As of April 2027

CRDAM
2027 List of Equipment open for collaborative research

General Responsible Person : CRDAM Director Prof. Kato
tel.+81-22-215-2114 e-mail : hidemi.kato.b7

1. Material preparation group

	Equipment	Deputy Manager	Contact		Responsible Operator		Contact	
			Tel.	e-mail			Tel.	e-mail
1-1	Electron Beam Lithography & Ion Milling System	Seki Prof.	215-2095	takeshi.seki	Yamazaki	Assistant Professor	215-2097	takumi.yamazaki.d5
1-2	Multi-Target Reactive Sputtering (Ion Beam Sputtering)				Sasaki	Technical Staff	215-2375	tomoko.sugiyama.a6
1-3	Reflection High Energy Electron Diffraction System				Sakamoto	Associate Professor	215-2097	shoya.sakamoto.e1
1-4	Multi-Ion Vapor Deposition System				Sasaki	Technical Staff	215-2375	tomoko.sugiyama.a6
1-5	Spark Plasma Sintering SPS-1050	Kato Prof.	215-2114	hidemi.kato.b7	Harata	Technical Staff	215-2375	koichi.harata.e7
1-6	Spark Plasma Sintering SPS-3.20 Mark IV				Harata	Technical Staff	215-2375	koichi.harata.e7
1-7	High Frequency Induction Tilt Casting				Umetsu	Professor	215-2199	rie.umetsu
1-8	Single Roll Melt Spinning				Umetsu	Professor	215-2199	rie.umetsu
1-9	IR Image Furnace for Floating Zone Melting				Sugawara	Technical Staff	215-2159	takamasa.sugawara.d3
1-10	Tungsten Resistivity Element Furnace for Vacuum Heating※				Nomura	Technical Staff	215-2371	akiko.nomura.d7
1-11	High-frequency Induction Furnace				Sugawara	Technical Staff	215-2159	takamasa.sugawara.d3
1-12	High Temperature Floating Zone Furnace for Composite Ceramics				Sugawara	Technical Staff	215-2159	takamasa.sugawara.d3
1-13	Vacuum Arc Melting Furnace for Small-sized Ingot				Nomura	Technical Staff	215-2371	akiko.nomura.d7
1-14	Vacuum Arc Melting Furnace for Large-sized Ingot				Nomura	Technical Staff	215-2371	akiko.nomura.d7
1-15	Arc-melting Furnace with Horizontal-traveling Hearth				Nomura	Technical Staff	215-2371	akiko.nomura.d7
1-16	Programmable Furnace with $MoSi_2$ Heater				Nomura	Technical Staff	215-2371	akiko.nomura.d7

Equipments with an ※ may become unavailable depending on the PCB test results.

e-mail address : Add "@tohoku.ac.jp" .

Tel. No. : Add the nation and area codes (+81-22) first.

2. Material analysis group

	Equipment	Deputy Manager	Contact		Responsible Operator		Contact	
			Tel.	e-mail			Tel.	e-mail
2-1	Magnetic Property Measurement System	Seki Prof.	215-2095	takeshi.seki	Sakamoto	Associate Professor	215-2097	shoya.sakamoto.e1
2-2	X-ray Diffractometer (Micro Area Type)	Kato Prof.	215-2114	hidemi.kato.b7	Nomura	Technical Staff	215-2371	akiko.nomura.d7
2-3	X-ray Diffractometer (Horizontal Sample Setting Type)				Nomura	Technical Staff	215-2371	akiko.nomura.d7
2-4	X-ray Photoelectron Spectrometer (XPS)				Omura	Technical Staff	215-2375	kazuyo.omura.b1
2-5	Field Emission Scanning Electron Microscope (FE-SEM)				Narita	Technical Staff	215-2375	issei.narita.b4
2-6	Field Emission Electron Probe Micro Analyzer (FE-EPMA)				Narita	Technical Staff	215-2375	issei.narita.b4
2-7	Scanning Electron Microscope (Tungsten Filament) (W-SEM)				Narita	Technical Staff	215-2375	issei.narita.b4
2-8	Superconducting Quantum Interference Device (SQUID) Magnetometer	Umetsu Prof.	215-2199	rie.umetsu	Umetsu	Professor	215-2199	rie.umetsu
2-9	Differential Scanning Calorimetry (DSC)				Huang	Assistant Professor	215-2375	huang.yin.chen.a3
2-10	Conventional Type Thermal Analaysis Measurement System (DTA, DSC)				Umetsu	Professor	215-2199	rie.umetsu
2-11	Vibrating Sample Magnetometer (VSM)				Umetsu	Professor	215-2199	rie.umetsu
2-12	Laue X-ray Back Scattering by Digital CCD Camera				Huang	Assistant Professor	215-2375	huang.yin.chen.a3
2-13	Powder X-ray Diffractometer with a Multipurpose High-Temperature Sample Holder※				Nomura	Technical Staff	215-2371	akiko.nomura.d7
2-14	Seebeck Coefficient/Electrical Resistivity Measurement System				Endo	Technical Staff	215-2159	takahide.endo.e5
2-15	Laser Flash Apparatus for Thermal Diffusivity and Conductivity Measurements				Endo	Technical Staff	215-2159	takahide.endo.e5
2-16	Static Particle Image Analyzer	Kato Prof.	215-2114	hidemi.kato.b7	Endo	Technical Staff	215-2159	takahide.endo.e5
2-17	Flat / Cross Section Ion Milling System				Narita	Technical Staff	215-2375	issei.narita.b4
2-18	Micro Vickers Hardness Tester				Harata	Technical Staff	215-2375	koichi.harata.e7

