Joint Research Laboratory 104
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.



Specifications	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. 23

Name	General Purpose SEM
Model No.	S-3000N
Manufacture	Hitachi High-Tech
Location	Joint Research Laboratory 104
Adviser	Ishikawa Makoto
Staff	Hirata Hisashi

Features

It obtains images by irradiating with a scanning electron beam onto a sample in a high vacuum and detecting the ejected electrons. The secondary electron image is usually observed, but the backscattered electron image can also be observed, which is useful for observing non-conductive organisms. The use of a cool stage allows observation at low temperatures and reduces damage to the specimen caused by the heat generated by electron beam irradiation.



Specifications	Resolution: SE image 3.5 mm, BSE image 5.0 mm
	Magnification: 15 - 100,000x (depending on various parameters)
Electron Optical System	Filament: tungsten hairpin filament
	Accelerating voltage: 0.3 - 30 kV Probe current: 1^{-12} - 1^{-7} A
Stage	Movement range: horizontal move 32 x 32 mm, tilting $\pm 90^\circ$, rotation 360°
	Cool stage: temperature range - 20 to + 10 °C

No. 24

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 of 3 - 5 nm.



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

No. 25

Name	Ion Milling
Model No.	EM RES101
Manufacture	LEICA
Location	Joint Research Laboratory 104
Adviser	Murakami Kenji
Staff	Ishikawa Makoto

Features

It prepares TEM samples with ion beams.



No. 26

Name	Soft Etching
Manufacture	meiwafosis
Location	Joint Research Laboratory 104
Adviser	Murakami Kenji
Staff	Ishikawa Makoto

Features

It's used to remove a contamination layer on sample surface.



No. 27

Name	Pt Sputter
Model No.	JFC-1600
Manufacture	JEOL
Location	Joint Research Laboratory 104
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. 28

Name	Cross-section Polisher
Model No.	IB-09020 CP
Manufacture	JEOL
Location	Joint Research Laboratory 104
Adviser	Ishikawa Makoto
Staff	Koyama Tadanobu

Features

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



No. 29

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. 30

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	1×10^{-11} - 5×10^{-7} A (25 kV)
X-ray Spectrometry Range	0.087 - 9.3 nm
Number of X-ray Spectrometers	Up to 5

No. 31

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. 32

Name	XRD
Model No.	RINT Ultima II
Manufacture	Rigaku
Location	Joint Research Laboratory 1010
Adviser	Shimomura Masaru
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. 33

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. 34

Name	Mass sSpectrometer
Model No.	microTOF
Manufacture	BRUKER
Location	Innovation and Social Collaboration Building 208
Adviser	Tanaka Yasutaka
Staff	Hayakawa Toshihiro
Features	Mass Spectrometer



No. 35

Name	Shape Mesuring Instrument
Model No.	VR-3200
Manufacture	KEYENCE
Location	Joint Research Laboratory 102
Adviser	Ishikawa Makoto
Staff	Ishikawa Makoto

Features

Non-contact measurement of a wide range of 3D

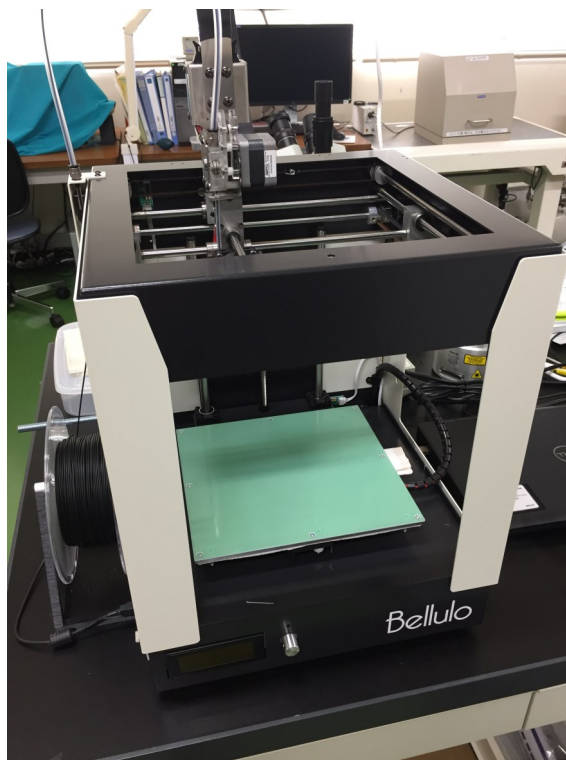


No. 36

Name	3D Printer
Model No.	Bellulo200
Manufacture	Systemcreate
Location	Joint Research Laboratory 101
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.



