Utilization of HyTReC

Test Charge

Test charges are set for each laboratory.
Test charges include the followings.

- Utilization of a laboratory and equipment
- Preparation, operation and clearance of a test
- Test report
- Consultation concerning test methodologies and test conditions
- Overhead costs

Our customers can use the following apparatus free of charge

- Analytical instruments(Gas chromatography, mass spectroscopy, ion chromatograph, SEM, 3D laser microscope, digital microscope, etc.)
- Workshop and machine tools
- Internet connection

Security control

HyTReC controls information security strictly because tests are dealt with the technologies under development by customers.

- Conclusion of non-disclosure agreement with a customer
- Access control to the test area by IC security card
- Monitoring of each laboratory and main area of the facility by security cameras
- Security guard patrol at night and on holidays

Facility safety features

- 540mm thick reinforced concrete walls(Laboratory Building "HyTReC" is 250mm)
- Hydrogen leak detector
- Ventilation of 20 times per hour (30 times/h in laboratory Building "HyTReC")
- Door opening sensor to prohibit entry while testing
- Observation window(s) made of bulletproof glass and fireproof glass
- Explosion-resistant chamber made of 12 mm thick stainless steel (High pressure hydrogen lab.) (8 mm at laboratory Building "HyTReC")
- Explosion-proof type electric devices in hydrogen lab.
- High pressure hydrogen booster and pressure accumulator are set up inside the barrier.

a/ Forced ventilation fan
b/ Dual structure window consisting of bulletproof glass and fireproof glass
c/ Central monitor room

Access

By train Fukuoka city subway Kuko-line bound for Meinohama and Karatsu.Get off at Chikuzen-Maebaru Station,Ten minutes by taxi.
By bus Showa-bus, Itoshima-go, from Hakata station bus terminal. Get off at Maebaru Interchange and walk for ten minutes.
By car About 35 minutes from Fukuoka airport via Fukuoka Expressway and Nishikyushu Expressway. Get off at Maebaru I.C.

HyTReC
Hydrogen Energy Test and Research Center

Hydrogen Energy Test and Research Center
915-1, Tomi, Itoshima-City, Fukuoka 819-1133, Japan
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2020.2

HYDROGEN ENERGY TEST AND RESEARCH CENTER

HyTReC

An ideal launch pad into the hydrogen energy sector

The Hydrogen Energy Test and Research Center, HyTReC, offers cutting-edge hydrogen testing facilities for scientific research, prototyping, and full product testing. Established under the auspices of Fukuoka Prefecture, HyTReC is an independent non-profit organization that supports new hydrogen energy businesses and serves as a launch pad for hydrogen technologies and products they develop. Hydrogen system components such as valves, sensors, hoses, and cylinders in vehicular or stationary applications including hydrogen stations can be tested and qualified at HyTReC for R&D and commercialization.

HyTReC's programs

> Prototype and product testing

Testing capabilities include durability (e.g., environment, vibration, pressure cycling) and performance (e.g., pressure, gas leak, permeability)

> Product development

Research and development of hydrogen materials and components (e.g., valves and connections), offered in conjunction with private partners

> Testing methodologies

Development of test methods that simulate field conditions for hydrogen products in order to contribute to national and international standardization efforts

> Outreach and public relations programs

Orientation for technologies, safety workshops as well as tours of HyTReC facilities

Message from President

I invite you to take full advantage of the superb product development environment HyTReC offers.

For hydrogen energy to become a full-fledged industry, cost reduction and performance improvements of hydrogen components and systems are imperative. This can only be achieved by attracting a broad spectrum of players to the sector so that there is a critical mass for competition.

To successfully enter into the new hydrogen sector, a private business must demonstrate the performance and reliability of its products by testing them in a hydrogen environment. However, the large initial investment required to establish a hydrogen test facility prevents many companies from entering into this new energy sector.

HyTReC is the first institution in Japan to offer a full lineup of hydrogen testing services. In addition, our partnership with HYDROGENIUS, a world leader in hydrogen research located at Kyushu University, assures that our product development services are at the forefront of hydrogen science.