e-mail address : Add "@tohoku.ac.jp" .

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Equipment for Collaborative Research in 2027

1. Material preparation group

1-1 Electron Beam Lithography & Ion Milling System

Building No. 2, Room 211

Microfabrication at a sub-micron scale can be performed by a 50-kV thermionic electron gun to obtain micro-sized structures of approximately 100 nm. Photolithography in combination with electron beam lithography equipment using a photomask aligner with large-area processing can be used to fabricate devices. An attached secondary ion mass spectrometer enables depth profile measurement using ion milling.

ELIONIX: ELS-7500 (2003)



1-2 Multi-Target Reactive Sputtering (Ion Beam Sputtering)

Building No. 2, Room 111

This multi-target reactive sputtering (ion beam sputtering) system enables the preparation of thin films/multi-layer samples without Ar plasma damage. This sputtering system consists of three ion source guns for sputtering and one ion milling gun for cleaning. There are six sputtering targets that can be installed in the deposition chamber.

Toei Scientific Industrial Co., Ltd: 3000HC (1989)

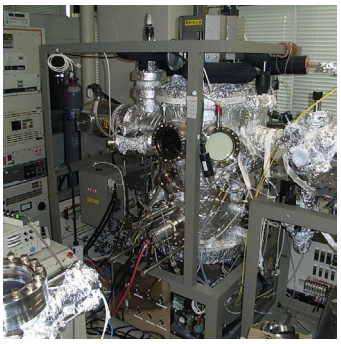


1-3 Reflection High-Energy Electron Diffraction System

Building No. 2, Room 111

This system consists of a main deposition chamber and a load lock chamber. In the main deposition chamber, epitaxial thin films/metallic superlattice samples can be developed while monitoring the film growth by reflection high-energy electron diffraction (RHEED). This RHEED system has a 30 kV-accelerated electron gun and a 150 mm-diameter screen. Moreover, a PC software for monitoring and analyzing RHEED patterns is available.

(1997)

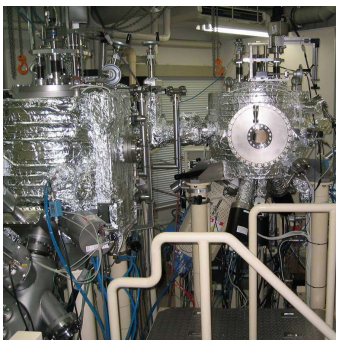


1-4 Multi-Ion Vapor Deposition System

Building No. 2, Room 104

This is a thin-film deposition system equipped with magnetron sputtering cathodes. This deposition system also consists of an electron cyclotron resonance ion source for Ar milling and surface modification. In addition, a Freeman ion source enables ion implantation and dynamic mixing of samples, and its maximum acceleration voltage is 50 kV.

ULVAC: MB98 (1999)



1-5 Spark Plasma Sintering: SPS-1050

Building No. 2, Room B01

This is a powder consolidation machine that uses the spark plasma sintering method. The raw material powder is filled in the conductive mold and is compressed by the top and bottom punches. A large pulsed current flowing through the moldgenerates heat for the sintering. Owing to the rapid heating effect, the grain growth can be suppressed and fine-structured compact specimens can be obtained.