No. N1	
Name	Thin Layer XRD
Model No.	RINT Ultima III
Manufacture	Rigaku
Location	Center for Nanodevice Fabrication and Analysis
Adviser	Shimomura Masaru
Staff	Koyama Tadanobu

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

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.



No. N2	
Name	Pt / Carbon Coater
Model No.	SC701C
Manufacture	Sanyu Electron
Location	Center for Nanodevice Fabrication and Analysis
Adviser	Ishikawa Makoto
Staff	Ishikawa Makoto

Features

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

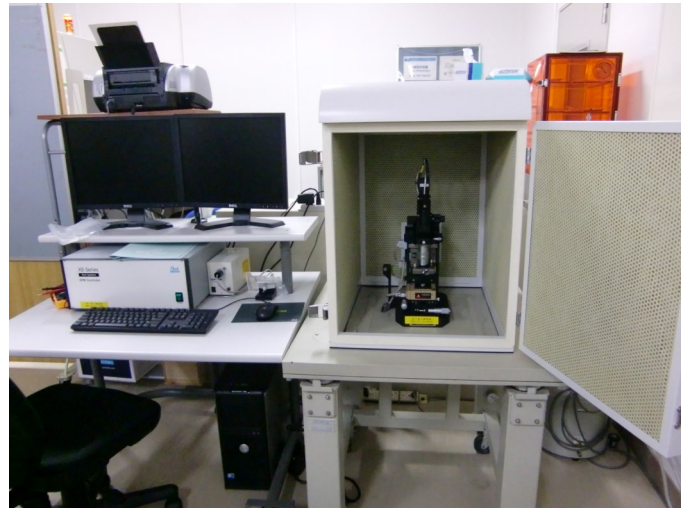


No. N3

Name	Wide Area AFM
Model No.	XE-70
Manufacture	Park Systems
Location	Center for Nanodevice Fabrication and Analysis
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 (frame max 20 Hz)
Field of View	480 μm x 360 μm

No. N4

Name	FE-SEM
Model No.	JSM-6335F
Manufacture	JEOL
Location	Center for Nanodevice Fabrication and Analysis
Adviser	Murakami Kenji
Staff	Ishikawa Makoto

Features

It is a scanning electron microscope equipped with a field-emission electron gun. It is also equipped with an optional electron beam lithography system, which can be used for microfabrication and creation of nano-machines.



Electron Gun	Field-emission electron gun Accelerating voltage: up to 30 kV
Remarks	Equipped with electron beam lithography system

No. N5

Name	Analysical FE-SEM
Model No.	JSM-7001F
Manufacture	JEOL
Location	Center for Nanodevice Fabrication and Analysis
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. N6

Name	FIB
Model No.	JIB-4500
Manufacture	JEOL
Location	Center for Nanodevice Fabrication and Analysis
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. N7

Name	Ion Slicer
Model No.	EM-09100 IS
Manufacture	JEOL
Location	Center for Nanodevice Fabrication and Analysis
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. N8

Name	XPS/SIMS
Model No.	AXIS ULTRA DLD
Manufacture	SHIMADZU
Location	Center for Nanodevice Fabrication and Analysis
Adviser	Shimomura Masaru
Staff	Miyake Aki

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. N9

Name STEM

Model No. JEM-2100F

Manufacture JEOL

Location Center for Nanodevice Fabrication and Analysis

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 *Standardless quantitative analysis *High-speed X-ray mapping



No. N10

Name Carbon Evaporator

Model No. JEC-560

Manufacture JEOL

Location Center for Nanodevice Fabrication and Analysis

Adviser Ishikawa Makoto

Staff Miyake Aki

Features

This is specimen coating device for SEM. A fine stream of carbon is deposited onto a non-conducting specimen.



No. N11

Name	Solar Simulator
Model No.	VK-SS-50, VK-IPCE-10
Manufacture	SPD Laboratory, Inc.
Location	Center for Nanodevice Fabrication and Analysis
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. N12

Name	Surface Area Analyzer
Model No.	TriStarII Plus
Manufacture	SHIMADZU
Location	Center for Nanodevice Fabrication and Analysis
Adviser	Sakamoto Naonori
Staff	Hayakawa Toshihiro

Features

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



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