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ISTEC Started the "Superconductors Network Device Project"

In fiscal 2002, International Superconductivity Technology Center (ISTEC: headed by President Hitoshi Araki, Vice Chairman of Japan Federation of Employers' Associations) began to work on the Superconductors Network Device Project (project leader: Professor Hisao Hayakawa of Nagoya University) commissioned by the Ministry of Economy, International Trade and Industry. The five-year project starting in fiscal 2002 is scheduled to be completed in fiscal 2006. The project had a budget of ¥614 million for the initial year.

This project is part of Advanced Telecommunications Device Program that the Ministry of Economy, International Trade and Industry started in fiscal 2002. The project aims to find a way to solve telecommunications traffic jams, caused by increase in networking volumes, and a technical achievement for low-power consumption of the router and server, both of which are important elements of telecommunication infrastructure.

Specifically, the project is going to apply Josephson elements, made from niobium, to demonstrate the functions of ultrahigh speed and low-power consumption that have been difficult to develop so far with existing semiconductor technologies. More specifically, the project is going to develop a switching module for routers and a processor module for servers.

As shown in Figurer 1 below, the project will be carried out under a centralism research. The project staff members consist of dedicated researchers at SRL (Superconductivity Research Laboratory),an R&D division of ISTEC, and researchers temporarily assigned to SRL by member companies in Japan. In addition, universities and national institutes, which exhibited excellent research results in the relevant fields when they took part in re-commissioned portions of the project or when they participated in relevant research areas in the form of collaboration, will be included in the project to develop ultrahigh speed

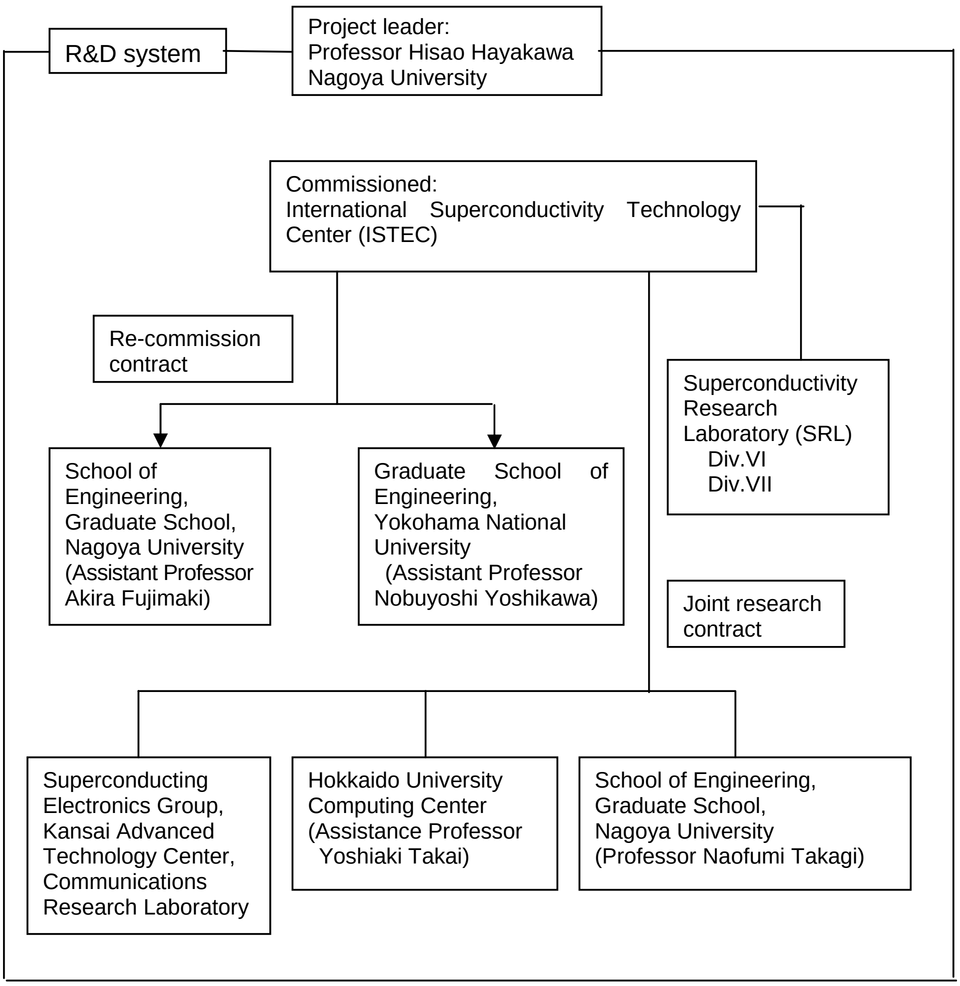

Figure 1 Research System

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network devices. The main R&D work will be carried out by the SRL Low Temperature Superconducting Device Laboratory at the NEC Tsukuba Laboratory.

The Project for Development of a Low Power Consumption Type Superconducting Network Device will work on the four research topics listed below. As shown in Figure 2, the technologies developed in (a) and (b) will be applied to the research topics in (c) and (d).

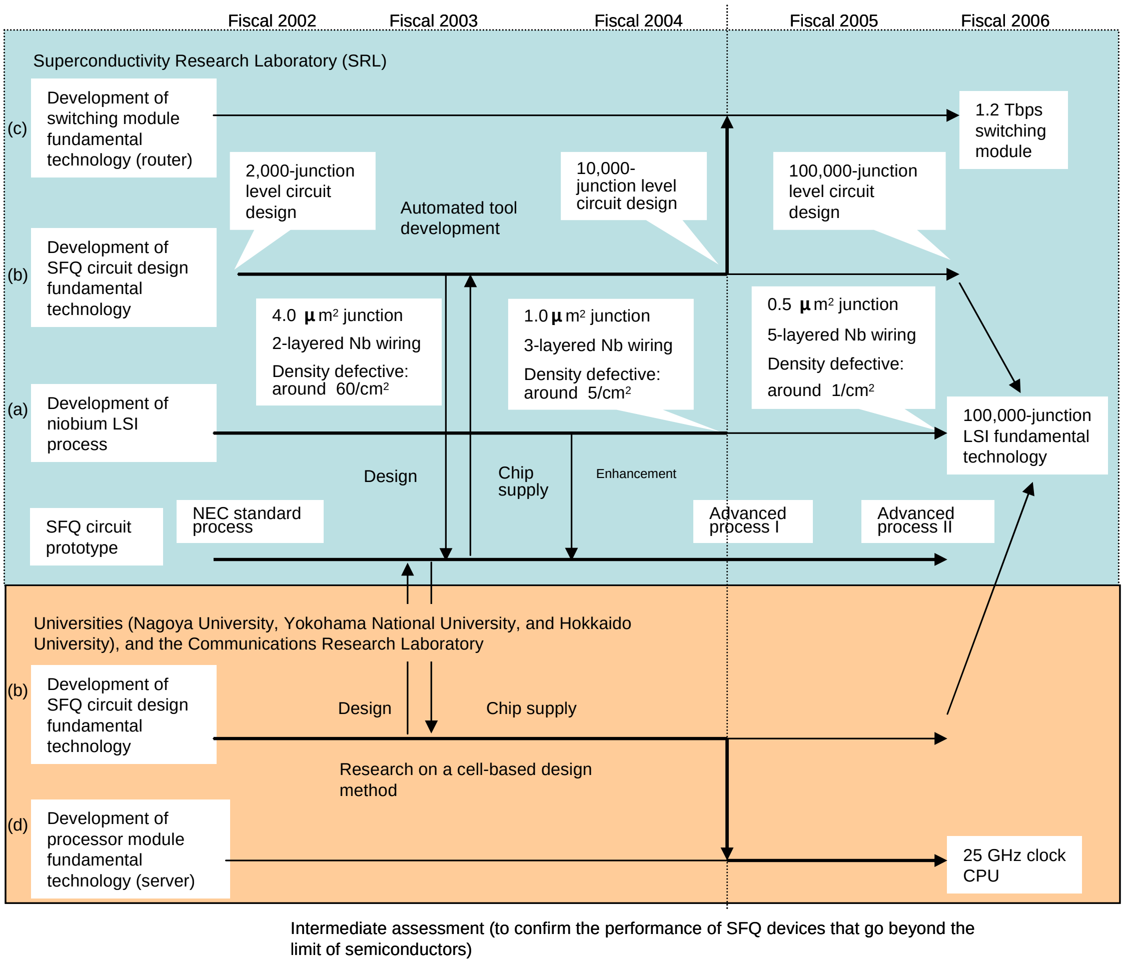

Fig.2 Research Scheme

(a) Development of the Niobium LSI process

The technology that can make several thousand junction level circuits has been developed by a centralized researching on NEC (NEC standard process). The project will improve this technology further to develop a technology that can make some 100,000-junction level circuits (advanced process I and II).

(b) Development of superconducting flux quantum (SFQ) circuit design fundamental technology

This R&D aims to establish SFQ circuit design fundamental technology based on cell-based top-down design. Specifically, the R&D will focus on three areas, namely (1) the logic cell library formation and development of optimal design algorithm tools for logic cells; (2) research on an automated design method and its tool development; and (3) R&D for making high speed circuits, including an optimal circuit architecture and wiring scheme.

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(c) Development of a switching module fundamental technology for SFQ routers

The R&D will focus on the development of an SFQ circuit technology-applied packet switching module. The target performance is 1.2 Tbps. The R&D is subdivided into (1) the development of a router architecture; (2) the development of a packet switching LSI; and (3) the development of an ultrahigh speed SFQ LSI packed module.

(d) Development of processor module fundamental technology for SFQ servers

In anticipation of applying SFQ circuits to a multi-processor-configured server, this R&D will propose and assess an appropriate multi-processor configuration method; propose a micro architecture for a processor module; demonstrate and access the operation of a basic configuration; and demonstrate high speed operation of the configuration circuit (25 GHz clock rate).

The above R&D activities will allow us to assess the ultra high speed and low-power performances of superconducting devices at system level unlike in the past where only small-scale testing circuits were used to access those performances.