Sumiseki Materials Co., Ltd: DR.SINTER Model SPS-1050 (1992)



1-6 Spark Plasma Sintering: SPS-3.20, Mark IV

Building No. 2, Room B04

This is a powder consolidation machine that uses the spark plasma sintering method. The raw material powder is filled in the conductive mold and is compressed by the top and bottom punches. A large pulsed current flowing through the mold generates heat for the sintering. Owing to the rapid heating effect, grain growth can be suppressed and fine-structured compact specimens can be obtained. Compared with the SPS-1050, a larger current (8000 A) and a higher load (20 ton) can be applied in this equipment; this is useful for preparing large compact specimens.

SPS SYNTEX INC: DR.SINTER Model SPS-3.20 Mark IV (2005)



1-7 High-Frequency Induction Tilt Casting

Building No. 3, Room 307

This device can prepare a master alloy ingot by tilt-casting into a mold by high frequency induction heating under inert gas atmosphere. The amount of an alloy that can be prepared at one time is about 70 g in terms of iron. By selecting the optimum crucible material, the maximum temperature can be reached up to 1500 ℃.

Makabe Giken Co,.Ltd.: VF-HMF100 (2007)



1-8 Single Roll Melt Spinning

Building No. 2, Room B06A

This device is used for ultra-rapid cooling of molten metals in a vacuum or an inert gas atmosphere. An alloy is melted in the quartz nozzle and spun by the high-speed rotating copper roller. The melting temperature of the alloy must be below 1200 °C. This machine can also be used as a copper mold casting machine.

NISSIN GIKEN Corporation: NEV-A04 (1999)

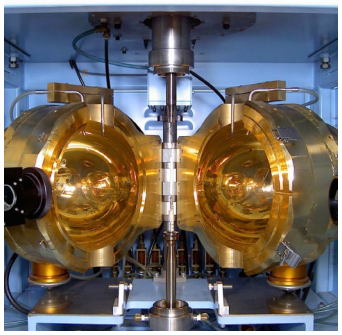


1-9 IR Image Furnace for Floating Zone Melting

Building No. 3, Room 208

This equipment can obtain highly purified single-crystalline materials by the floating zone melting method using an infrared (IR) beam focused from a halogen lamp. It can melt materials under an arbitrary atmosphere and can be used to obtain single crystals of metals, alloys, intermetallic compounds, and oxides. The equipment can obtain highly purified materials because the materials are melted without the use of a reaction container.

Asgal: FZ-SS35WV (1989)



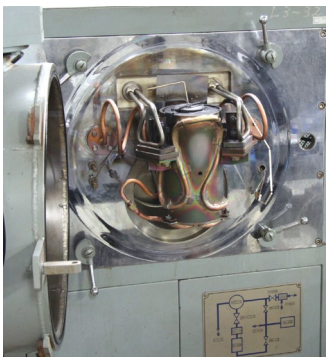
1-10 Tungsten Resistivity Element Furnace for Vacuum Heating

(This may become unavailable depending on the PCB test results.)

Building No. 3, Room 208

This furnace can be used to heat and melt samples at a high temperature (up to 1800 °C) using a tungsten mesh heater in vacuum.

ULVAC: FHW-50-special specification (1971)



1-11 High-Frequency Induction Furnace

Building No. 2, Room B08

This furnace is capable of melting quantities of various metals (1 kg in the case of iron) in a high vacuum of 2.0×10^{-3} Pa. The charged metals are melted in an appropriate crucible in vacuum or an inert gas atmosphere; they are then cast into a mold by inclining the crucible. The furnace can be used to prepare ingots of raw metals, mother alloys, and metallic glasses.

DIAVAC: VMF-1-11 (2004)

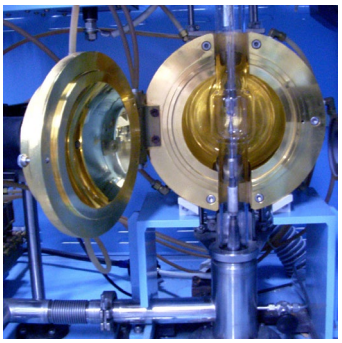


1-12 High-Temperature Floating Zone Furnace for Composite Ceramics

Building No. 2, Room B08

This equipment can be used to heat and melt samples at a high temperature (up to above 2000 °C) using a xenon lamp heating system without a crucible. The equipment is used extensively for single-crystal growth and ceramic synthesis at a high melting temperature.

