Low Temperature Center, Ito Branch

伊都地区センター

Message from the Director

The Low Temperature Center was founded in April 2005 as a joint-use institute of Kyushu University to supply cryogens, liquid helium, and liquid nitrogen to researchers, technical staff and students. The main goals of the center are 1) to educate users on safe handling techniques of cryogens, and 2) to provide a steady supply of cryogens to users.

In 2006, the faculty of engineering and related institutes were relocated to the Ito campus. The center consists of two branches: the Hakozaki branch and the Ito branch. Both branches supply cryogens to the campus.

The surroundings of the Ito branch were equipped with new facilities, such as a helium liquefier, in April 2006. A test run on the facilities was conducted for half a year. They are currently in steady operation. We will continue to provide useful information and guidance for safe utilization of cryogens to all users.

Kazuo Funaki, Director of the Low Temperature Center

Helium Liquefier System

In 1908, Heike Kamerlingh Onnes from Leiden University succeeded in the liquefaction of helium for the first time. He was later awarded the Nobel prize in 1913. His discovery on liquid helium has led to various applications such as superconductors.

The latest high performance helium liquefier system was installed and launched in the Low Temperature Center. This system provides a strong support for educational and research activities requiring cryogens.

Specifications

＜Liquefaction & Refrigeration＞

・Helium liquefier/refrigerator
LindeKryotechnik AG LR280
・Compressor for helium liquefier
Kaeser Kompressoren ESD441
Liquefier capacity 235 ℓ/h
Refrigerator capacity：1440 W @20 K
1550 W @50 K

＜Recovery & Purification＞

・Compressor for recovery and purification
GreenField Engineering Co.
C5N210GX
Recovery capacity：100 Nm^3/h

・High pressure external purifier
Koike Sanso Kogyo Co., Ltd
Purify capacity：100 Nm^3/h×5 h
50 Nm^3/h×10 h

＜Storage＞

・Liquid helium storage
Jecc Torisha Co., Ltd CH-2000
Capacity: 2000ℓ
・Clustered cylinders for pure gas
Koike Sanso Kogyo Co., Ltd
Maximum capacity：1035 m^3
・Clustered cylinders for gas impurities
Koike Sanso Kogyo Co., Ltd
Maximum capacity：1924 m^3
・Gasbag
Koike Sanso Kogyo Co., Ltd
Volume：30 m^3×2

Linde LR280


External purifier


Recovery system


Operation room

Compressor

If a gas is expanded freely into an open space through a valve or a throttling device, the temperature of the gas can be slightly decreased. This phenomenon is known as the Joule-Thomson (JT) effect, which is used in the final stage of the helium liquefier. Due to the weak intermolecular interaction of helium gas, this effect can be exploited at temperatures below 40 K. Therefore, helium gas is first cooled down to 20 K or less by another method (expansion engine) before applying the JT effect.

The operation process of helium liquefier is as the following. First, a high pressure (HP) gas is prepared by the compressor. Then, the HP gas is cooled down through the heat exchanger, and some of the gas flows through the expansion engine, in which an efficient turbine-type engine is recently employed. When the gas rotates the turbine in the expansion engine, work is done. As a result, the temperature and pressure of the gas decrease. This process is known as the adiabatic expansion in the Carnot's cycle for an ideal gas system (equi-entrophy process), which is different from a JT expansion for a real gas system (equi-enthalphy process). Since the turbine should rotate smoothly even at low temperatures, an advanced technique is required. The resultant cold gas with a temperature of about 10 K is used to refrigerate the main HP gas at below 40 K. Finally, the cold HP gas is expanded to atmospheric pressure through the JT valve and is liquefied.

Liquid N_2 Cold Evaporator

CE10000-M

Japan Chemical Engineering & Machinery Co., Ltd.

Storage capacity: 10000 ℓ

＜Liquid nitrogen＞

The boiling point of liquid nitrogen (LN_2) is about 77 K. LN_2 has various uses because of its low cost. LN_2 is relatively safe and is easy to handle, however, a constant supply of oxygen is essential during use.

＜Support＞

LN_2 is supplied by the Low Temperature Center. Users should attend the seminar on safe handling techniques of cryogens prior to using LN_2.

Utilization of liquid helium in Ito campus

Liquid helium is used in various fields such as the development and characterization of new functional materials or superconductors for applications and fundamental research in condensed matter physics.

Compact-type variable and modulate temperature apparatus

This apparatus provides a stable test field containing helium gas, which is hold at a fixed temperature ranging from 20 K to 70 K. Various performance tests of superconducting wire and coil are done in such environment.

Research Institute of Superconductor Science and Systems, Funaki Lab.

Dilution refrigerator equipped with a superconducting magnet

The refrigerator can go down to a temperature of 50 mK and go up to a magnetic field of 8 T. The rear black panel is a ^{3}He-^{4}He gas handling system.

Applied quantum physics, Kawae Lab.