(Shinya Hasuo, Director, SRL/ISTEC)

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Present Situation of the HTS-SQUID Development

Hideo Itozaki
Director
SQUID Group, Superconducting Material Research Center
National Institute for Material Science

The operation of the HTS-SQUID was confirmed at an early stage of high-temperature superconductor research. At present, the HTS-SQUID has almost reached the level of practical application after a series of R&D activities on a grain boundary superconducting junction, design of the HTS-SQUID, and its drive electronic circuit.

Moves are underway for the development of devices that apply the HTS-SQUID. Since the HTS-SQUID is easily usable with liquid nitrogen cooling compared with the existing Nb-based SQUID, a broad range of applications is expected. For example, applications are expanding to measurement technologies that use no magnetic shield, such as nondestructive inspection and geological surveys recently. When the SQUID is applied in terrestrial magnetic field, a magnetic flux is trapped onto the superconducting thin film. The thermal movement of the magnetic flux causes magnetic noise. The noise is eliminated when micro slits are created in the thin film of SQUID to deter the flux traps. In addition, remarkable progress has been made in the developments of differential measurement technologies to eliminate enviromental and urban magnetic noise. Concerning the SQUID, a differential SQUID has been successfully developed that can seize the differential magnetic field crossing the two rings by fixing SQUID in the center of a 8-letter shape thin film pickup coil. The SQUID is designed for measurements such as nondestructive inspection where the inspection object can be set relatively near the SQUID. In addition, research is underway to feed back environmental magnetic field to a coil mounted on a SQUID for inspection object measurement to eliminate environmental magnetic noise from the measurement. The research on the improvement of filtering technology is also ongoing.

Concerning research on HTS-SQUID applications, cardiac magnetic field measurement has been promoted as part of bioinstrumentation since its relatively early stage, opening the door to multi-channel applications. In recent years, measurement technology using no magnetic shield has made considerable progress, which encourages easier introduction of the technology into hospitals. Concerning nondestructive inspection, inspection of reinforcing steels in the concrete of bridges and roads and inspection of aircraft wheels have been examined intensively for the past several years in Germany with financial help from the German government. The examinations have indicated practical possibilities of HTS-SQUID for nondestructive inspection.

For field applications, use of HTS-SQUID in geological surveys and metal deposit exploration have been developed in Japan, Germany, and Australia. An example is an application of SQUID to measure a magnetic field formed by shielding current underground, which was caused by the magnetic field transmitted underground. The measurement leads to the formation of a distribution map of electric conductivity underground. Field tests of portable HTS-SQUID have begun in desert areas in China and in the Arctic Ocean.

In biotechnology, Japan, the United States, and Germany have begun to examine the method of detecting the quantity of antibodies magnetically with SQUID by making magnetic particles to react with antigens. Compared with existing fluorescent markers, the SQUID-based detecting method can achieve detection sensitivity several to tens of times higher.

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In semiconductor technology, the development of a laser SQUID microscope is underway. When completed, the non-destructive and non-contact tests will be realized to inspect LSI wafers in their processing courses at a submicronic level of accuracy.

The SQUID has begun to find applications in the inspection of pharmaceuticals and foods, and in the process control of industrial products, where dimensionless metal fractions happen to mix.

As mentioned above, research has been underway to promote applications of the SQUID over a broader range, and has begun to bring about steady results for practical applications. It seems likely that high-temperature superconducting electronics will appear in the form of practical products in the near future.

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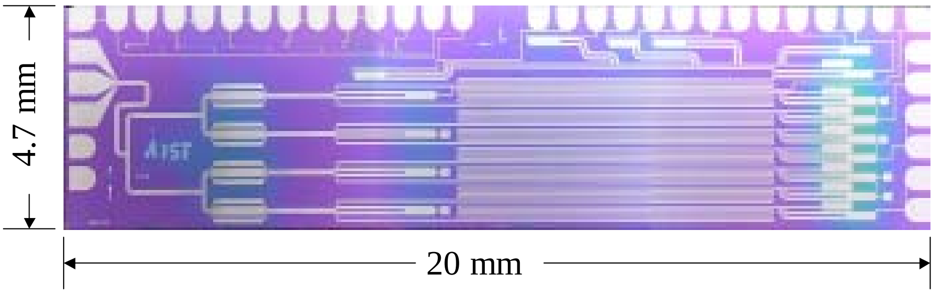
Present Situation of Voltage Standard Development

Akira Shoji
Group Leader
Nano-Electronics Research Institute
National Institute of Advanced Industrial Science and Technology (AIST)

The voltage standard based on the AC Josephson effect is presently adopted as the primary standard by over thirty countries. Specifically, highly accurate voltage up to 10 V (accuracy of $1/10^9$) is obtained by irradiating millimeter waves (70 to 100 GHz) of stabilized frequency (accuracy of $1/10^{10}$) on a chip where usually approximately 20,000 Josephson junctions are integrated. However, the present Josephson voltage standard will be replaced with a new method, called the "programmable Josephson voltage standard," in the near future. The reasons are that the programmable Josephson voltage standard allows highly accurate voltage to be set in a very short time (<1 ms) and the range of bias current that ensures a fixed voltage is over 10 times broader (>1 mA) than the existing range.

For the present Josephson voltage standard, the Nb/AlOx/Nb junctions are adopted that indicate the current-voltage characteristic of hysteresis in ultra low temperature. Meanwhile, for the "programmable Josephson voltage standard," the SNS junctions or the SINIS junctions are adopted that indicate no current-voltage characteristic of hysteresis. Examples of the Josephson voltage standard include the Nb/PdAu/Nb junctions [1)] developed by S.P. Benz et al. of NIST and the NbN/TiNx/NbN junctions [2)] developed by the author and others at AIST. Meanwhile, an example of the programmable Josephson voltage standard includes the Nb/AlOx/Al/AlOx/Nb junctions [3)] adopted by H. Schulze et al. of PTB. Recently, the author and others have successfully developed an 8-bit digital-analog converter (8-bit DAC: photo) where 32,768 NbN/TiNx/NbN junctions were integrated on an Si chip. [2)] The chip can output up to 1 V of voltage under a compact refrigerator and does not use liquid helium. The authors are planning to develop a 10-V standard DAC chip where approximately 320,000 junctions are integrated. Part of the programmable Josephson voltage standard system development at AIST has been conducted under the “Research and Development of Measuring Apparatus Calibration Data System Project” of NEDO.



8-bit DAC Chip for the Programmable Josephson Voltage Standard

1) S.P. Benz, C.A. Hamilton, C.J. Burroughs, and T.E. Harvey: Appl. Phys. Lett. 71 (1997) 1866-1868.
2) A. Shoji, H. Yamamori, M.Ishizaki, S.P. Benz, and P.D. Dresselhaus: presented at ASC 2002. Aug.5-9, Houston, USA (2002) 4EB-03.
3) H. Schulze, R. Behr, J. Kohimann, F. Muller, and J. Niemeyer: Supercond. Sci.Technol. 13 (2000) 1293-1295.

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Present Situation of Tunable Filter Development

Akira Fujimaki
Associate Professor
Graduate School of Engineering, Nagoya University

Researchers were engaging in active research on applications of superconducting filters mainly to base station front-ends of mobile communications because superconducting filters have the characteristics of low loss and sharp cutoff. In recent years, a number of reports have been made on the field tests of superconducting filters that indicated the effectiveness of the filters. The market is now concerned with their commercialization: how much will they cost to produce? When we actually produced superconducting filters, we found that the pass frequencies and the bandwidths were different from their design values because the substrates had different dielectric constants and different thin film characteristics or because they varied due to differences in temperature. To compensate these dispersions, we promoted the development of a tunable filter.

Two tuning methods are proposed: one is to change the dielectric constant by mounting a ferroelectric substance on a superconducting filter and applying an electric field to the substance (electric field control type) and the other method is to change the magnetic permeability by mounting a dielectric magnetic substance on a superconducting filter and applying a magnetic field to the substance (magnetic field control type). According to observation reports made by Kinki University and other research institutions, the magnetic field control type had a slightly larger displacement of 0.3% or so of the central frequency. These methods have a displacement width sufficient to compensate declinations and are good at real-time change. However, the use of such a ferroelectric substance and a ferromagnetic substance will eliminate the advantage of the characteristic of low insertion loss. This is one of the problems that prevent the practical application.

Meanwhile, a group from Kinki, Nagoya, and Osaka universities proposed a mechanical tunable filter that can broaden the range of tuning although the method has the weakness of real-time. Specifically, the method is to tune by lifting up or down a dielectric plate placed above a thin filter through piezo elements and other actuators. This method is applicable to thin films only, which is characteristic of superconducting filters. Some preliminary experiments indicated low insertion loss and 20% of displacement width. In addition, a group from Toshiba realized a variable bandwidth by combining two mechanical tunable filters. At present, an idea is proposed that applies the MEMS technology to a mechanical tunable filter to make it more flexible. Whether these mechanical tunable filters are accepted by the market depends largely on the move for the 4th and 5th generation mobile communication networks to be introduced in 2010 and thereafter. Since the space is limited, detailed explanations cannot be provided here. However, effective use of frequencies and demands for diverse communication qualities are urging high flexibilities in analog components. In this regard, hopes for superconducting tunable filters remain strong.

(1) Tunable filters are detailed in the following document:
Hiroyuki Fuke, Superconductivity News, No. 46 (2001), 16-17; Shigeki Hontsu, Superconductivity News, No. 46 (2001), 18-19

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MgB_2 Josephson Tunnel Junction

Zhen Wang
Leader
Superconductive Electronics Group
Kansai Advanced Research Center, Communications Research Laboratory

The Superconductive Electronics Group, Kansai Advanced Research Center, Communications Research Laboratory, has succeeded in as-grown deposition of magnesium diboride (MgB_2) thin films[1], a new superconductive material found in 2001, and the fabrication of Josephson tunnel junctions using the MgB_2 films at low substrate temperature[2].