Asgal: FZ-20065XHVG (1998)



1-13 Vacuum Arc Melting Furnace for Small-sized Ingot

Building No. 3, Room 203

The arc-melting furnace can melt charged materials and fabricate polycrystalline material ingots. The material is melted by means of an electrical arc, which is generated conventionally by a power of 2 to 6 kW. It is used extensively to melt and cast metals, alloys, intermetallic compounds, and some oxides, by increasing the temperature to above 3,000 °C.
obtainable sample size: [disk-shaped sample] max ϕ30 mm×10 mmt, [rod-shaped sample] ϕ8-10 mm × 90 mmL

DIAVAC: ACM-01 (1986)



1-14 Vacuum Arc Melting Furnace for Large-sized Ingot

Building No. 3, Room 203

This is a larger version to Vacuum Arc Melting Furnace for Small-sized Ingot (Max output: 300 A) (listed up as # 1-13), and equipped with a turbo-molecular pump to evacuate the chamber. We can obtain refractory alloy ingots with a dimension of 50 mm in diameter and 10 mm in thickness.

DIAVAC: ACM-S14TMP-M (2020)



1-15 Arc-Melting Furnace with Horizontal Traveling Hearth

Building No. 3, Room 203

This arc-melting furnace exhibits a performance similar to that of a conventional furnace (such as the one listed in 1-13). In addition, the furnace is attached with a system that shifts the copper hearth horizontally at a speed of 5–60 mm/h. Therefore, it can fabricate long rod-shaped specimens with elongated and coarsened grains.
obtainable sample size: [rod-shaped sample] ϕ10 mm × 290 mmL

DIAVAC: ACM-S-6 (1985)



1-16 Programmable Furnace with $MoSi_2$ Heater

Building No. 3, Room 116



This furnace, which is equipped with a $MoSi_2$ heater, can heat up to a maximum temperature of 1600 °C in air. The furnace can also be used for the synthesis of complex oxides by reaction sintering and for the fabrication of various sintered compacts.

NECCO: 850-M-120×120 (1998)

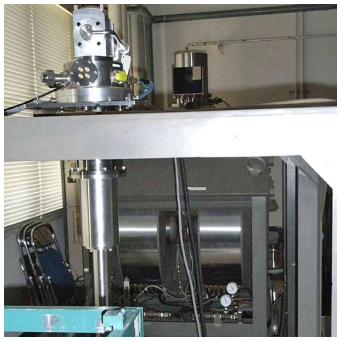
2. Material analysis group

2-1 Magnetic Property Measurement System

Building No. 2,Room 107

This measurement system can be used to characterize the magnetic properties of magnetic materials (mainly thin-film samples). The maximum magnetic field is 2 T. The magnetization can be measured.

TAMAKAWA CO.,LTD: TM-VSM2614HGC-KIT (2014)



2-2 X-ray Diffractometer (Micro-Area Type)

Building No. 2, Room 103

This X-ray diffractometer can analyze fine precipitation in specimens using a micro X-ray collection device, CBO-f.

Rigaku: UltimaIV/MAJ (2009)



2-3 X-ray Diffractometer (Horizontal Sample Setting Type)

Building No. 2, Room 103

A high-performance detector (D/teX Ultra) enables a high-speed analysis, up to 100 times compared with a conventional scintillation counter. In addition, a trace element analysis can be performed.

Rigaku: UltimaIV/SG (2012)

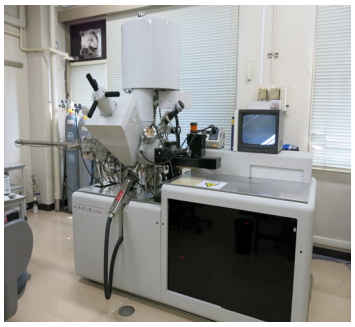


2-4 X-ray Photoelectron Spectrometer (XPS)

Building No. 2, Room 106

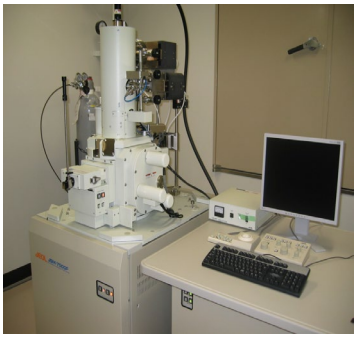
The composition of a sample can be analyzed by measuring the energy and intensity of photoelectrons generated under irradiation of X-rays. The position of peak energy determines the chemical state, and the surface with a depth of several nanometers can also be analyzed. The sample transfer container system enables the analysis of chemically-treated samples without exposure to the atmosphere.

