Superconductivity Web21

超電導 Web21 Superconductivity

SUMMER,2001

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Congratulations on Superconductivity Web 21

Dr. Masanori Yoshikai
Former Deputy Minister
Industrial Science and Technology Policy and Environment Bureau, METI

To the publication staff, I offer my hearty congratulations and respect for their efforts and planning in realizing the publication of Superconductivity Web21.

Dynamic technological innovation is leading to a new paradigm for the 21st century. Brimming with new insight on information technology, IT, biotechnology, nano- technology, and new superconductivity materials and their applications, the significance of information management, such as dispatch, receipt, accumulation, and so on, has been gradually increasing. The publication of Superconductivity Web 21 is a hopeful current trial that will result in new mutual communication.

Expectations for Superconductivity Web 21 as new media

Professor Dr. Eisuke Masada, Science and Engineering Department of Tokyo Science University

In the 21st century, effective use of energy resources and integrity of the earth environment would need to realize new superconducting technologies. In addition, a new superconducting material, magnesium diboride (MgB_2), should make a reflection of international interests. Meanwhile, confliction of continued technology development along the long term road-map should result in growth in a global business recession.

In these serious circumstances, the promotion of the superconducting development require wide support by many industries. For realizing the goal and understanding of many sponsors, timely information, suitable and well-organized on a wide range of superconductivity technologies, such material technologies, their application technologies and related technologies, must be provided.

For the International Superconductivity Technology Center, ISTEC, which has provided excellent research and development results, as a center of superconductivity technology development in Japan, substantial speedy and well-supplementary valuable propagations are expected.Consequently,the publication of Superconductivity Web 21 is expected to be timely, quick-responsive, wide-accessible media, which could not be achieved through the ordinary print media.

Goodbye ISTEC Journal, hello Superconductivity Web 21

First of all we would like to celebrate the debut of Superconductivity Web21 on July, 2001 whose Japanese version has already been published since April, 2001. Superconductivity Web21, which succeeds the paper-based media getting accustomed to the ISTEC Journal for thirteen years, is the electronic information site we have looked forward to, for the 21st century. Superconductivity Web 21 is a very important medium in that communication in any situation will be quick, informative, multi-channelled, cumulative, and mutual. Superconductivity Web21 will contribute especially to a flow of good ideas on current information on the strategy of superconductivity technology, superconductivity business, new superconductivity products or technologies, and scientific research and development in Japan.

In order to successfully operate Superconductivity Web 21, the Web needs not only hard work of the publication staffs, but also supports and understanding of customers such as you who access the internet today. Superconductivity Web21 will do its best to serve you and the publication staff askes for your continued business with us.

(Yasuzo Tanaka, Editor of Superconductivity Web 21)

Contents (Summer, 2001)

ISTEC's Outline of Activity Plans for Fiscal 2001

International Superconductivity Technology Center (ISTEC) has announced that Hiroshi Araki, President of ISTEC, held the general board of directors in the 27th time and the board of councilors in the 17th at the Keidanren Kaikan on March 15, and deliberated ISTEC's Activity Plans for fiscal 2001.

The activity plans feature active promotion of research on superconductivity by conducting surveys and investigations on pertinent topics, performing fundamental research and development required for specific superconductivity applications, and promotion of international exchanges. Consequently, these activities will provide significant contributions to the expansion of the superconductivity industry.

In addition, fiscal budget of about 5 billion yen including the income from commissioned business, supporting membership fees, etc. is expected for the following activities.

1.Promotional and Educational Activities, and International Exchanges

(1)The Fourteenth International Symposium on Superconductivity (ISS2001)
Period: September 25 (Tuesday) to 27 (Thursday), 2001
Venue: Kobe International Forum and International Exhibition Center, Kobe City

(2)Workshop on research results
Date: June 5 (Tuesday), 2001
Venue: Toshi Center Hotel, Tokyo

(3)Thirteenth Superconductivity Workshop
Theme: High-Tc superconductors, process and applications
Period: June 24 (Monday) to 27 (Wednesday), 2001
Venue: Hyatt Regency Hotel, Honolulu, Hawaii, USA
Cosponsor: MRS in USA

(4)Tenth International Superconductivity Industrial Summit(ISIS'2001)
Period: October 1 (Monday) to 3 (Wednesday), 2001
Place: Washington D.C., USA
Cosponsors:CSAC (a private association for superconductivity R&D in the USA), and CONECTUS (a private association on superconductivity R&D in Europe)

(5)Superconductivity Web 21
Information on the development and practical applications of superconductivity technology will be distributed through the Internet to ISTEC members via E-mail (monthly Japanese version, quarterly English version) and a public website.