The Josephson tunnel junctions with as-grown MgB_2 base electrode, aluminum nitride (AlN) tunnel barrier, and niobium nitride (NbN) counter electrode were fabricated on a single crystal sapphire substrate by using conventional trilayer processes. The MgB_2/AlN/NbN trilayers were continuously deposited on sapphire (0001) substrates in the same vacuum run, and the junctions were patterned by using photolithography, reactive ion etching (RIE), electron cyclotron resonance (ECR) etching, and liftoff techniques[2] [3]. The substrate temperature was set to the range from 200 to 300℃ for deposition of the trilayers, and was optimized with the pressure, deposition rate, and other film depositing conditions. The composition ratios of the films were controlled by controlling sputtering powers of Mg (DC sputter) and B (RF sputter) independently.

Figure 1 shows an example of I-V characteristics and dI/dV-V characteristics of the MgB_2/AlN/NbN tunnel junction fabricated on a sapphire substrate (0001). The junction size is 20 µm x 20 µm. Super currents and quasiparticle tunneling current were clearly observed at the zero and 4 mV voltage. This is the first result for MgB_2 tunnel junction, made by the conventional trilayer process, with an I-V characteristic that showed a sharp gap structure. To investigate the Josephson tunneling properties, we measured the dc magnetic field dependence of the critical current and the temperature dependence of the gap voltage. We found that the junctions showed an ideal Fraunhofer pattern and the BCS-like temperature dependence of the gap voltage, indicating good Josephson tunneling and quasiparticle tunneling characteristics in our MgB_2 tunnel junctions[2]. The junctions showed good I-V characteristics with small subgap leakage currents and an ideal Fraunhofer pattern, although the junctions had ultra-thin AlN tunnel barriers (0.8 nm). This suggests that there is a flat-surface at MgB_2 base electrode and a uniform distribution of the tunnel currents. Accordingly, the next step is expected to realize all-MgB_2 tunnel junctions.

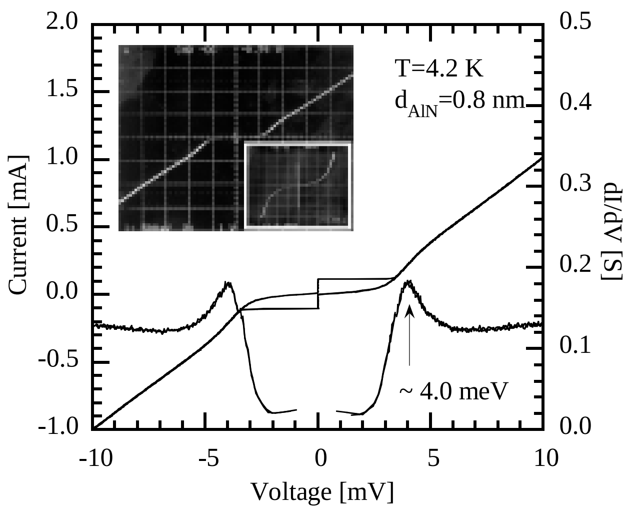

Fig.1 I-V and dI/dV-V Characteristics of a MgB_2/AlN/NbN Tunnel Junction

MgB_2 is positioned in the middle between Nb, the major material of the existing superconductive electronic materials, and oxide high-T_c superconducting materials that are expected to play a major role in the future. MgB_2 could break through the limit of Nb's gap

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frequency and difficulties in fabricating multilayer and integrated circuit of high-T_c superconductors. In the future, progress in the developments of MgB_2 thin films and tunnel junctions will play the key role in superconducting electronics and understanding of the material physics.

References:

[1] A. Saito, A. Kawakami, H. Shimakage, and Z. Wang, "As-Grown Deposition of Superconducting MgB_2 Thin Films by Multiple-Target Sputtering System, " Jpn. J. Appl. Phys., Vol.41, Part 2, No.2A, ppL127-L129, Feb. 2002.

[2] A. Saito, A. Kawakami, H. Shimakage, H. Terai, and Z. Wang, "Josephson tunneling properties in MgB_2/AlN/NbN tunnel junctions," submitted to J. Appl. Phys., 2002.

[3] Atsushi Saito, Akira Kawakami, Hisashi Shimakage, Zhen Wang, "As-Grown Formation of MgB_2 Thin Film and Josephson Junction Formation," Institute of Electronics, Information and Communication Engineers, Shingaku Jiho Vol. 102, No. 10, pp. 7-12, 2002.

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What Is Expected of the Small-Capacity SMES

Among applications of superconductivity technologies to electric power areas, the Superconducting Magnetic Energy Storage (SMES) has a number of advantages compared with existing energy storage systems. The advantages include high storage efficiency and speedy input and output of energy. These advantageous functions of the SMES are expected to contribute to the stabilization of power systems, upholding of electricity quality, leveling of loads, and many other effects.

Under this environment, researchers at ISTEC have been working on the development of the SMES for small-capacity power system control technologies. This is because such the SMES probably could be materialized and demand for the SMES is potentially strong in society, where the number of distributed power sources is increasing due to ongoing liberalization of electricity in the retail market, demands for enhanced power system control technologies are growing due to greater load in changes of electricity demand, and the number of power sources is expanding. The major subject of the SMES development lies in the reduction of product costs. Researchers at ISTEC have been working on the technological development of low-cost superconducting coils, commissioned by NEDO, for a period from fiscal 1999 to fiscal 2003.

Table 1 shows the relation between SMES applications and their capacities.

Table 1 SMES Applications and Their Capacities

Capacity / Application	Micro: 1kWh-class	Small: 100kWh-class	Medium: 10MWh-class	Large: GWh-class
Instantaneous voltage drop	○	○	△	
Improvement in stability		◎	△	
Load fluctuation compensation		◎	○	
Frequency control		○	○	○
Load leveling			△	◎

As is listed in Table 2, SMES for small-capacity power system control has diverse functions. When SMES is introduced into a power system, the power system will be stabilized, and the quality of electricity will be upheld. In addition, cut in the emission of carbon dioxide will contribute to the environment, and technological ripple effects will bring about a broad range of industrial effects.

This project has made steady progress and won a high mark in an intermediate assessment conducted by NEDO. In fiscal 2002 to 2003, the project will undergo verification tests of the functions through an economical design model coil and examine costs. Furthermore, through demonstrations and other tests for system reliability, SMES will be thrown into practical application hopefully around 2010.

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Table 2 Functions of SMES for Small-Capacity Power System Control

Application	Installation site	Power system stability control		
		Static (dynamic) condition stability	Transient stability	Voltage stability
Power system stabilization	Power plant	◎	◎	
	Intermediate (switch yard)	○	○	○
Frequency control	Ultra-high voltage substation	△	△	○
	Primary and secondary substations			◎
Load fluctuation compensation	Primary to secondary distribution substations			◎
	Consumers			

Application	Installation site	Frequency control		Voltage control
		Frequency adjustment in governor-free areas	Frequency control in LFC areas	Voltage control
Power system stabilization	Power plant			
	Intermediate (switch yard)			◎
Frequency control	Ultra-high voltage substation	◎	◎	◎
	Primary and secondary substations	◎	◎	◎
Load fluctuation compensation	Primary to secondary distribution substations			◎
	Consumers			◎

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Application	Installation site	Load following control		Reliability control
		Control of fluctuations by the second	Control of fluctuations by the minute	Avoidance of instantaneous outrage or instantaneous voltage drop
Power system stabilization	Power plant			
	Intermediate (switch yard)			
Frequency control	Ultra-high voltage substation			
	Primary and secondary substations			
Load fluctuation compensation	Primary to secondary distribution substations	◎	◎	
	Consumers	◎	◎	◎

Legends: ◎:Very effective, ○:Effective, △:Not very effective

(Seiichi Koso, Research and Planning Dept., ISTEC)

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Situation of Low Temperature Superconducting SMES Development

Shunji Taniguchi
Leader
Power Storage Technology Group, Research Institute
Kyushu Electric Power Co., Inc.

The development of a micro (several MW/several MJ capacity) Superconducting Magnetic Energy Storage (SMES), where Nb-Ti and other low-temperature superconductors are applied, has already reached the stage of practical application. And these micro SMES units can be manufactured even with existing technologies.

The development of a larger capacity SMES unit is underway, including the development of conductors, coils, and other element technologies. For practical application, the controllability and reliability of these elements and their system verification must be examined at pilot plants. The recent major developments are as follows:

For the "Development of the Superconducting Magnetic Energy Storage (SMES) System Technology", a national project of Japan, the technological development of an SMES for small-capacity power systems is underway centering on ISTEC, the major contractor of the project. Japanese electric power companies and manufacturers have also participated in the project. During fiscal 2002 to 2003, the project is scheduled to hold performance assessment tests of element model coils (10 kA-class CIC conductor; storage capacities stand at 2.8MJ and 10.5 MJ) for power system stabilization (100 MW/15 kWh (54 MJ) at Kyushu Electric Power Co. Inc. and for load fluctuation compensation and frequency control (100 MW/500 kWh (1.8 GJ)) at Chubu Electric Power Co. Inc.

Besides, Kyushu Electric Power Co. Inc. installed a 1 MW/1 kWh (3.6 MJ)-class module SMES unit (two-module configuration) at Imajuku Test Center in March 1998. The unit is designed to verify element technologies where SMES will be applied for load leveling, power system stabilization, load fluctuation compensation, and to check the effectiveness of SMES on the power system. Diverse experiments of module characteristics, system interconnection tests, overload tests, and other advanced tests have been conducted for the past four years at the Imajuku Test Center to broaden the functions of SMES. At Chubu Electric Power Co. Inc., the development of a 5 MW/7.5 MJ micro SMES is underway, which hopefully will be completed in fiscal 2003. The micro SMES is designed to compensate instantaneous voltage drops which occur mainly when a lightning accident takes place on a transmission line. The SMES units will be installed at the site of real consumers in Japan to verify the compensation system against instantaneous voltage drops (eventually, a 10 MW-class oxide superconducting micro SMES is targeted).

For overseas R&D activities, American Superconductor in the United States has already released a 3 MW-class micro SMES in the commercial market. As of September 2002, over 20 micro SMES units have been installed in existing power systems in the United States and several other countries.