SHIMAZDU Co.: KRATOS AXIS-Ultra DLD (2009)



2-5 Field Emission Scanning Electron Microscope (FE-SEM)

Building No. 2, Room 217



High-resolution observations on the order of 1 nm in secondary electron images can be achieved by using the FE electron gun. This equipment can analyze complex surfaces, such as tensile-fractured surfaces. Insulation materials can be observed using various observation modes without pre-treatment.

JEOL: JSM-7500F (2009)

2-6 Field Emission Electron Probe Micro-Analyzer (FE-EPMA)

Building No. 2, Room 106



FE-EPMA with a small probe of 40 nm and a high resolution of 3 nm enables high-precision composition analysis using a wavelength dispersive X-ray spectrometer, which can detect elements from boron to uranium. The attached EBSD system analyzes the crystal orientation of specimens.

JEOL: JXA-8530F (2009)

2-7 Scanning Electron Microscope (Tungsten Filament) (W-SEM)

Building No. 2, Room 107



This thermionic-emission gun with a tungsten filament provides high-resolution secondary electron images (SEI) and back-scattered electron (BSE) images of metallic and inorganic materials. The chemical compositions of samples can be determined using the attached EDX system. The maximum size of a specimen that can be installed in the analysis chamber is 200 mm in diameter and 80 mm in thickness.

Hitachi High Technologies: S-3400N (2008)

2-8 Superconducting Quantum Interference Device (SQUID) Magnetometer

Building No. 2, Room 107



Quantum Design's MPMS magnetometry provides users with a superconducting quantum interference device, SQUID, which has a sensitivity $\leq 10^{-6}$ emu under a temperature range of 2–400 K and a magnetic field control below 5 T. AC magnetic measurements can also be performed in a frequency range of 0.01–1500 Hz.

Quantum Design: MPMS-5S (1997)

2-9 Differential Scanning Calorimetry (DSC)

Building No. 2, Room 215

The high temperature Differential Scanning Calorimeter (DSC) is designed to quantitatively measure the energy absorbed or released by samples as they are heated; from room temperature up to 1400 °C. The DSC can measure many thermodynamic properties of samples including the: (ΔH) Transition & Reaction Enthalpies; (TM) Temperatures of Melting & Phase Transformations; (TG) Temperature and energy change of Glass Transition & Crystallization; Tests are performed with an inert reference held in a shared chamber with the sample. Both reference and sample are exposed to the same heating rates and environment, and thermodynamic properties can then be calculated by comparison. The instrument is not designed to handle sample decomposition or volatility and should not be used with reactive samples.

Netzsch Japan: DSC404C (2007)



2-10 Conventional Type Thermal Analysis Measurement System (DTA, DSC)

Building No. 2, Room 215

Differential thermal analysis (DTA) and differential scanning calorimetry (DSC) between the sample and reference are monitored against time or temperature, while the temperature of the sample is programmed in a specified atmosphere. A aluminum, platinum, or alumina crucible can be used while monitoring the DTA and DSC properties of the sample. The system delivers an extended temperature range from ambient temperature to 1300 °C for DTA and to 1200 °C for DSC. The cooling unit can be used to measure the DSC in a temperature ranging from -150 °C to 500 °C.

SIISeiko Instruments Inc.: EXSTAR 6000 series, TG/DTA 6300, DSC 6200 6300 (2007)



2-11 Vibrating Sample Magnetometer (VSM)

Building No. 2, Room B05

Magnetic properties of bulk, powder, and thin-film materials can be measured with high sensitivity in a temperature range of 77 K to 1200 K using this magnetometer. The maximum applicable magnetic field is 1.5 T and the magnetization range is 10^{-3} to 10^{2} emu. Magnetization curves at an arbitrary temperature, thermal magnetization curves under a constant magnetic field, temperature changes during magnetization, spontaneous magnetization, and Curie and Neel temperatures can also be obtained. The measurement of magnetostriction by using Strain-Gauge under applying magnetic field is also possible.