(6)Publication of SRL Technical Reports fiscal

(7)Reports on the results of superconductivity projects

(8)Collection and distribution of information on superconductivity activities in Japan and abroad (ISTEC News, ISTEC Overseas News, etc.)

2.Research and Development Activities

(1)Research and Development of fundamental technologies for superconductivity applications(FY1998 - FY2002)

(2)Research and Development of superconducting magnetic energy storage system(SMES) (FY1999- FY2003)

(3)Development of superconducting magnetic bearing for flywheel electric power storage systems(FY2000- FY2004)

(4)Development of Superconductor Manufacturing Technology Utilizing a Microgravity Environment(FY1995-FY2003)

(5)Applied Research
Research on using Single Flux Quantum High Speed Memories (FY2000- FY2001)

3.International Standardization

(1)IEC/TC 90 superconductivity: 2001 Korea Meeting

(2)Preparation of JIS Drafts

(Mitsuhiro Anju, General Affairs Department, ISTEC)

Japanese government's Superconductivity-related Budgets for FY2001

The Japanese government's FY2001 budget of 13.6billion yen for superconductivity-related R&D except for the Ministry of Public Management, Home affaires, Posts and Telecommunications was completed on March 26th, 2001 was passed in an ordinary Diet session.

Financial resources of superconductivity-related budgets, which are summed up by the Ministry of Economy, Trade and Industry (METI), the Ministry of Education, Culture, Sports, Science and Technology, and the Ministry of Load, Infrastructure and Transport, are allocated to the expenditures for the culture and education, the science and technology promotion in the general account, the supplementary account, and the government-related organizations. The total budget showed a slight increase over FY2000, which was initially 12.6billion yen.

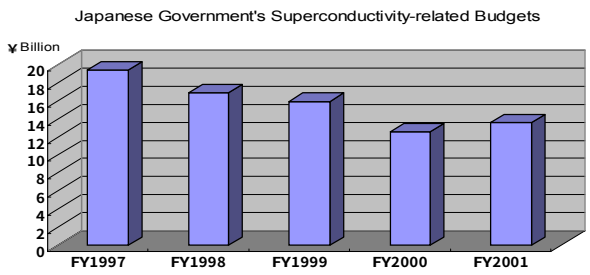
METI demanded 9.09billion yen, which increased by 14.5% of 7.94billion yen from FY2000 budget. Concretely, METI supports the continuation of national projects, for the development of basic technologies for manufacturing and processing superconducting materials, the development of basic technologies for manufacturing AC superconducting electric power equipment, the development of technologies higher density of superconducting generators, the development of uperconducting bearings for flywheel electric power storage system, and the development of technology for superconducting magnetic energy storage (SMES) system.

The Ministry of Education, Culture, Sports, Science and Technology, which was administrating restructure from the Ministry of Education and Culture, and the Science and Technology Agency, demanded 3.25billion yen, which is a decrease of 0.9% from the 3.28billon yen of the FY2000 budget. Concretely, the second phase multi-core project as the major one in the ministry has been postponed by this fiscal year.

The Ministry of Public Management, Home affaires, Posts and Telecommunications proposed a continuation of research for ultrahigh frequency-high speed circuit technology using superconducting devices.

The Ministry of Load, Infrastructure and Transport demanded 1.25billion yen for the development of superconducting magnetic levitated train, which is an increase of 5.9% over the FY2000 budget, 1.18billion yen
in the FY2000 budget.

(Mitsuhiro Anju, General Affaires Department, ISTEC)



Establishment of Independent Administrative Institution, National Institute for Materials Science (NIMS)

National Institute for Materials Science (NIMS) began operations on April 1, 2001. The NIMS is a new independent administrative institution that combined the National Research Institute for Metals (NRIM) and the National Institute for Research in Inorganic Materials (NIRIM) in the Science and Technology Agency, now under the Ministry of Education, Culture, Sports, Science and Technology.