It is said that the Center for Advanced Power Systems is going to install a 100 MJ/100 MW SMES to start experimental operation in 2004.

All of the SMES units in Japan and abroad use Nb-Ti wire for superconducting magnets. Nb-Ti wires are most preferable because they are low-priced, easy to process, and demonstrate more stable performance than any other materials of this kind. We expect that the development of an SMES that uses high-temperature superconductors will make progress and further reduce production costs.

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Situation of High-Temperature Superconducting SMES Development

Shirabe Akita
Director
Electricity and Physics Div., Komae Research Laboratory
Central Research Institute of Electric Power Industry

If an SMES with a high-temperature superconducting wire is realized, it will give a large margin up to the critical temperature under superconducting condition. This will create an extremely convenient condition to operate, like existing oil- cooling-type power equipment. This is because the specific heat of the superconducting coils is extremely large compared to that of low-temperature superconducting coils. Superficially, such an SMES will allow for rises of transitional temperature when electric energy is charged and discharged, and the SMES superconducting coil will be characterized as having almost no quench.

At present, "Research on High-Temperature Superconducting SMES Technology" is underway. The research has been commissioned to ISTEC as a NEDO project by the Agency of Natural Resources and Energy. Specifically, the research is examining a possible conduction cooling system by using a cryocooler to cool down superconductors, which meets advantages of high-temperature superconducting SMES. This is because in conduction cooling the same cooling system can be used to cool down the temperature of the superconductor coil even when the temperature greatly varies, which allows you execute the transitive operation of SMES by using the specific heat of the superconducting coil. For example, a current that exceeds the critical current can be carried by high-temperature superconducting coil for SMES in cases, such as power system stabilization operation, which require a large capacity of energy to absorb in a short time. In addition, the SMES against instantaneous voltage drops can accommodate generations of AC loss that exceeds the capacity of the cooling system during operation.

To examine whether transitive SMES operation is feasible or not, we have made a small prototype coil to assess the characteristics of five types of 10-cm diameter superconducting coil units where Bi-2212 and Bi-2223 wires were applied. We used these prototypes to conduct transitive operation tests under the conduction cooling condition by using a freezing machine. As a result, our power system stabilization operation revealed that a current that exeeds the critical current can be carried. In addition, our experiments with high-temperature superconducting coil for SMES revealed that high-accuracy SMES design that includes transitive characteristics is possible since the characteristics of the wire allows you to estimate the characteristics of the coil easily. At present, we are examining operational characteristics of a small prototype coil made from Bi-2212 wire with a diameter of 70 cm class. The examination aims to check whether we can adopt a design that can predict temperature distributions in a high-temperature superconducting coil under conductive cooling system conditions.

Furthermore, since invasion heat from the current lead is dominant in a high-temperature superconducting SMES, a large current lead will be the key to realizing SMES in the conduction cooling system. Thus, we devised a system where a current lead was combined with a GM system pulse tube cryocooler. So far, we have confirmed stable operations up to 850 A.

As mentioned above, technologies necessary for the realization of a high-temperature superconducting SMES are steadily underway in Japan. However, many other nations are of the opinion that the development of a high-temperature superconducting SMES should be started only after such a conductor is successfully developed since the largest technological subject lies in the realization of a high-temperature superconductor for SMES. Thus, we could say that, at present, Japan's high-temperature superconducting SMES technology is ahead of other nations.

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SMES from the Viewpoint of Electric Power Companies

Shigeo Nagaya
Leader
Superconductivity and New Material Team
Electric Power Research and Development Center
Chubu Electric Power Co., Ltd.

In the power field, the goal of development of electric energy storage technology in the past was leveling power loads during day and night. In the SMES field, the SMES concept was proposed that could replace a pumped storage power station by using bedrocks in the underground as the structural support. The SMES research was very active in the 1990s, stimulated by findings of oxide superconductors.

In those days, manufacturing a magnet using a metal superconductor had only a few problems so long as the energy storage required an MJ or less. The development of the SMES was conducted by making the SMES at laboratory level and examining the effectiveness of the SMES by the test equipment that simulates a power system. This is because efficiency is the most requirements for energy storage technology. In particular, since efficiency, especially the efficiency of power conversion of the SMES meant the electric energy/magnetic energy conversion, the efficiency was very high compared with other methods of power conversion. Thus, researchers' concerns were naturally focused on the advantages of the SMES.

Results of the SMES experiments at the laboratory confirmed many advantages of the SMES, including load leveling, independent control of effective and reactive power, and good time-responsiveness. These advantages are ideal for power system control equipment.

Naturally, the next stage should have been to develop a relatively small-capacity SMES for power system control. A successful development and operation of the SMES was supposed to open the door to the development and practical application of a large-capacity SMES for load leveling. However, like other superconductive equipment, the SMES is very costly. In addition, recent moves for partial deregulation of power in the retail market and introduction of distributed power sources have changed some of the major requirements for the SMES; load leveling was no longer the primary concern. Researchers are now discussing most appropriate applications of the SMES and accordingly working on the development of an SMES.

These applications can be classified into two areas: one is to apply the SMES to charge and discharge the entire stored energy by the second, using the good time-responsiveness of the SMES. This will contribute to the stability of a power system on the supply side and to the compensation of instantaneous voltage drops on the load side. The other area includes applications for load leveling on trains and other industries that require frequent loads, and for the stabilization of variable power sources such as wind power. This is because the SMES has less degradation of electricity by repeated charges and discharges and has a much longer cycle life compared with that of batteries.

Small-capacity SMES units for power system stabilization, called "micro SMES" units, are in practical use overseas. The SMES to compensate instantaneous voltage drops will be in practical use soon in Japan. However, the present metal SMES has limitations in making a higher magnetic field because the metal is costly. Thus, the true practical use lies in the realization of the SMES that uses a superconducting wire with strong characteristics, high critical temperature, and high operational reliability.

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Present Situation of Bulk Superconductor Application Research

1. Introduction

The bulk superconductor is a block of high-temperature superconductor (HTSC). In this report I will focus on bulk $REBa_2Cu_3O_7$ (RE: rare earth element)-based superconductors. Once the applications of low-temperature superconductors (LTSC) in a bulk form were sought. Since LTSC's are thermally unstable, no practical applications have been realized so far.

For HTSC's, thanks to their high stability the applications in a bulk form are possible. The advantage of bulk HTSC's is their relative easiness for fabrication since they are brittle ceramics. Besides this, the number of elements to be handled is many in HTSC, so its control is very difficult in a complicated form.

However, process development in the bulk superconductor production has cleared these problems, opening the door to the control of characteristics of materials. Now research is underway for engineering applications.

Applications of the bulk superconductors are classified into three major areas. Below are descriptions of the present status of applied research in these three areas.

2. Application to Levitation

The key to the application of the bulk superconductor lies in the fact that the bulk superconductor can be stably levitated without any control. There are many technologies to levitate objects. However, the bulk superconductors alone can be suspended stably because of the pinning effect.

An example of levitation applications is a flywheel system for energy storage, introduced in the special supplement of this issue. Many researchers are attempting to develop flywheel applications. When superconductivity is used successfully, rotation loss can be kept at minimum level, opening the way to long time storage. In recent years, a growing number of mechanical flywheels have been accepted, replacing battery-type storage system. For these applications, minimizing rotation loss is still important.

In the United Sates, application to backup power supplies for computers is being proposed. Meanwhile, Japanese electric power companies are engaging in the development of large-capacity flywheels that will be mainly installed in transformer stations to level load during day and night. The development of a small-capacity flywheel is also important.

Researchers are also examining possible applications of bulk superconductors into transportation of semiconductors and other logistics. As shown in Figure 1, China has successfully made a magnetically levitated vehicle for five passengers! A vehicle installing bulk superconductors cooled by liquid nitrogen is levitated above a guide rail made of Fe-Nd-B magnet. Since little friction is generated in the translational direction, a simple linear motor can drive the vehicle back and forth. President Jiang Zemin has tried riding on the vehicle. So China is deploying nation-wide support to the development of the vehicle.

Fig.1 A five-passenger vehicle maglev developed by Southwest Jiaotong University in China. The maglev vehicle installing bulk superconductors levitates above a guide rail made of Fe-Nd-B magnet.
(from a Southwest Jiaotong University pamphlet)

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3. Magnet Application

From the viewpoints of making effective use of bulk superconductors, magnet applications are the most appropriate. Since the levitation uses an external magnetic field source, the output is limited by it rather than the full capacity of bulk superconductors.

Meanwhile, magnet applications use the entire pinning forces of the superconductor. A bulk superconductor magnet can trap 3T at 77K and 15T at 30K. Since there was no bulk magnet that generated such strong magnetic fields in the past, there is no sample of applications unlike superconducting wires and superconducting devices. Thus, we have to develop new application areas of strong magnetic fields.

As shown in Figure 2, Aishin Seiki and IMRA Materials Laboratory have successfully developed a system where the magnetic field of the superconducting bulk magnet can be used. The idea of offering a magnetic field generation system for research and developments is an important milestone as an application of bulk superconductors.

Fig. 2 A magnetic field generator, sold by Aishin Seiki, uses a superconducting bulk magnet. The generator can provide 3T of magnetic field in free space. The development has been jointly carried out by IMRA Material and Nagoya University.

Meanwhile, an ideal application example of the superconducting bulk magnet is found in the magnetic separation system for water purification, developed by Hitachi. Most of the existing magnetic separators for water purification use a filter to separate contaminants from water. However, dust materials attached on the filter must be removed from the filter, which requires additional work for the user. On the other hand, Hitachi's magnetic separator uses the superconducting bulk magnet to separate dust materials off the filter. The superconducting bulk magnet separates dense dust off the filter and keeps the filter clean, resulting in maintenace-free operation.

A research group at Nagoya University has shown the possibility of making high-performance thin film by using a superconducting bulk magnet instead of using a permanent magnet installed in magnetron sputtering equipment. The research group is actually working on the development of such a system.

As described above, the superconducting bulk magnet could explore new industrial applications, depending on the idea.