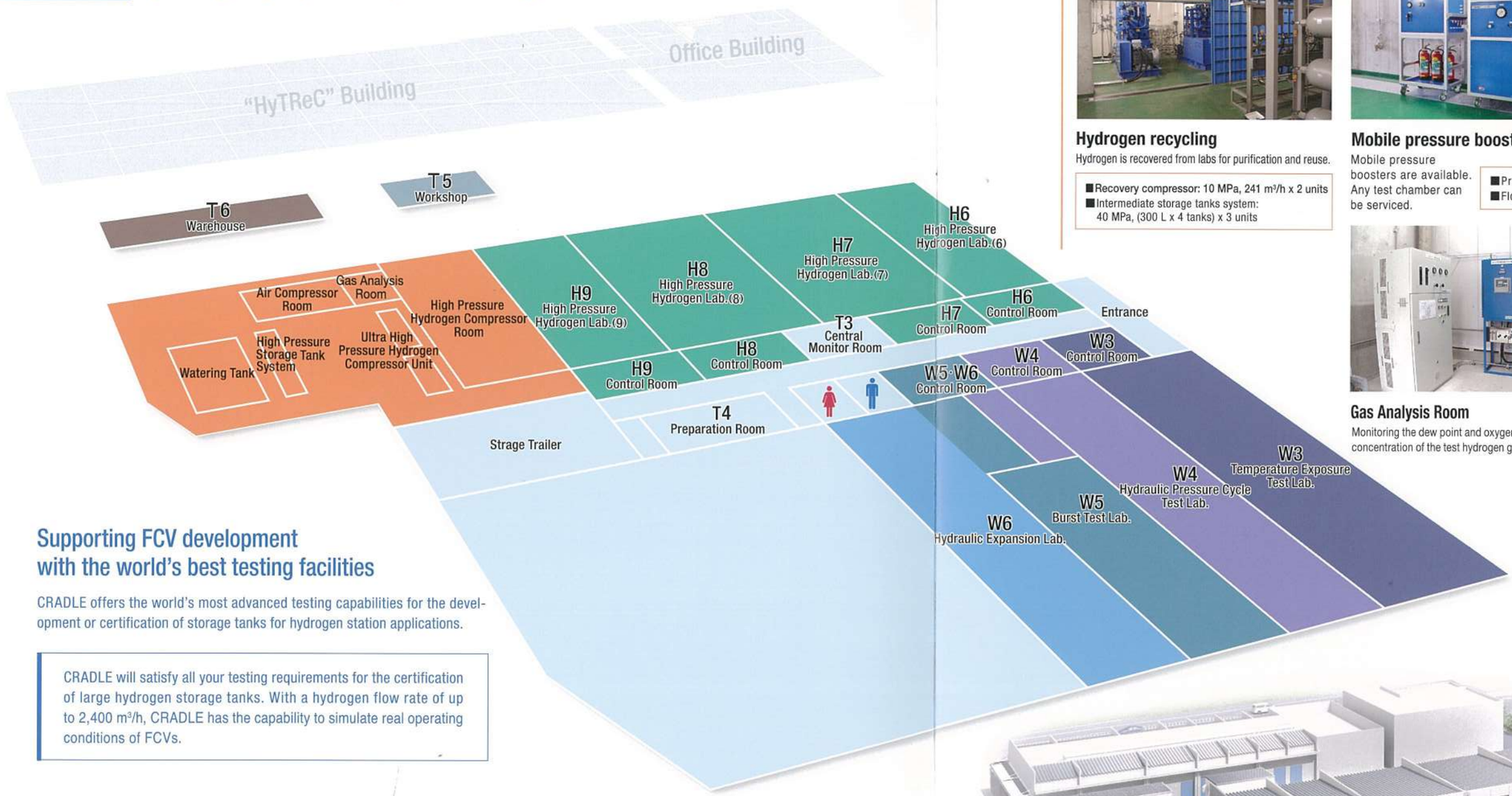
It is our sincere wish that as many companies as possible will take advantage of the efficient and effective product R&D platform we offer. HyTReC is here to contribute to the development of new hydrogen energy industries.