Toei Scientific Industrial: VSM-5 (1995)



2-12 Laue X-ray Back Scattering by Digital CCD Camera

Building No. 2, Room 110

The constituent instruments of this system are 1) X-ray generator, 2) Laue back scattering optical system, 3) Sample stage, 4) Cooling-type CCD digital camera, and 5) PC. A tungsten target is used as the X-ray tube and the maximum load power is 3 kW. A four-axis goniometer is commonly used in the electric discharge machine. Diffraction spots can be immediately obtained on the PC using the CCD digital camera.

Rigaku: RASCO-IIBLA (2014)

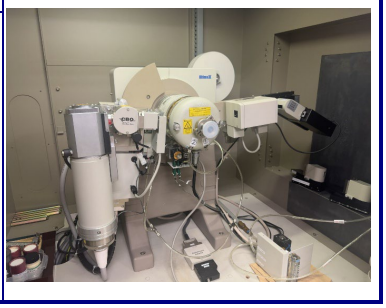


2-13 Powder X-ray Diffractometer with a Multipurpose High-Temperature Sample Holder (This may become unavailable depending on the PCB test results.)

Building No. 2, Room 103

The sample holder of this horizontal powder X-ray diffractometer is equipped with a heater, enabling powder X-ray diffraction measurements to be performed while heating the sample within a temperature range of room temperature to ~1,200°C. It is well-suited for analyzing phase transitions and changes in crystal structure that occur as the temperature changes.

Rigaku: UltimaIII-SS (2010)

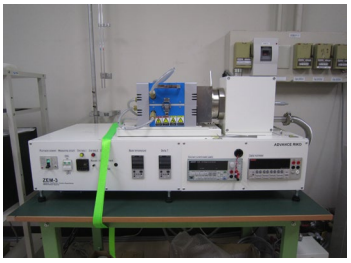


2-14 Seebeck Coefficient/Electrical Resistivity Measurement System

Building No. 3, Room 308

The Seebeck coefficient and electrical resistivity can be measured by the steady direct-current method and by the four-point probe method. The operating temperature ranges from room temperature to 1000 ºC. The available sample shape is a rod or a prism with a length of 5〜2 mm.

Advance Riko: ZEM-3 (2015)



2-15 Laser flash apparatus for thermal diffusivity and conductivity measurements

Building No. 3, Room 308

The Laser Flash Apparatus is useful to measure the thermal characteristics (thermal diffusivity, specific heat capacity, thermal conductivity) of solid materials such as metals, ceramics, glass, carbon, and plastics. Since it is easier to measure than the steady-state method and the data obtained is so reliable, it should be the most effective method to obtain the thermal conductivity.

Advance Riko: TC-7000S (2020)

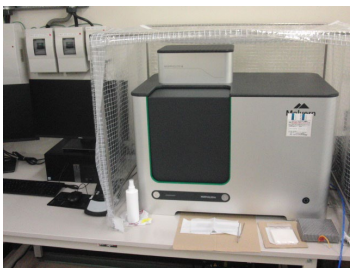


2-16 Static particle image analyzer

Building No. 3, Room 307

This device can accurately evaluate the morphology of powder particles by static image analysis. A series of operations from sample dispersion to measurement can be performed automatically. The imaging optical system can be selected from transmission or incident-light mode. The binarized image and characteristic parameters are automatically recorded. It can handle many types of powder samples such as metals, ceramics, and organic substances.

Malvern Panalytical: Morphologi 4 (2021)



2-17 Flat / Cross Section Ion Milling System

Building No. 3, Room 310

This apparatus allows us to polish the sample using the sputtering phenomena by argon ion beam irradiation. In the planar milling mode, it is possible to remove the surface contaminated layer, fine scratches, and strain of the sample specimen. In the cross-section milling mode, focused argon ion beam processing provides a sound cross-section surface for microstructural observation. We can obtain high-quality image and analysis via scanning electron microscope (SEM) and backscattered electron diffraction (EBSD) using the specimen polished by the apparatus.

Hitachi High-Tech Corporation: IM4000PLUS (2022)



2-18 Micro Vickers Hardness Tester

Building No. 2, Room B01

The Vickers hardness tester determines the hardness of a material by pressing a diamond pyramid-shaped indenter against a test piece and measuring the load and the length of the diagonal of the indentation.

Shimadzu Corporation : HMV-2ADW (2024)