4. Conductor Application

Since high-temperature superconductivity was discovered, a number of researchers have been working on the possible applications of bulk superconductors to current leads. In fact, the development of high-temperature superconducting leads has led to superconducting magnet operation with cryo-coolers. However, since mechanical strength of high-temperature superconducting leads is poor, one needs to carefully handle them in practical operation.

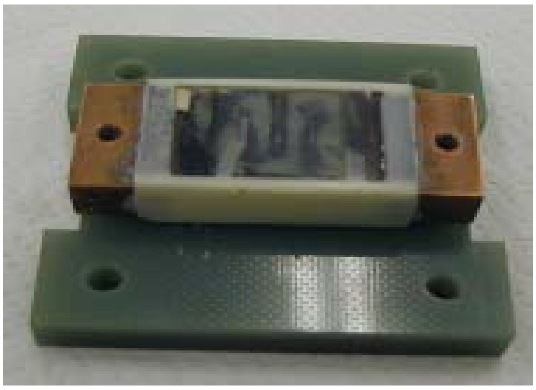

Fig. 3 Bulk Superconducting lead where epoxy resin is impregnated. Experiments are planned for Maglev. (Credit: Masaru Tomita of Railway Technical Research Institute)

At present, Bi-Sr-Ca-Cu-O bars are used as the main materials for current leads. However, since these materials are low in critical currents in magnetic fields, the magnetic fields need to be shielded, or the current lead needs to be distant from the magnetic source.

Meanwhile, RE123-based materials are good in magnetic field characteristics but inferior in mechanical characteristics. As shown in Figure 3, the latter problem can be solved with epoxy resin impregnation. A recent experiment on fatigue tests has revealed that a resin-impregnated RE123 bulk could be used for the current lead to the superconducting coils for Maglev. Thus, the Railway Technical Research Institute is going to test the feasibility of bulk RE123 leads to Maglev system in the near future.

5. Summary

RE123-based superconducting bulk materials have already exceeded critical currents needed for superconductivity applications through improvements in processing technologies. The mechanical properties have been improved through epoxy resin impregnation and reached the level for practical applications. In addition, that resin impregnation contributes to the enhanced resistance against environmental corrosion. These successful improvements and developments have laid the foundation for full-dressed applications of the bulk superconductors. As described here, a number of practical application projects for industries are underway. Depending on the idea of researchers, more interesting applications will emerge in this field.

(Masato Murakami, Director, Divs. I & III, SRL/ISTEC)

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Present Status in Research and Development for Superconducting Bearing Technology for Flywheel Energy Storage

Flywheel energy storage has many advantages: high in energy storage density; repeated charge and discharge of electricity; and environmentally friendly because of no emissions of hazardous waste. Expected applications include load leveling, the system to compensate load fluctuations, and the uninterruptible power supply (UPS) system for data centers. Existing systems with mechanical bearing or magnetic bearing have large rotation loss and consume considerable power during idling state. In addition, their capacities cannot be enhanced because the magnetic bearing alone does not have enough loading capacity. The superconducting bearing, a combination of high-temperature bulk superconductor and permanent magnet, has emerged as an innovative technology that can improve rotation loss and loading capacity. NEDO under the Ministry of Economy, International Trade and Industry (formerly the Ministry of International Trade and Industry) started the technological development project for a superconducting bearing applicable to the flywheel energy storage system in 1995. The project reached the second phase in fiscal 2000. The project members consist of ISTEC, Shikoku Research Institute, IHI, Koyo Seiko, Sumitomo Special Metals Co., and IMRA Material R&D Co., with the cooperation of AIST.

This project has engaged in the technological developments of loading capacity improvement, rotation loss reduction, and creep reduction for the radial superconducting bearing whose capacity can be enhanced for the flywheel energy storage system. Specifically, the project aims to provide a technological forecast on the superconducting bearing for a 100kWh-class superconducting flywheel energy storage system. The project also aims to make a 10kWh-class superconducting flywheel energy storage system for experimental operation, which will reveal problems of system element technologies that must be cleared.

Concerning the research on bearing element technology, we have made a 10kWh-class radial bearing module, made of a YBCO bulk stator and a NdFeB permanent magnet rotor, and are assessing the module. Concerning loading capacity, we have achieved approximately 8N/cm^2 of loading caspacity against 10N/cm^2 at 77K of target value, and 2.5mW/N of rotation loss against 2mW/N of target value. Concerning bearing drop due to flux creep, we have found supercooling and pre-loading are effective to deter bearing drop.

Concerning the 10 kWh-class test machine, we plan to rotate an approx. 400kg rotor including a CFRP flywheel at 15,000 rpm or higher. We have to find methods for how to control vibrations, generated when the heavy rotor is rotated at the high speed, and how to obtain the mechanical strength necessary for the rotation. In addition, we have repeated experiments with a medium-capacity rotation test machine with magnet bearings, and now have a good prospect for realizing high speed stable rotation by the improvement of the weight imbalance of the heavy flywheel and by contrivances for the magnet poles of the active magnet bearing for axis vibration control, and for the control method. At present, we are working on the detailed design of the system and making components for a 10 kwh-class operation test machine, which will be built and tested during fiscal 2003.

(Naoki Koshizuka, PL of "Research and Development of Superconducting Bearing Technology for Flywheel Energy Storage", Deputy Director General, Morioka Laboratory, SRL/ISTEC)

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Successful Launch of Bulk Superconductor Experimental Satellite on September 10

On September 10, 2002 at 17:20, H-IIA rocket No. 3 successfully lifted off the launch site at Tanegashima Space Center as scheduled. Many of you may remember the launch because the launch was televised and reports appeared in the newspapers. The launch, called a "double-launch," involved two mounted application satellites. Some 14 minutes after the launch, the next generation unmanned space experimental system (USERS) satellite was separated from the rocket at an altitude of 450 km, and then some 29 minutes later, a data relay technology satellite (DRTS: called "Kodama" now) was separated from the rocket.

One of the experiments to be conducted in the USERS satellite is an experiment with the crystal growth of bulk superconductor. Although the mass media did not mention the name SRL, the laboratory is in charge of the experiment. SRL has been working on the development of a magnetic bearing, magnetic separator, and superconducting pseudo-permanent magnet, by using a RE-Ba-Cu-O-based (RE: rare earth elements) large-sized bulk superconductor for practical application. The magnetic field that a RE-Ba-Cu-O-based bulk can trap is proportional to the critical current density and the bulk diameter. Making a large-sized bulk superconductor with good characteristics is not easy on earth because of reactions with substrate materials and leakage of liquid phases and so on. However, under the microgravity environment, it is possible to hold and support one point of a seed crystal to grow the bulk by applying no substrate materials. In principle, to make even quality and large-sized bulk with no deterioration of characteristics is possible. In this growth experiment, the material to be produced will be large, having 127 mm in diameter and 20 mm in thickness. When the growth experiment succeeds, we will be able to trap a magnetic field of nearly 5T at 77K (A material to be produced in this growth experiment is ten to several thousand times larger than the materials produced in past growth experiments held in the microgravity environment. Besides, the microgravity environment has many restrictions. Thus, experts on experiments in space assess this growth experiment as pretty hard.) Details of the experiment and progress will be released later when the time is appropriate.

After the launch of the rocket, our visual inspection lasted 3 to 5 minutes. Afterwards, we relied on data transmitted from the H-IIA rocket and the satellites to judge whether the experiment succeeded or not. According to the information as of September 16, the USERS satellite rose on to the scheduled orbit (515 km) by itself. The USERS satellite executed the checkout of the bus system on and after September 17; executed the checkout of the experimental equipment on and after September 26; and is expected to start experiments assigned to SRL on and after October 2, 2002.

Incidentally, the USERS satellite will be separated to REM (Re-entry module) and SEM (Service Module) 8 months after the launch. The REM, where bulk specimens after the experiments are carried, will return to the coast of the Ogasawara Islands for recovery. Afterwards, a variety of experiments with household appliances will be carried out in the microgravity environment of the SEM for two and a half years.

(Naomichi Sakai, Div. III, SRL/ISTEC)

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Superconductivity Related Products Guide

-- Superconducting Digital Equipment Under Development --

AD converter for radio communication:
- Project on "Research and Development on Basic Technologies Required for Superconductivity"
Target: Wide bandwidth and high-accuracy Σ - Δ type AD converter for software radio
Development stage: Succeeded in the demonstration of the LTS-applied 300-junctions Σ - Δ type AD converter operation (Analog frequency: 10 MHz; Bit accuracy>5; Power consumption: 28 μW); Succeeded in 100 GHz operation of an HTS-applied 13-junctions Σ - Δ type AD modulator
Project leader: Shoji Tanaka (Director, SRL)

Switch for Higher End routers:
- Project for "Development of a Low-Power Consumption Type Superconducting Network Device"
Target: Development of a switching module for LTS-based SFQLSI-applied routers and of processor module for servers
Development stage: Started in fiscal 2002
Project leader: Hisao Hayakawa, Professor, Nagoya University

Sampler:
- Project on "Research and Development on Basic Technologies Required for Superconductivity" and NEDO's immediate-effect proposal-based project (H10)
Target: Digital waveform measurement instruments, Current waveform measurement instruments
Development stage: Succeeded in HTS sampler-based 20 GHz cine wave current waveform measurement and 5.9 Gbps digital waveform measurement

-- Superconductivity-Applied Industrial Equipment (partly under development) --

Superconducting semiconductor single crystal growth device:
- Mitsubishi Electric Corporation
"Superconducting Magnet for Silicon Single Crystal Growth Device"
Contact: Tsuneaki Minato, Accelerator & Superconductivity-Applied Technology Section, Power and Industrial System Office, Tel: +81-78-682-6124

- Toshiba Corporation
Low-Temperature Superconductor-Applied Silicon Single Crystal Growth System
High-Temperature Superconductor-Applied Silicon Single Crystal Growth System (Demonstration system No. 1 completed)
Contact: Shoji Kawazu, Product Development Promotion Dept., Nuclear Power Division, Power Systems & Services Company, Tel: +81-3-3457-3793

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Superconducting magnet-levitated railway (under evaluation test for practical application)

- Railway Technical Research Institute

"Superconducting Magnet-Levitated Railway Yamanashi Experiment Center" (Evaluation test for practical application, including long-runs of a low-temperature superconductor (LTS)-applied vehicle

Contact: Levitated Railway Development Headquarters

Superconducting dynamotor (under development)

- Shinko Electric Co., Ltd.