Shogo Watanabe
President

Plant Guide
01

“CRADLE” Building

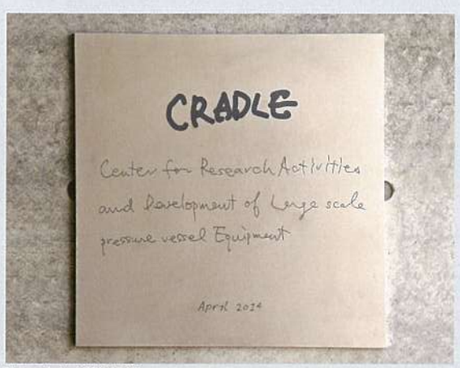
(for large hydrogen storage tank testing)



Supporting FCV development with the world’s best testing facilities

CRADLE offers the world’s most advanced testing capabilities for the development or certification of storage tanks for hydrogen station applications.

CRADLE will satisfy all your testing requirements for the certification of large hydrogen storage tanks. With a hydrogen flow rate of up to 2,400 m³/h, CRADLE has the capability to simulate real operating conditions of FCVs.



Nameplate of CRADLE

CRADLE

Acronym representing

the Center for Research Activities and Development of Large scale pressure vessel Equipment.

It reflects our goal of making HyTReC the cradle for the hydrogen industry.

Laboratories:
A total of eight labs of reinforced concrete construction

Gross floor area:
approx. 2,700m²

Site area:
approx. 8,300m²

Testing available for storage tank sizes up to:

- Internal capacity: 500 L
- Dimensions: Φ800 mm x 6,000 mm (L)
- Design pressure: 110 MPa
- Highest working temperature: +85°C
  Lowest working temperature: -40°C

Utility / Exterior / Interior

Hydrogen recycling

Hydrogen is recovered from labs for purification and reuse.

- Recovery compressor: 10 MPa, 241 m³/h x 2 units
- Intermediate storage tanks system: 40 MPa, (300 L x 4 tanks) x 3 units

Mobile pressure boosters

Mobile pressure boosters are available. Any test chamber can be serviced.

- Pressure: 110 MPa
- Flow rate: 15 m³/h

Gas Analysis Room

Monitoring the dew point and oxygen concentration of the test hydrogen gas.

Ultra high-pressure hydrogen compressor

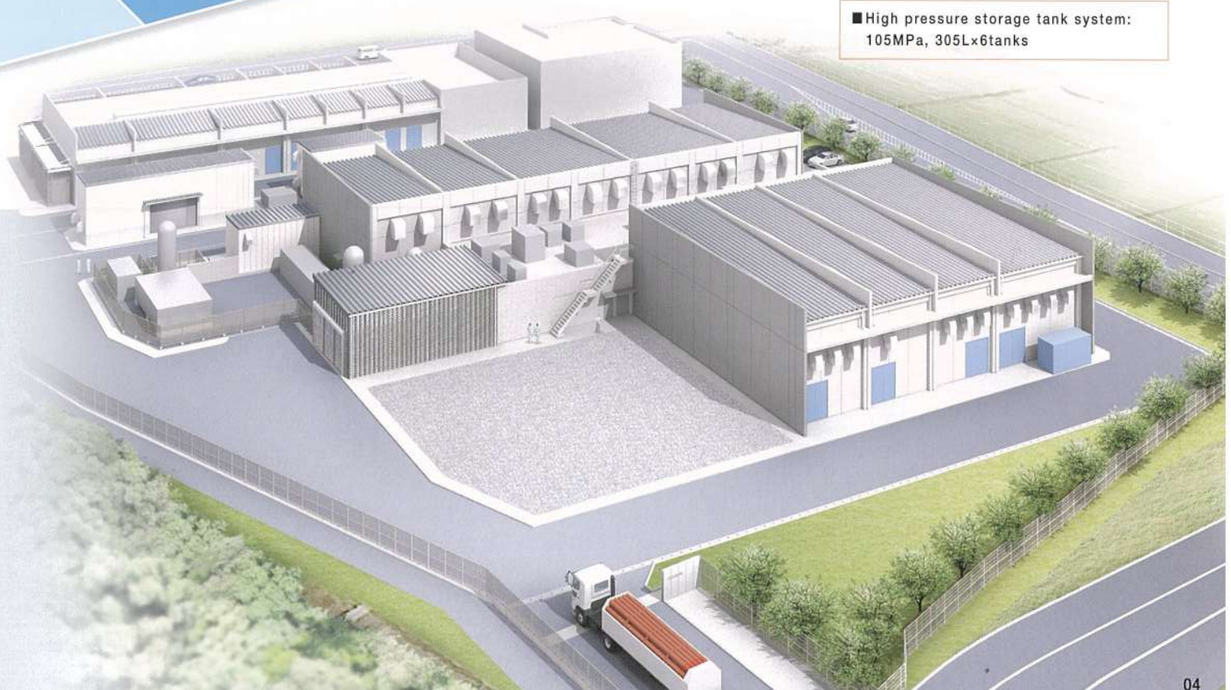
Provides ultra high-pressure hydrogen to labs