NIMS(see http://www.nims.go.jp)has three Laboratories: Advanced Materials Laboratory (AML), Nanomaterials Laboratory (NML) and Materials Engineering Laboratory (MEL), mainly on Sengen Site, Namiki Site and Sakura Site in Tsukuba. These laboratories are proceeding with superconductivity research in the investigation of new superconducting materials and their fabrication processing.

Mr. Yoshihiro Takada of Materials Development Promotion Session of Research Promotion Bureau in the Ministry of Education, Culture, Sports, Science and Technology, has reported that the FY2001 budget of 3.251billion yen consists of 2.193billion yen for the superconducting materials research including the multi-core project,0.517billion yen for the nuclear fusion research, 0.021billion yen for the evaluation research by the National Atomic Power Organization, and 0.52billion yen for support of the education in superconductivity-related institutes.

(Masaji Yoshida, International Affairs Department, ISTEC)

National Institute of Advanced Industrial Science and Technology (AIST), Independent Administrative Institution (IAI) under the Ministry of Economy, Trade and Industry (METI)

The National Institute of Advanced Industrial Science and Technology (AIST) renewed its organization on April 1. It has combined eight National Research Institutes (or Laboratories) in Tsukuba and seven regional National Industrial Research Institutes under the Agency of Industrial Science and Technology (also abbreviated by AIST), and the Weights and Measures Training Institute, all in the Ministry of International Trade and Industry (MITI).

According to the AIST homepage (http://www.aist.go.jp in English) and the Keizai-Sangyo (Economy, Trade and Industry) Journal (2001 May No. 361 in Japanese), the new AIST has flexible organizations: Research Centers, Research Institutes, Special Divisions, Research Initiatives, and the temporal special research units in Collaboration Department, depending on the characteristics of individual research fields and the multiple phases of each research mission and R&D project.

Several research units are proceeding with superconductivity research in the investigations of novel electronic properties and devices in the Correlated Electron Research Center, electric and magnetic standardization in the National Metrology Institute of Japan, low-loss electric power transmission in the Energy Electronics Institute, innovative digital electronics devices in the Nanoelectronics Research Institute, and non-invasive diagnostics in both the Institute for Human Science and the Biomedical Engineering and the Life Electronics Laboratory. The figure shows these research units in the organization of AIST.

(Masaji Yoshida, International Affairs Department, ISTEC)

Hitachi 100GHz Comparator for HTS AD Converter

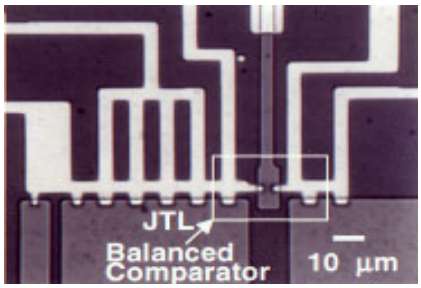
Hitachi has fabricated a comparator using high temperature superconducting (HTS) single flux quantum (SFQ) circuits and demonstrating a clock frequency of 100 GHz at 30 K.

For example, a clock frequency of 10 GHz has been attained with a low temperature superconducting (LTS)-AD converter system. In the future, a higher level of digital signal processing, at no less than a peta floating-point operations per second (FLOPS), and low AC loss characteristics will be required for the expansion of applications into mobile communication systems and multimedia networks.

The Hitachi comparator circuit has been fabricated with eleven ramp-edge Josephson junctions of YBCO. Dr. Kazumasa Takagi, Senior Chief Researcher, Hitachi Research Laboratory, has reported that the circuit has been fabricated by excellent technologies in the Josephson junctions, and several thousands of Josephson junctions can be available, and an AD converter will be successfully realized in the near future.

Dr. Kazuo Saito, Chief Researcher, Hitachi Research Laboratory also emphasized that the newest architecture, the most advanced microfabrication technologies in cooperation with optoelectronics and semiconductors need to be developed to realize a super-computer.