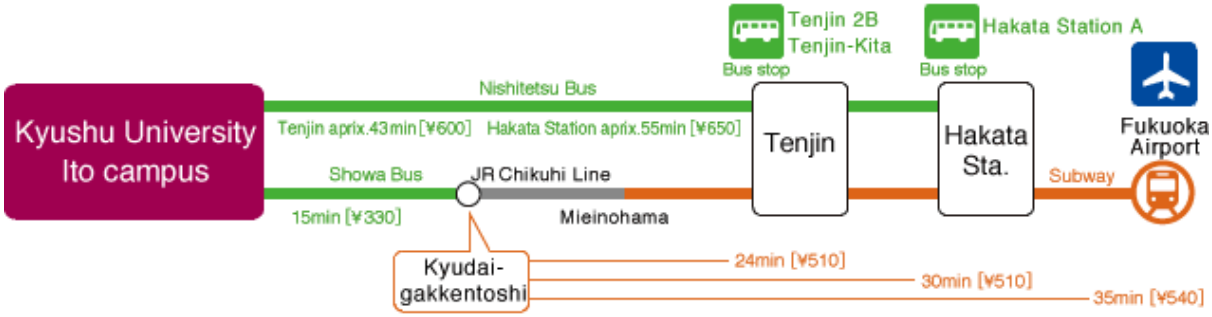
Measurement system for normal propagation phenomena in a high Tc superconducting wire

Liquid helium can be transferred easily from a 250-L vessel to the system using a transfer tube. The relation between normal propagation and cooling effect is investigated in this system.

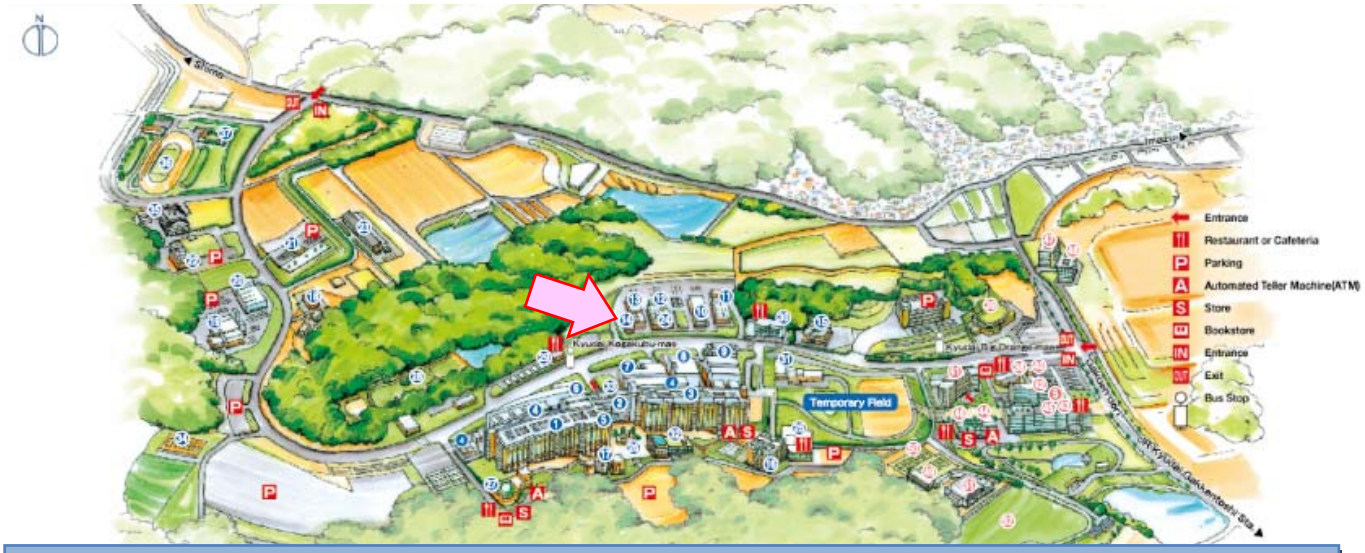
Research Institute of Super-conductor Science and Systems, Funaki Lab.

Access & Fare

http://suisin.jimu.kyushu-u.ac.jp/en/info/index.html



Ito Campus Map



West Zone

1 West Zone 4
2 West Zone 3
3 West Zone 2
4 Engineering Department Experimental Facilities
5 International Student and Researcher Support Center
6 Research Center for Steel
7 Hydrogen Station
8 International Research Center for Hydrogen Energy
9 Research Center for Hydrogen Industrial Use and Storage
10 Research Laboratory for High Voltage Electron Microscopy
11 Institute for Materials Chemistry and Engineering
12 Research Institute of Environment for Sustainability
13 Research Institute of Superconductor Science and Systems
14 Low Temperature Center (Ito Center)
15 Energy Center
16 Faculty of Mathematics
17 Lecture Hall West – Faculty of Engineering
18 Exploratory Research Project Laboratory
19 Center for Advanced Aerospace Engineering
20 Seakeeping and Maneuvering Basin / High Speed Circulating Water Channel
21 Satellite Communication Laboratory
22 Center for Accelerator and Beam Applied Science
23 Agri-Bio Research Laboratory
24 Research Institute for East Asia Environment
25 Ito Library
26 QIAO – Rock Art
27 Big Dora – Restaurant & Shops
28 Biodiversity Conservation Zone
29 Academic Lantern
30 INAMORI Center
31 Student Activity Support Facility
32 Open Learning Plaza
33 Institute of Health Science, West Zone Office
34 Tennis Court (West Zone)
35 Extracurricular Activities Facility II
36 Multipurpose Sports Field
37 Japanese Archery Range

The Low Temperature Center, Ito Branch

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