Bulk Superconducting Magnet-Applied Dynamotor and Testing Equipment, sponsored by Central Japan Railway Company

http://www.shinko-elec.co.jp

Contact: Servo Actuator Sales Dept., Tel: +81-3-5683-1324 Fax: +81-3-5683-1168

-- Superconductivity Related Measurement Equipment and Products --

Voltage Meter

- Keithley Instruments Inc.

2182-Type Nano-Volt Meter; 2002-Type Super-Digital Multi-Meter; Nano-Volt Preamp for 2002-Type DMM; 7001-Type Switching System Main Unit; 7168-Type 8-Ch Nano-Volt Scanner Card

Contact: Mr. Uchiyama (Marketing)
Tel: +81-3-5733-7555 Fax: +81-3-5733-7556
e-mail:info.jp@keithley.com
URL: http://www.keithley.jp (Japanese)
URL: http://www.keithley.com (English)

Temperature Sensors & Temperature Measurement Devices

- Toyo Corporation

Capacitan Bridge 2700A type; Temperature Controller 331 Series; AC Resistance Bridge 370 Type
Contact: General-Purpose Measurement Instrument Sales Dept.
Tel: +81-3-3279-0771 Fax: +81-3-3246-0645
e-mail: gpi@toyo.co.jp http://www.toyo.co.jp

- Niki Glass Co., Ltd.

High-Accuracy Temperature Controller Model 62, Model 84, Model 32 made by Cryogenic Control Systems Inc.

Contact: Low-Temperature Equipment Group
Tel: +81-3-3456-4700 Fax: +81-3-3456-3423
http://www.kagaku.com/niki

- Nippon Automatic Control Co.

Model 9700 High-Performance Temperature Controller; Oxide Ruthenium Temperature Sensor (available in a magnetic field) Model RO600&RO105

Contact: Mr. Moriya, Science System Dept.
Tel: +81-3-5434-1600 Fax: +81-3-5434-1630
e-mail:nacc-toc@xa2.so-net.ne.jp

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Data Recording System:

- Keithley Instruments Inc.

2701-Type Internet-applicable Multi-meter Data Recording System; 2700/2750-Type Switch/Measurement Systems
Contact: Mr. Uchiyama (Marketing)
Tel: +81-3-5733-7555 Fax: +81-3-5733-7556
e-mail:info.jp@keithley.com
URL: http://www.keithley.jp (Japanese)
URL: http://www.keithley.com (English)

Power Source Related Equipment

- Keithley Instruments Inc.

2400-Type Series Source Meter; 6430-Type Super Wide Range Current Source
Contact: Mr. Uchiyama (Marketing)
Tel: +81-3-5733-7555 Fax: +81-3-5733-7556
e-mail:info.jp@keithley.com
URL: http://www.keithley.jp (Japanese)
URL: http://www.keithley.com (English)

Cryostat Related Equipment

- JECTRI Co., Ltd.

LHe & LN_2 Cryostat; Subcool LN_2 Circular Cooling system; He Free SCM Cryostat
Contact: Head Office and Plant
Tel: +81-49-225-7555 Fax: +81-49-225-7558

Nippon Automatic Control Co.
Cryostat for NMR; Top Load Cryostat
Contact: Mr.Moriya, Science System Dept.
Tel: +81-3-5434-1600 Fax: +81-3-5434-1630
e-mail: nacc-toc@xa2.so-net.ne.jp

(Yasuzo Tanaka, Editor)

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What's New in the World of Superconductivity (November)

Power

American Superconductor Corporation (November 4, 2002)

American Superconductor Corporation announced that it has completed the manufacturing and testing of a rotor assembly for the world's first HTS ship propulsion motor. The rotor assembly will be installed in a high torque, low speed (230 rpm), 5 MW prototype motor that is being developed under contract for the U.S. Navy's Office of Naval Research. American Superconductor has shipped the rotor assembly, which includes HTS coils wound with American Superconductor's HTS wire, an integrated refrigeration component, and other mechanical components, to ALSTOM's Power Conversion Business in the U.K. ALSTOM has been contracted to build the stator, and the final assembly and factory testing of the complete motor will occur in their facilities. In July 2003, the Navy will acquire possession of the motor and begin testing. The HTS motor will be half the size and weight of a conventional motor (built with copper coils); as a result of its higher electrical efficiency, its electrical losses will also be less than half of a conventional motor's losses. HTS motors are expected to revolutionize the commercial marine and navy ship industries because of their low weight, small size, and high efficiency. While the present 5 MW motor is suitable for many classes of passenger and merchant vessels, the next key step in the development of military and commercial HTS ship propulsion motors will be the demonstration of a 25 MW/120 rpm motor. The global market for electric ship propulsion systems is expected to grow from an annual total of US $ 400 million today to $ 2 – 4 billion in only 10 years.

News Source:
"American Superconductor Ships Rotor Assembly for World's First HTS Marine Propulsion Motor to ALSTOM Power Conversion"
American Superconductor Corporation press release (November 4, 2002)
http://www.amsuper.com/press.htm

American Superconductor Corporation (November 4, 2002)

American Superconductor reported net revenues of US $ 4.48 million for the second quarter of fiscal 2003 (ending September 30, 2002), up from $ 3.26 million for the second quarter of fiscal 2002. Operating losses for the two periods were comparable ($10.5 million for Q2, 2002; $ 10.47 million for Q2, 2003). Net loss increased from $ 9.12 million for the second quarter in 2002 to $ 10.22 million for the same period in 2003, partly because of a much lower income from interest as a result of a lower cash balance and lower interest rates. American Superconductor Corporation presently has $ 35 million in cash, cash equivalents, and investments and no long-term debt, compared to $45.6 million at the end of the first quarter of 2003 and $ 68.2 million at the end of fiscal 2002. Greg Yurek, chief executive officer of American Superconductor, explained that the company's quarterly rate of cash use peaked in the June 2001 quarter, when the company was completing the first phase of the construction of their commercial wire manufacturing plant. Since then, their quarterly rate of cash use has decreased through the last five quarters to the presently reported level of $ 10 million and is expected to continue decreasing as the plant nears commercial start-up. The sale of two D-VAR ™systems during the first half of the present fiscal year also had a positive impact on the rate of cash use during that period; further sales of this product are expected in the second half of fiscal 2003.

News Source:
"American Superconductor Reports Second Quarter Results"
American Superconductor Corporation press release (November 4, 2002)

http://www.amsuper.com/press.htm

Intermagnetics General Corporation (November 12, 2002)

Intermagnetics General Corporation's subsidiary, SuperPower, Inc., and Sumitomo Electric Industries have signed a definitive agreement outlining a previously announced HTS cable project to be installed in the Albany, N.Y., power grid. The project will be the world's first in-grid demonstration of "3-core", second-generation HTS cable technology. Initially, a 350-meter long (34.5 kV) first-generation HTS cable system will be installed and operated; a 30-meter section of the cable will then be replaced with a second-generation cable. The cable will be installed in an underground duct, enabling the ability of HTS cables to replace conventional copper cables, while providing 3 –5 times the power, to be demonstrated. This feature offers substantial benefits to areas with crowded urban right-of-way concerns. Sumitomo will be responsible for fabricating the cable assembly and refrigeration systems, while SuperPower will coordinate the overall planning, procure the first-generation HTS wire, and supply the second-generation wire. The two companies will share all development costs not covered by third-party funding sources (the New York State Energy Research and Development Authority has already agreed to supply US $ 6 million in funding). The total cost of the project is estimated to be $ 25 million. SuperPower will also have the right to supply second-generation wire for Sumitomo's HTS activities in North America.

In addition, SuperPower announced that it had exceeded its calendar year 2002 performance milestone toward the commercial manufacturing of second-generation HTS wires. Wire with a performance of over 100 amp-meters is being routinely manufactured in lengths of more than one meter using a scalable, cost-effective, reel-to-reel process. Wire with a performance of 315 amp-meters has also been produced.

News Source:
"Intermagnetics" Superpower Subsidiary, Sumitomo Electric Industries Sign Collaboration Agreement"
Intermagnetics General Corporation press release (November 12, 2002)
http://ir.thomsonfn.com/InvestorRelations/PubNews.aspx?partner=Mzg0TVRBeU1UVT1QJFkEQUALSTO&product=MzgwU1ZJPVAkWQEQUALSTOEQUALSTO

Intermagnetics General Corporation (November 12, 2002)

Intermagnetics General Corporation's Chairman and CEO, Glenn H. Epstein, described the recently announced collaboration between Intermagnetics subsidiary, SuperPower Inc., and Sumitomo Electric Industries as being an important step in the company's long-term objective of commercializing HTS materials and devices for electric power transmission and distribution. Speaking at an annual meeting of shareholders, Epstein outlined the US $ 25 million project that is expected to result in a 350-meter long, 34.5 kV, 3-phase cable. This cable will be installed in the Niagara Mohawk distribution system in Albany, N.Y. The project, which is scheduled to be completed in 2005, also includes the insertion of a 30-meter second-generation cable during the latter phases of the project; such an installation would be the first in-grid demonstration of a second-generation HTS cable.

In addition, Leo Blecher (sector president of Intermagnetic's MRI department), reported a strong long-term outlook for the MRI market, which is growing at an average annual rate of 10%. The department anticipates that new applications as well as magnet and RF coil products will further increase the demand for superconducting magnets. Next year, the group plans to begin shipping high-field superconducting open magnets.

The SuperPower subsidiary remains on target to ship the HTS coil assemblies for the 5 – 10 MVA HTS transformer (developed in conjunction with Waukesha Electric) by the end of this year. The transformer is scheduled to be installed and tested at Waukesha's Wisconsin facility in 2003. SuperPower is also planning to develop an HTS fault current limiter that could be used to protect power grids from electrical surges.