(Yasuzo Tanaka, Editor of Superconductivity Web21)



HTS SFQ circuits demonstrating a clock frequency of 100GHz at 30K, by the courtesy of Hitachi

NTTDoCoMo watching superconducting filter for IMT-2000

NTT DoCoMo, Inc. has announced that a new service of IMT-2000 called FOMA will be introduced as the world's first third- generation mobile communications this summer. Recently, the service is postponed until this fall. Even so, the receiving filters for mobile telecommunication base stations of the major instrument for the IMT-2000 will be chosen as the conventional filter system.

Dr. Toshio Nojima, Radio Environment Technology Research Laboratory of NTT DoCoMo, has explained that high temperature superconducting (HTS) receiving filters have already been fabricated, by using foreign-made HTS filters with a cryogenic low noise amplifier (CLNA), and demonstrated on a cryogenic receiving front end of mobile telecommunication base station cooled by a small cryocooler.

He has also pointed out that the Japanese radio band situation is different from the US, where the high frequency bands are very tight. The skirt characteristics in frequency response profiles at the distributed frequency bands of 800 MHz, 1.7 GHz and 2.5 GHz corresponding to IMT-2000, are not so severe in Japan. Consequently, people are watching the HTS filters having a low insertion loss at a distance. In addition there is a higher system cost, which is estimated by

five to ten times higher than conventional systems. Dr. Katsumi Suzuki, Senior Chief Researcher of ISTEC, has the same opinion.

(Yasuzo Tanaka, Editor of Superconductivity Web 21)

Coming of New Superconducting Materials

Since the summer of 2000, ten or more new superconducting materials and new superconductivity mechanisms have been reported.

The most interesting material has been the magnesium diboride (MgB_2) invented by Prof. Dr. Jun Akimitsu and his fellow researchers. Most of the investigations seems to support the general conclusion that the mechanism of MgB_2 is consistent with the classic BCS theory, that is, in an ordinary superconductor family.

On the other hand, some of new superconductive materials are unfortunately unidentificated by the other researchers.

All the researchers have pointed out that these new superconducting materials reveal some new superconductivity mechanisms as shown in the following items. Consequently, these mechanisms will lead to the invention or discovery of further new superconducting materials.

1. Intermetallic compounds in place of the oxides
2. Superconductivity mechanism due to FET effects for C_{60}
3. Organic superconducting polymers
4. Magneto-organic superconductors
5. Magnetically induced superconductivity mechanism for organic superconductors

New superconducting materials are reviewed based on the following five categories:(1)inventers or reporters, (2)references, (3)obstacle names,(4)critical temperature and(5)comments.

1.(1)J.H.Schon,C.Kloc,B.Batlogg,(2)Naturevol.406,(2000)p.702, (3)pentacene,(4)2.0K, (5)FET structure,electron-phone interaction?

2.(1)J.H.Schon, C.Kloc and B.Batlogg,(2)Nature vol.406, (2000) p.702,(3)tetracene, (4)2.7K,(5)FET structure, electron-phone interaction?

3.(1)J.H.Schon, C.Kloc and B.Batlogg,(2)Nature vol.406, (2000) p.702,(3)anthracene, (4)4.0K,(5)FET structure, electron-phone interaction

4.(1)J.H.Schon, C.Kloc and B.Batlogg,(2)Nature vol. 408, 30 nov. (2000) p.549-552,(3)C_{60}, (4)52K, (5)FET structure

5.(1)J.Nagamatsu, N.Nakagawa, T.Muranaka, Y.Zenitana and J.Akimitsu, (2)Nature vol. 410, 1 March (2001) p.63-64, (3)MgB_2, (4)39K,(5)electron-phone interaction

6.(1)Z.X.Zhao et al,(2)Nikkei Science May(2001), (3) $Mg_{0.8}Cu_{0.2}B_2$, (4)49K,(5)unidentificated and deleted later

7.(1) J.H.Schon, A.Dodabalapur, Z.Bea, C.Kloc, O.schenker and B.Batlogg,(2)Nature vol. 410, 8 March (2001) p.189-192, (3)poly3-hexylthiophene,(4)2.35K, (5)1st organic superconducting polymer in FE device

8.(1)J.Akimitsu et al,(2)Special Meeting in the US Physical Society, (3)Mg-Be-B, (4)35K ,(5)held on 12 March 2001