- Pressure: 110 MPa
- Flow rate: up to 2,400 m³/h

High pressure storage tank system

Stable supply of high-pressure and large-flow hydrogen to each test room.

- High pressure storage tank system: 105MPa, 305L×6tanks



H6～H9 High-Pressure Hydrogen laboratory (6) ~ (9)

Capable of supplying hydrogen gas at up to 2,400 m^3/hr, these labs are designed for different types of durability tests.

H6・H9 a/ Explosion-proof chamber: open (cuboid) b/ Explosion-proof chamber: closed (cuboid) c/ Control room

H7・H8 d/ Explosion-proof chamber: open (cylindrical) e/ Explosion-proof chamber: closed (cylindrical) f/ Testing pit

Specifications

- MAWP (NWP): 120 MPa (110MPa)
- Hydrogen flow rate: up to 2,400 m^3/hr
- Temperature range: -40°C to +85 °C
- Pre-cooler temperature: -40°C
- Chamber internal dimensions
  H6, H9: 2,300 (W) × 5,500 (L) × 2,000 (H) mm
  H7, H8: Φ1,200 × 6,000 (L) mm
- Testing pit dimensions: H7, H8: 6,200 (W) × 14,900 (L) × 4,450 (H) mm

Applicable tests include:

- Hydrogen gas pressure cycle test
- Hydrogen gas permeability test
- Fast filling test
- Gas leak test

MAWP: Maximum Allowable Working Pressure NWP: Nominal Working Pressure

W3 Temperature exposure test laboratory (W3)

This lab is capable of pressurizing at up to 140 MPa under specified temperature.

Specifications

- Maximum hydraulic pressure: 140 MPa
- Plunger pump: 61L/stroke
- Temperature range: -40°C to +85°C
- Accelerated stress test: 200 MPa
- Inner dimensions: Φ1,200 × 6,000 (L) mm
- Testing pit dimensions: 4,800 (W) × 15,900 (L) × 4,500 (H) mm

Applicable tests include:

- Hydraulic pressure cycle test
- High-temperature creep test

a/ Temperature control chamber
b/ Hydraulic pressure cycle test system for 500 L class storage tanks
c/ High-temperature creep test equipment

W4 Hydraulic pressure cycle test laboratory (W4)

This lab is for ambient durability testing of hydrogen storage tanks at up to 140 MPa.

Specifications

- Maximum hydraulic pressure: 140 MPa
- Plunger pump: 61 L/stroke
- Testing pit dimensions: 2,500 (W) × 9,900 (L) × 2,884 (H) mm

Applicable tests

- Ambient pressure cycle test

a/ Hydraulic pressure cycle test system for 500 L class storage tanks
b/ Testing pit

W5 Burst test laboratory (W5)

This lab is capable of applying up to 380 MPa for burst tests.