News Source:
"Intermagnetics Updates Shareholders at Annual Meeting"

Intermagnetics General Corporation press release (November 12, 2002)
http://ir.thomsonfn.com/InvestorRelations/PubNews.aspx?partner=Mzg0TVRBeU1UVT1QJFkEQUALSTO&product=MzgwU1ZJPVAkWQEQUALSTOEQUALSTO

American Superconductor Corporation (November 19, 2002)

The Federal Energy Regulatory Commission (FERC) has finished accepting recommendations on new technologies and policies that have the potential to encourage investment and that could be used to upgrade the transmission grid in the US. While an adequate supply of power exists in the US, transmission problems have led to rolling brownouts, blackouts, and other power supply shortages. At present, grid owners have no economic incentive to invest in solutions that would relieve congestion. The FERC hopes to reverse this situation by attracting investment and innovation to the US' electric power infrastructure. American Superconductor Corporation submitted a report to the FERC expressing their support of the commission's intentions but cautioning that consumer rates might rise in congested areas if an adequate grid infrastructure was not available. Superconductor applications were identified as advanced technologies that could be used to update the capacity of existing grids and ease grid bottlenecks; additionally, the report emphasizes that superconductor applications have a very low environmental impact – a factor that is of great concern to states and local communities.
News Source:
"Experts Available to Discuss Implications of Government's New 'Standard Market Design' Proposal"
American Superconductor Corporation press release (November 19, 2002)
http://www.amsuper.com/press.htm

Sensor

Oxford Instruments and Quantum Design (November 2 and 11, 2002)

Oxford Instruments and Quantum Design have signed an initial two-year sales agreement in which Oxford Instruments Superconductivity will oversee the sales and distribution of Quantum Design products in China. The sales agreement will be followed by a service and installation agreement that will commence in January 2003. The agreements are part of a strategic alliance between the two companies to develop measurement systems for the materials characterization market. Specific products identified by the strategic alliance include high-field instruments that utilize Oxford Instruments' superconducting magnetic technology, the incorporation of Oxford Instrument's refrigeration technology into Quantum Design's Physical Properties Measurement System (PPMS) range, and the use of Oxford Instrument's 14 T magnets in Quantum Design's 14 T PPMS product. Such instruments are extremely important in fields such as nanotechnology and quantum computing. Oxford Instruments already has two offices in China and has a well established reputation among Chinese research institutes, putting the company in an excellent position to help Quantum Design meet the needs of a this rapidly growing marketplace.
News Source:
"New collaboration to enhance nanotechnology research"
Oxford Instruments press release (November 11, 2002)
http://www.oxford-instruments.com/SCNNWP565.htm
"Quantum Design, Oxford Instruments Sign Important Agreement"
Quantum Design press release (November 2, 2002)
http://www.qdusa.com/latestnews/pressreleases.html

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Material

Superconductive Components, Inc. (November 11, 2002)

Superconductive Components, Inc. announced income applicable to common shares of US $22, 407 for the three months ending September 30, 2002. The net loss for this period was $4, 083. On a sequential quarter basis, the company has experienced a 20% increase in total revenues, an improved gross margin, lower general and administrative expenses, and nearly breakeven performance regarding income applicable to common shares. Total revenues for the three months ending September 30, 2002, amounted to $ 863,179, the highest amount in the past four quarters but 3.2% below the total revenues for a comparable period last year. Product sales decreased by 3.1% for the third quarter in 2002, compared to the third quarter in 2001, because of weak economic conditions.

Contract research revenues amounted to $ 68, 376 for the third quarter in 2002. The start of a Phase 1 SBIR grant from the U.S. Department of Energy to increase the current density of long BSCCO HTS wires by modifying the tube packing density resulted in an improvement in funded research revenues. Also in the third quarter of 2002, Superconductive Components was selected to participate in a Superconductivity Partnership Initiative led by Oxford Instruments' Superconductivity Technology division. The team will receive a grant from the U.S. Department of Energy to produce BSCCO-2212 materials for use in MRI systems. This three-year project will begin in the final quarter of 2002.

News Source:
"Superconductive Components, Inc. Announces Third Quarter Results"
Superconductive Components, Inc. press release (November 11, 2002)
http://www.investquest.com/iq/s/scci/ne/earnings/scci32.htm

Communication

ISCO International, Inc. (November 7, 2002)

ISCO International reported consolidated net revenues of US $ 430,000 and $ 2.127 million for the three- and nine-month periods ending September 30, 2002, respectively; these figures are up from comparable periods in 2001 ($ 90,000 and $1.976 million, respectively). Their consolidated net loss was $ 2.806 million and $ 10.789 million for the three- and nine-month periods ending September 30, 2002, respectively; these figures are considerably down from comparable periods in 2001 ($ 10.689 million and $20.965 million, respectively). Cost reductions, including the consolidation of facilities, accounted for the reduction in net losses. Legal expenses accounted for the only increase in costs during the last three- and nine-month periods, compared to the same periods in 2001. Dr. Amr Abdelmonem, CEO of ISCO, commented that "Despite the challenging telecom environment today, quarterly revenue tripled during the third quarter and we expect it to more than triple during the fourth quarter. While quarterly revenue is still in the building stage and we expect to grow it further next year, we have already surpassed last year's revenue and look to be close to doubling those results on a full year basis."

News Source:
"ISCO International Reports Quarterly Results"
ISCO International, Inc. press release (November 7, 2002)
http://www.iscointl.com/

Superconductor Technologies Inc. (November 7, 2002)

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Superconductor Technologies Inc. (STI) reported total net revenues of US $ 4.7 million for the third quarter of 2002, an increase of 124% compared to the comparable period in 2001. Net commercial product revenues for the third quarter of 2002 increased by 266% to $ 4.3 million, compared to the same period in 2001. Government contract revenues were less than anticipated ($ 429,000) because of a delay in a key government order; this order was received during October. Total net loss for the third quarter of 2002 was $ 4.8 million, the same as in the third quarter of 2001. At the end of the 2002 third quarter, STI had $ 8.1 million in cash and cash equivalents and $10.1 million in working capital. STI's product backlog was estimated to be $6.7 million as of September 28, 2002. M. Peter Thomas, STI's president and chief executive officer, commented, "While 2002's success has been highly dependent on progress with two customers, Alltel and US Cellular, our growth in 2003 will be the result of continuing orders from existing customers, as well as orders from new large customers like those with whom we are currently in discussions and trials. Our combination with Conductus doubles our sales forces and with outstanding people, products and a strong balance sheet, we will be better positioned than ever to pursue our long-term growth." STI expects their total net revenue for 2002 to be in the range of $ 22 million to $ 25 million, with commercial product revenue accounting for approximately 80% of this figure.

News Source:
"Superconductor Technologies Inc. Reports Third Quarter 2002 Results"
Superconductor Technologies Inc. press release (November 7, 2002)
http://ir.thomsonfn.com/InvestorRelations/PubNews.aspx?partner=Mzg0TlRrMU1RPT1QJFkEQUALSTO&product=MzgwU1ZJPVAkWQEQUALSTOEQUALSTO

Superconductor Technologies Inc. (November 12, 2002)

Superconductor Technologies and Heinz Corporation, a service provider to the wireless industry, have formed a strategic alliance in which the two companies will jointly provide, design and install solutions to improve the quality of wireless networks, particularly those in urban areas. The two companies have begun to collect and analyze RF data for several US cities; a joint engineering team will then use this data to minimize the effects of RF interference on network performance. Jim Heinz, president of Heinz Corporation, commented, "The wireless carriers are looking for economical ways to improve coverage and performance throughout their networks, especially in dense urban areas. STI's SuperLink Rx products can do all that with unmatched effectiveness, while Heinz Corporation brings our engineering services for data collection, along with the expertise to aid in the design and deployment of SuperLink solutions." Heinz Corporation uses a proprietary method to collect RF data; wireless carriers can then use this information to perform interference studies.

News Source:
"Superconductor Technologies Inc. and Heinz Corporation Team Up to Improve Wireless Network Performance"
Superconductor Technologies Inc. press release (November 12, 2002)
http://ir.thomsonfn.com/InvestorRelations/PubNews.aspx?partner=Mzg0TlRrMU1RPT1QJFkEQUALSTO&product=MzgwU1ZJPVAkWQEQUALSTOEQUALSTO

Conductus, Inc. (November 12, 2002)

Conductus, Inc. announced revenues of US $ 1.28 million for the third quarter of 2002, down 32% from the comparable period in 2001. Product revenues decreased by 52% (to $ 341,000) and contract revenues decreased by 20% (to $ 941,000), compared to the third quarter results for 2001. Total revenue for the first nine months of 2002 was comparable to that for the first nine months of 2001 ($ 4.84 million and $ 4.85 million, respectively). Product revenues for the first nine months of 2002 increased by 16 % to $ 2.32 million (from $ 1.997 million for the comparable period in 2001), while contract revenues decreased by 12% to $ 2.52 million (from $ 2.85 for the comparable period in 2001). The decrease in product revenues for the reported quarter is the result of a decrease in revenues from government product shipments; revenues from commercial product shipment

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increased during this period. The decrease in contract revenues was mainly a result of delays in the start dates of anticipated new contracts. Net loss for the third quarter of 2002 was reduced to $ 4.7 million, from $ 5.2 million for the comparable period in 2001. This loss includes the impact of write-downs of excess and obsolete inventory as well as expenses associated with the ongoing ISCO International litigation.

Last month, Conductus announced that they would be merging with Superconductor Technologies Inc. Since this announcement, Conductus has received an additional $ 5 million in new financing commitments from institutional investors, bringing the total to $ 20 million.

News Source:
"Conductus Reports Third-Quarter Results"
Conductus, Inc. press release (November 12, 2002)
http://www.conductus.com/newsroom.html

(Akihiko Tsutai, International Affairs Department, ISTEC)

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Patent Information

Introduction of Approved Patents

We will introduce you important ISTEC's patents approved recently.

For detailed information, visit the homepage of the Patent Office of Japan and check the patent database of IPDL (Intellectual Property Digital Library).