9.(1)N.K.Sato, N.Aso, Kmiyake,. R.Shiina, P.Thalmeier, G.Varelogiannis, C.Geibel, F.Steglich, P.Fulde and T.Komatsubara,(2)Nature vol.410 15 March(2001) p.340-343, (3)UPd_2Al, (4)1.8K,(5)"heavy" electrons

10.(1)J.S.Slusky, N.Rogado, K.A.Regan, M.A.Hayward, P.Khalifah, T.He, K.Inumaru, S.M.Loureiro, M.K.Haas, H.W.Zandbergen and R.J.Cava, (2)Nature vol. 410 15 March(2001) p.343-345, (3)$Mg_{1-x}Al_xB_2$ 0<x<0.40, (4)<38K

11.(1)D.Djurek, Z.Medumie, A.Tonejc and M.Paljevic, (2)Physica C 351(2001) p.78-81, (3)Pb-Ag-C-O $Ag_{beta}Pb_6CO_9$ 0.7<beta <1, (4)<(240-340K),(5)unidentificated

12.(1)H.Kobayashi, A.Kobayashi and M. Tokumoto, (2)Bulletin Japan Physical Society vol. 56, No.3,(2001) p.162-168,(3)lambda -$(BETS)_2Fe_{0.47}Ga_{0.53}Cl_4$, (4)superconducting phase at 3.8-4.2K,(5)magneto-organic superconductor

13. (1)H.Kobayashi, A.Kobayashi and M. Tokumoto, (2)Bulletin Japan Physical Society vol. 56, No.3,(2001) p.162-168,(3)kappa -$(BETS)_2FeBr_4$, (4)1.1K,(5)magneto-prganic superconductor

14.(1)S.Uji, H.Shinagawa, T.Terashima, T.Yakabe, Y.Terai, M.Tokumoto, A.Kobayashi, H.Tanaka and H.Kobayashi,(2)Nature vol.410 19 April(2001) p.908-910, (3)lambda - $(BETS)_2FeCl_4$, (4)0.1K at 17T

(Yasuzo Tanaka, Editor of Superconductivity Web21)

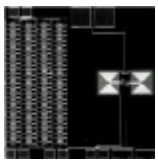
SII Intends Scanning SQUID Microscope and X-Ray Detector for Semiconductor Industry

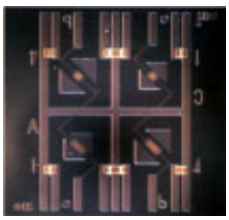
Seiko Instruments Inc. (SII) has developed a high resolution magnetic imaging system, SQM2000, and a high speed X-Ray detector, Transition Edge Sensor (TES), as a preliminary step for the semiconductor industries. SQM2000, that is, a scanning SQUID microscope mounting DC-SQUID, provides high resolvable images of micrometer level and variations of a temperature range of 4K to100K due to a unique cooling system by liquid helium flow. SQM2000 is applicable to characterizations of magnetic materials and measurements of current distribution in the semiconductor integrated circuits. Further, SQM2000 installs the wide range scanning system of 10mm x 10mm with a resolution of 25nm.

On the other hand, TES is a kind of superconducting micro-calorimeter comprising of transition edge sensor circuits and its front SQUID amplifier. TES has a high resolution of energy of some electron volts, and an availability of joining with the scanning SQUID microscope.

Dr. Kazuo Chinone, the 1st section manager, Scientific Instrument Department of SII, has announced that the most interesting target is in the performance of a combination with the scanning SQUID microscope and a high speed X-Ray detector such as TES under supporting the CAD system for the on-line detecting system in the semiconductor industry. SII has already developed the basic technologies, while the other supporting systems including the cooling system have to be improved further in the future. See <http://www.sii.co.jp>

(Yasuzo Tanaka, Editor of Superconductivity Web21)





Superconducting micro-calorimeter, TES, comprising of transition edge sensor circuits and its front SQUID amplifier, by the courtesy of SII

Sumitomo Develops Magnetic Shieldless Magnetocardiograph using HTS SQUID

The collaborative efforts of Prof. Takeshi Kobayashi of Osaka University and Sumitomo Hightechs Co., Ltd. supported by Sumitomo Electric Industries Co., Ltd. have produced a single channel magnetocardiograph, without the magnetic shielding, using high temperature superconducting SQUID.

