§11. Standardization of the Fabrication and the Operation Technologies for Large Scale Superconducting and Cryogenic Systems

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i) Introduction

Large superconducting magnets and accompanying large cryogenic systems have been fabricated in a lot of institutes; the Large Helical Device (LHD) is an example. The magnet systems were specially designed for each purpose so that its technology cannot directly transfer to other systems. This is a trouble to large scale superconducting magnet system.

The superfluid helium (He II) database have been arranged for design of superconducting magnet system by arrangement of a large number of data and by investigation of complementary data of He II. Researchers can apply its data for design. Using this database, we suppose that magnet systems can be divided into classes of cooling technology. This concept would be expanded into whole existing large scale magnet systems. Then, we hope to establish the standardization of the fabrication and the operation technologies for large scale superconducting and cryogenic systems.

This group consists of five institutions of various fields: high-energy physics, applications of high magnetic field, power application, fusion science, and so on. Therefore, ideas from various fields can be integrated for the establishment of the standardization.

ii) He II database

The He II database is categorized as shown in Table 1. It has enough information to apply by researchers who design He II cooled magnet system. So far, more than 850 data have been completed in the database.

In FY 2005, we integrated the He II database by searching and collecting data from literatures published from 2000 to 2003. Some new data have been found and have checked on the effectiveness and reliability. Their graphs, figures and required information is still selecting for the database. The utility of the database was also upgraded. Users can search and access required data though the internet web site. For the convenience of its access, the computer for the database was renewed, and the program for its homepage was improved. For easy integration of the database, the method of information input is modified, and data can be directly sent and is stored in the computer though the internet.

Table 1. Technical items for He II database.

Head items	Items	Sub items
Heat transfer	He II pressurized	plate
		channel
	He II saturated	plate
		channel
System	Cryostat	
	Heta exchanger	JT
		HeIIp-HeIIs
	Pumping	vacuum pump
		cold compressor
	Materials	
Cooling technology	Measurement	temperature
		pressure
		flow rate
		level
		miscellaneous
	Special technique	seal
		miscellaneous
Operated cases	Refrigeration Magnet Magnet stability Conductor	

iii) Discussion on the standardization of the fabrication and the operation technologies for the large scale superconducting magnet and cryogenic systems

We discussed how to standardize large scale superconducting magnet and cryogenic systems once in FY 2005. First, we had to have a common idea what is the standardization. Some existing large scale systems: LHD, the Large Hadron Collider (LHC) at CERN, the 920MHz NMR Magnet at NIMS, and 45T hybrid magnet at National High Magnetic Field Laboratory (NHMFL), were chosen as examples for a discussion. Their magnets applied various cooling methods and conductors. We could recognize the difficulty of the standardization because the systems were specially designed with different concepts so that it is difficult to divide the systems into common units. However, only a liquefier, especially a compressor, was thought to be able to become one of example for the standardization. In FY 2006, we will start to consider solutions for the standardization.

Reference:

1) Yuyama, M., et al., Abstracts of CSJ Conference, Vol. 74 (2006), p.101 (in Japanese).