Patent No. 3278638: 'High-Temperature Superconducting Josephson Junction and Manufacture thereof,' Publication No. 2000-150974 (applied in fiscal 1999)

This patent relates to a method manufacturing ramp-edge-type Josephson junctions with surface-modified barrier structure.

In the ramp-edge junction with the upper and lower electrodes of YBCO superconducting layer, outstanding junction performance can be obtained when the lattice constant and the thickness of the barrier stand respectively at 0.41-0.43 nm and at 10 nm or less (especially, 2 nm or less), in addition to the YBCO phase of the barrier consisting of Y-element rich and Cu-element poor layer.

A detailed method of manufacturing high uniform junctions with the critical current density distribution of $1\sigma = \pm 5\%$ at 12 junctions is disclosed.

Patent No. 3257000: 'Copper Oxide Superconductor and Its Production,' Publication No. H8-143311 (applied in fiscal 1991)

An object of this invention is to provide flat particles of a 124-type or a 123-type superconductor, which are easy to orient by mechanical processing and to realize a superconductor having a high critical current density at a liquid nitrogen temperature, for the making of wires or tapes of Y-based copper oxide superconductors, and a process for production thereof.

A copper oxide superconductor of flat particles in good composition of RE123-type and RE124-type (RE: rare earth elements including Y) materials, where RE could be replaced with Ca; Ba, with Ca, Sr or others; Cu, with Al, Fe or others. The superconductor production method goes through making mixed liquid of alcoxide-dissolved metals, which will form the copper oxide superconductor, and drying and incinerating gel powder after the liquid is hydrolyzed.

Published Unexamined Patents for the 2nd Quarter of Fiscal 2002

1) Publication No. 2002-187798: 'Oxide Superconductive Thin Film Laminated Substrate'

YBCO123-type oxide superconductive thin film laminated substrate, having c-axis orientation and high critical temperature above 70K, is formed on an SiO_2 substrate through the buffer layer of ultra-thin Platinum (Pt) of 140 to 400 A. This allows you to make a low dielectric constant substrate for high frequency applications.

2) Publication No. 2002-198214: 'Superconducting Magnet Power Lead '

In a superconducting magnet device, a superconducting magnet power lead performs an important part of feeding a current to a superconducting coil, cooled down to liquid helium temperature, via a radiation heat shielding unit, cooled down to liquid nitrogen temperature. This power lead is made to have a structure in which at least a part of the power lead located inside the radiation heat shielding unit is partially formed of an oxide high-temperature superconducting bulk body, whose critical temperature is higher than liquid nitrogen temperature.

3) Publication 2002-203439: 'Tape-like Oxide Superconductor'

To provide a tape-shaped oxide superconductor having high c-axis orientation, high in-plane orientation and high Jc value, the first intermediate layer formed by depositing YSZ or $Zr_2R_xO_7(R_x$; Y, Nd, Sm, Gd, etc.) particles generated from a target while ions are irradiated on a substrate from the inclined direction; the second intermediate layer comprising CeO_2 or Y_2O_3; and an $RE_{1+x}Ba_{2-x}Cu_3O_y$ superconducting layer formed by coating a metal organic acid salt containing F and heat-decomposing it are formed in sequence.

4) Publication No. 2002-279838: 'Oxide Thin Film Manufacturing Method and Superconductive Structure Using Oxide Thin Film and Its Manufacturing Method'

This method is featured by forming a amorphous oxide layer, consisting of $REGaO_3$ (RE include Nd, Sm, Gd, etc.), on a substrate with Perovskite structure in the ambient temperature and changing it to a crystalline oxide layer by high temperature treatment in the atmospheric pressure. Using this oxide layer as the seed layer, an oxide superconductor is formed by the solution growth method as LPE. This simple thin film formation of a seed layer is suitable for the formation of a larger and longer superconductor.

(Katsuo Nakazato, Director, Development Promotion Div., SRL/ISTEC)

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Standardization Activities

This Month's Topic(September)

-- IEC International Standard (IS) Sets Two Standards --

On June 24, 2002, the following two superconductivity related international standards (IEC 61788-10, IEC 61788-12) were set. The validity of these standards will last until December 31, 2007. The present superconductivity related international standards (IS) total 10, including the above-mentioned two standards.

IEC 61788-10: Superconductivity - Part 10: Critical temperature measurement -- Critical temperature of Nb-Ti, Nb_3Sn, and Bi-system oxide superconductors by a resistance method

IEC 61788-12: Superconductivity -- Part 12: Matrix to superconductor volume ratio measurement -- Copper to non-copper volume ratio of Nb_3Sn composite superconducting wires

IEC 61788-10 is a method of testing the critical temperature of niobium-titanium, niobium 3-tin, and bismuth-based oxide composite superconductors by a (electrical) resistance method. This standard was proposed by Japan when Professor Satoru Murase of Okayama University was assigned to be the convener. After the standard was approved as a new work item proposal in May 2000, the item was put into a series of discussions for two years before it was issued as an IEC (International Electrotechnical Commission) standard, or an IS. Meanwhile, the JIS Drafting Committee in the IEC/TC90 Superconductivity Committee (Japan National Committee) set up a draft working group (WG11) in fiscal 2002 to prepare a JIS draft that conforms to the IEC61788-10.

IEC61788-12 is a method of testing the volume ratio of copper to non-copper in a Nb_3Sn composite superconducting wire. The standard was proposed by Japan when Professor Takakazu Shintomi of the High Energy Accelerator Research Organization was assigned to be the convener. After the standard was approved as a new work item proposal in June 2000, the item was put into a series of discussions for two years before it was issued as an IEC standard, or an IS. Meanwhile, the JIS Drafting Committee in the IEC/TC90 Superconductivity Committee set up a draft working group (WG6) in fiscal 2002, and since then has been working to prepare a JIS draft that conforms to the IEC61788-12.

This Month's Topics(October)

-- Integration for Standardization Starts with Superconductivity Related Research and Development Projects --

The Superconductivity Research Committee (headed by Professor Kozo Osamura of Kyoto University) formed in the Technical Committee of the IEC/TC90 Superconductivity Committee (Japan National Committee) began integrated promotion of superconductivity standardization and superconductivity related research and development projects in June 2002.

Following the National Industry and Technology Strategy (General strategy) formulated by the Japanese government in April 2000, the standardization strategy (general statement), formulated by the Standard Ad hoc-group of the Japanese Industrial Standards Committee in September 2001, stresses "integrated promotion of standardization activities with research and development." The Basic Issue Examination Committee of the IEC/TC90 Superconductivity Committee, held in November 2001, adopted the statement of "integrated promotion of standardization activities with research and development" in the superconductivity standardization strategies. The purpose of the activities is to exhibit Japan's technological capabilities and to reinforce Japan's competitiveness in superconductivity related projects by disclosing results of Japan's advanced superconductivity research and development in the international community in the forms of publicly available specifications (PAS) and the technical specifications (TS).

More specifically, we requested cooperation for standardization from the project leaders and managers of the "Development of Superconducting Magnetic Energy Storage System Technology," the "Research and Development of Fundamental Technologies for Superconducting AC Power Equipment," the "Research and Development of Fundamental Technologies for Superconducting Generators," and the "Research and Development of Superconducting Bearing Technology for Flywheel Magnetic Energy Storage." In addition, we started to formulate a PAS draft for fiscal 2002 in cooperation with the "Development of Superconducting Magnetic Energy Storage System Technology" project, and a TS draft concept with the "Research and Development of Fundamental Technologies for Superconducting AC Power Equipment" project.

We will try to consolidate these drafts in cooperation with the above-mentioned projects so that these drafts will be upgraded into a quasi-standard PAS draft and a TS draft. At the same time, we will continue to contact other relevant project leaders and managers to ask cooperation for standardization.

This Month's Topics(November)

-- Preparations Start for the IEC/TC Superconductivity International Conference (Vienna Conference) --

The IEC/TC90 Superconductivity Committee started preparations for the IEC/TC90 (Superconductivity) International Conference (called the "Vienna Conference" for short) to be held at Vienna, Austria, February 24 to 26, 2003.

The 2nd IEC/TC90 Superconductivity Committee Technical Committee meeting, held September 13, 2002, received progress reports under examination, made preliminary approval of document submission of the following four items, and decided to prepare the documents.

- Proposal for the Maintenance System of the Present 10 standards and Conceptual Draft for Revision

IEC60050-815:2000 Superconductivity related terminology
IEC61788-1:1998 Method of testing direct current Ic of Nb-Ti composite superconductors
IEC61788-2:1999 Method of testing direct current Ic of Nb_3Sn composite superconductors
IEC61788-3:2000 Method of testing direct current Ic of bismuth-based oxide superconductors
IEC61788-4:2001 Method of testing residual resistance ratio of Nb-Ti composite superconductors
IEC61788-5:2000 Method of testing the copper ratio of Nb-Ti composite superconductors
IEC61788-6:2000 Tensile testing method of Nb-Ti composite superconductors in room temperature
IEC61788-7:2002 Method of testing the surface resistance of superconductors at microwave bandwidth
IEC61788-10:2002 Method of testing the critical temperature of composite superconductors
IEC61788-12:2002 Method of testing the copper ratio of Nb_3Sn composite superconductors

- Proposal Draft for a Superconducting Product Standard Concept and Proposal Draft for Items for Product Standard Supplementary Standards Including Testing Method, etc.

Proposal for 1st priority product standard items (Nb-Ti composite superconductor, Nb_3Sn composite superconductor, superconducting current lead, superconducting magnet built-in cryocooler) and proposal for related supplementary standard items. However, cooperation of both domestic and overseas companies is indispensable for preparing these product standards because companies will play the major role in formulating the standard draft. Thus, to conclude agreements with those companies is necessary before preparing documentary materials.

- Revised Roadmap of Standardization for Superconductivity
- Activity Report on Integrated Activities with National Projects, WGs Activities, and Other Domestic Standardization

These documentary materials will be prepared with the cooperation of WGs, committees, and secretariats by the end of January 2003, and final confirmation by the domestic technical committee is tentatively planned for February 5, 2003.

(Yasuzo Tanaka, Standardization Dept., ISTEC)

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