Dr. Hideo Itozaki, Manager of Machining Technology Research, Itami Laboratory of Sumitomo Electric Industries Co., Ltd. announced that the magnetocardiograph installs four SQUID sensors of HoBCO high temperature superconductor, and a X-Y-Z vector differential gradiometer. As a result, the magnetocardiograph is able to detect very low magnetic flux of one-hundred billion Tesla from the human heart without any magnetic shielding devices.

Further detailed results have been reported in Meeting of Applied Physics held on March 28, 2001, and news releases. See <http://www.shs.co.jp/squid/>

(Yasuzo Tanaka, Editor of Superconductivity Web21)

Single channel magnetocardiograph, without the magnetic shield, using high temperature superconducting SQUID, by the courtesy of Prof. Takeshi Kobayashi of Osaka University

Multichannelled SQUID Magnetoencephalography, MEG, of 34 units in operation

A report, in the monthly New Medical, No. 293 May 1995, published by ME Promotion Associate, announced that multichannelled SQUID MEG of more than 20 units have already been operated in Japan. Further, Dr. Kazuo Chinone, the 1st section manager, Scientific Instrument Department of SII, and Dr. Hideo Itozaki, Manager of Machining Technology Research, Itami Laboratory of Sumitomo Electric Industries Co., Ltd. have estimated that multichannelled SQUID MEG of 30 to 34 units, which are made in foreign companies excepting only one unit made by Japanese company, contribute to brain diagnosis.

(Yasuzo Tanaka, Editor of Superconductivity Web21)

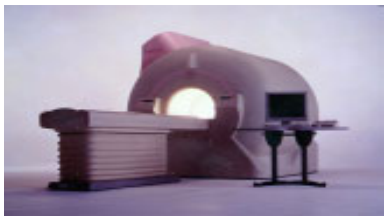
Toshiba Sells Quietest MRI, EXCELART™

Toshiba Medical Systems Co., Ltd. has announced that the quietest MRI in the world, EXELART™ MRT-1000 is being manufactured and more than four units have been sold out at the standard price of 686million yen for the general hospitals in Japan.

EXELART™ MRT-1000 is the third version of the EXELART™ series. EXELART™ MRT-1000 is equipped with a superconducting magnet of up to 1T, an acoustic noise reduced below one-tenth of the original level named Pianissimo™, and the MR angiography (MRA). The product was exhibited in the 2001 International Medical Imaging held on 4 to 7 April, 2001 in Kobe International Exhibition Hall.

Seiichiro Kebukawa, Senior Manager, MR Sales Department, Sales Division of Toshiba Medical Systems Co., Ltd. has announced that the share of the world MRI market is 40billion yen, in the world radiology market of 500billion yen according to the Japan Assurance Health Information System Association (JAHIS) and Japan Imaging Medical Association (JIRA). From the market situation and the FY2000's sales result of 75 units, Toshiba Medical Systems Co. will expect to sell for about 100 units this year. He also has an opinion about a special situation of the Japan MRI market, which is mainly on around 1T using tunnel type MRI systems. Abroad, the open type MRI systems are developing and coming in to the market for purposes of limited installation conditions and cost performance.

(Yasuzo Tanaka, Editor of Superconductivity Web21)



EXELART™ MRT-1000, by the courtesy of Toshiba Medical Systems Co., Ltd

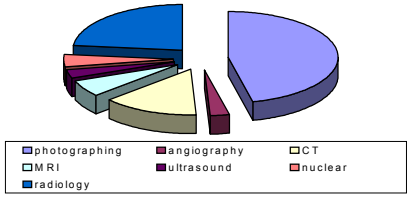
Advanced MRI built into General Medical System

Medical radiology instruments have been dramatically generalized in the last thirty years. Thirty years ago, medical imaging instruments such as X-ray, MRI and positron developed in the world, and they were individually applied to the radiotherapy. Today, the medical radiology instruments are mostly general-linked, and medical information is electronically computerized.