Specifications

- Maximum pressure: 380 MPa (burst pressure)
- Testing pit dimensions: 2,500 (W) × 10,330 (L) × 2,950 (H) mm
- Steel thickness of pit wall lining: 50 mm

Mobile hydraulic booster

- Maximum pressure: 500 MPa

Applicable tests

- Burst test

a/ Burst test system
b/ Testing pit
c/ Mobile pressure booster

W6 Hydraulic expansion test laboratory (W6)

The lab allows the precise expansion measurement of large storage tanks up to 500 liters.

Specifications

- Hydraulic expansion measurement test equipment
  Inner dimensions of the equipment for 500 L class storage tank:
  Φ1,100 × 7,000 (L) mm
- Hydraulic expansion measurement test equipment
  Inner dimensions of the equipment for 100 L class storage tank:
  Φ789 × 1,715 (L) mm

Main test cases

- Hydraulic expansion measurement test

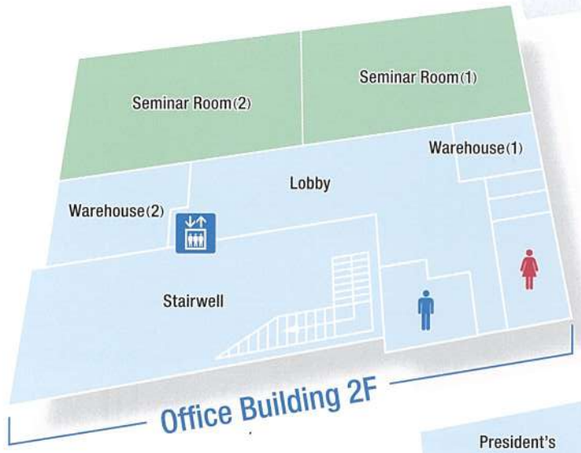
a/ Expansion measurement test system (open)
b/ Expansion measurement test system (100 L)
c/ Constant temperature over for creep test of a tank

Plant Guide
02

Office Building

HyTReC's base for the dissemination of latest knowledge and information, as well as human resources development activities in the hydrogen sector

Our entrance hall is a gallery for hydrogen energy products, and our meeting rooms host workshops on hydrogen.



Office Building

Entrance Hall

Displays commercial products successfully tested at HyTReC

A gallery for hydrogen related products

Meeting Rooms

Two meeting rooms with a capacity of 45 people each, accommodating up to 100 when combined.

Plant Guide
03

"HyTReC" Building

Houses fully equipped multiple labs for a wide range of hydrogen testing under high pressure.
Offers a wide range of testing capabilities, including vibration and high-pressure hydrogen exposure, to meet the diverse needs of our customers.

Workshop

Workshop

Available for tooling, machining, and the preparation or mounting of test samples.

Utility

Two hydrogen gas compressors and intermediate storage tanks

Hydrogen gas is collected, purified, and reused after each test.

- NWP: 19.5 MPa
- Flow rate: 70 m³/h×2

Mobile boosters

Mobile boosters are available.

- NWP: 110 MPa
- Flow rate: 7 m³/h

Office Building…
Two-story steel frame construction

Laboratory Building HyTReC…
One-story RC construction

Gross floor area…
approx.2,000 m²

Site area…
approx. 5,500 m²

H1～H5 High-pressure hydrogen laboratory (1) to (5)

For high-pressure hydrogen testing of
storage tanks, valves, sensors and other components.



Specifications

- MAWP: 99 MPa
- Hydrogen flow rate: 15 m³/h
- Temperature range: -40°C to +85°C
- Inner dimensions of explosion-proof enclosure: Φ1,000 × 2,000 (L) mm
- Inner dimensions of explosion-proof chamber: 1,700 (W) × 2,000 (L) × 1,500 (H) mm

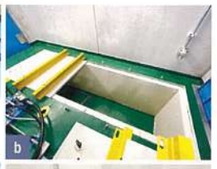
Applicable tests

- Hydrogen gas pressure cycle test
- Hydrogen gas permeability test
- Gas leak test

a/ Explosion-proof chamber (H5) b/ Explosion-proof enclosure c/ Hydrogen booster

W1 Hydraulic pressure laboratory (W1)

For durability testing of storage tanks of up to
300 L in capacity under hydraulic pressure cycles.


Specifications

[Hydraulic pressure cycle test equipment]
- Storage tank capacity: up to 300 L
- Maximum hydraulic pressure: 130 MPa
- Testing pit dimensions: 1,000 (W) × 3,705 (L) × 1,400 (H) mm

[High pressure water vessel]
- Hydraulic pressure: 0 to 87.5 MPa
- Inner dimensions of pressurization vessel: Φ400 × 1,100 (H) mm
- Temperature: ambient

Applicable tests

- Hydraulic pressure cycle test: Hydraulic pressure cycles are applied at specified high and low values

a/ Hydraulic pressure cycle test equipment (300L) b/ Testing pit c/ Pressurization vessel

W2 Hydraulic pressure laboratory (W2)

For the burst and durability testing of
storage tanks under hydraulic pressure



Specifications

[Hydraulic test system]
- Maximum pressure: 130 MPa
- Maximum pressure for burst testing: 343 MPa
- Test pit inner dimensions: 2,400 (W) x 3,200 (L) x 2,000 (H) mm

Applicable tests

- Burst test: Pressures greater than the design value are applied to measure the pressure at the time of burst and observe how the burst occurs
- Pressure cycle test: Hydraulic pressure cycles are applied at specified high and low values

a/ Hydraulic pressure test system b/ Testing pit c/ The moment of a burst (taken by a high-speed camera)

M1～M2 Multipurpose laboratory (M1~M2)

Environmental testing is conducted by
changing the ambient temperature.



a/ High-pressure autoclave b/ High-temperature autoclave
c/ Environmental test equipment

Specifications

- High-pressure autoclave
- Normal working pressure: 105 MPa
- Temperature: up to 125°C
- Inner dimensions: Φ100 × 250 (H) mm

High-temperature autoclave

- Normal working pressure: 20 MPa
- Temperature: up to 500°C
- Inner dimensions: Φ100 × 200 (H) mm

Environmental test equipment

- Temperature range: -70°C to +180°C
- Inner dimensions: 1,000 (W) × 810 (L) × 998 (H) mm

M3～M4 Multipurpose laboratory (M3~M4)

Flexible lab space
where customers can set up their own test systems



a/ Gas-tight chamber b/ Lab
c/ Preparation room

Specifications

- Utility※1
- Hydrogen pressure: 0.9 MPa to 110 MPa※2
- Lab dimensions: 5,000(W) × 5,000 (L) mm

Gas tight chambers

- Temperature range: ambient to +90°C
- Inner dimensions: Φ650 × 1,300 (L) mm

※1 For hydrogen, nitrogen, compressed air; with hydrogen recovery lines and vent line
※2 When using a mobile booster
Please consult us for the use of these labs

V1 Vibration laboratory (V1)

Vibration testing of
samples up to 200 kg in weight.


a/ Vibration test equipment b/ Environment and vibration test system

Specifications
Environment and vibration

- Exciting force: 2,300 kgf (sine wave)
- Frequency: up to 3,000 Hz
- Specimen weight: up to 200 kg (including jigs)
- Temperature range: -73°C to +180°C
- Inner dimensions: 1,168 (W) × 1,118 (L) × 1,270 (H) mm

Analysis lab

Analytical capabilities
include surface analyses,
hydrogen charge measurement and
chemical analyses

Confocal scanning laser microscope (CSLM)

- Magnification ratio: 110 to 17,000
- XY plane resolution: 1 nm
- Light source: 405 nm semiconductor laser

Digital microscope

- Optical magnification ratio: 1 to 1,400

High speed camera

- Sensitivity: ISO 5,000 (color)
- Frames per second: 50 (1,280 × 1,024 pixels) to 600,000 (16 × 4 pixels) fps

Hydrogen analyzer

Measures the amount of hydrogen contained in metal or resin by increasing temperature at a constant speed.

- Maximum temperature: 1,000℃