In the 1980s, medical instruments such as MRI became mature and popularized to many hospitals. In the late 1990s, several kinds of medical radiology instruments have been used at the same examinations, and those examinations have electronically resulted in the local Web system.

The " New Medical" 2000 published by the ME promotion association, has reported that in three typical hospitals in Japan: Hokkaido University, cancer center of Saitama prefecture and Nagasaki University, medical examinations of photographing-angiography, CT-MRI, ultrasound and nuclear radiology has resulted in 50%, 20%(14% for CT and 16% for MRI), 3% and 27%, respectively. In addition, in the latter 1990s, medical engineering and medical information processing have contributed to the genome analysis with increasing speed. Especially, under computerized morphological medical-information through CT, MRI and other radiology instruments, a patient can be generally diagnosed and properly treated.

(Yasuzo Tanaka, Editor of Superconductivity Web 21)



Medical examinations rate of photographing-angiography, CT-MRI, ultrasound and nuclear radiology in three typical Japanese hospitals

Furukawa support 25% in MRI maintenance of its magnet system

Makoto Kudo, Director, SCM service department of Furukawa Electric Engineering Service Co., Ltd. (FEES) has announced that FEES contributes much service and maintenance to the MRI magnet system of 25% in Japan. FEES has provided a great deal of service and maintenance for the superconducting magnet system, the cryogenic system and the refrigerator system since 1984. FEES has especially enjoyed much popularity in the medical sector, because FEES is effective at an online maintenance when the superconducting magnet is in operation.

FEES has supported about 720 MRI instruments in the FY2000 by analogy with the Japanese MRI markets of 2,868 units for superconducting type, 34 units for normal type and 976 units for permanent type. Further, FEES has enjoyed good business results, reflecting a growth rate of 7.7% per year in the Japanese MRI markets.

A report in January 2001 published by the ME Promotion Associate, confirmed that the medical imaging system markets including the MRI in the FY2000 is about 250 billion yen in Japan. The report also reveals the MRI market share is 17%. Another report, Superconductivity Communication, published in February 2001 by Superconductivity Information Society stated that the MRI market will popularize both the conventional solenoid-dome type and the newly developed sprit-open type.

Consequently, a service and maintenance business such as FEES will become indispensable to future superconductivity applications.

(Yasuzo Tanaka, Editor of Superconductivity Web 21)

What's New in the World of Superconductivity Power Applications

Intermagnetics General Corporation (March 22, 2001)

Intermagnetics General Corporation (IGC) announced the results of their third quarter. Net income increased to $ 2.9 million, an increase of 72% compared to the same period of the previous fiscal year. Net sales also increased to $ 34.3 million, compared to $ 28.1 million for the same period of the previous fiscal year. IGC's net income for the nine month period ending February 25, 2001, was $ 8.5 million, almost double the income for the same period of the previous year. Net sales for this nine month period were $ 98.4 million ($ 83.4 million for the same period of the previous fiscal year).

News Source:
"Intermagnetics Reports Q3 Net Income Up 72% to $2.9 Million"
(Intermagnetics General Corporation Press Release; March 22, 2001)
http://www.igc.com/

American Superconductor Corporation (April 2, 2001)

American Superconductor Corporation (AMSC) has reduced their revenue and earnings estimates for the fourth quarter of the fiscal year ending March 31, 2001. Revenue estimates were revised from between US $ 5.5 million and $ 9 million to the present estimate of $ 2.5 million. Estimated revenue for the year was revised from between $ 19.5 million and $ 23 million to the present estimate of $ 16.8 million. The company cites a delay in the sale of SMES products as the cause of the reduced revenue and earning estimates. Utility and semiconductor manufacturers, the main users of SMES technology, appear to be reluctant to purchase SMES units in the present economic and regulatory situation.

News Source:
"American Superconductor Reduces Revenue and Earnings Estimates for the Fourth Quarter of Fiscal 2001"
(American Superconductor Corporation Press Release; April 2, 2001)
http://www.amsuper.com

American Superconductor Corporation (April 18, 2001)

American Superconductor Corporation (AMSC) reported that Congressman John Olver had toured their new HTS wire manufacturing plant in Devens Commerce Center, MA. The facility will be the first large-scale commercial production facility for HTS wires in the world. Construction of the plant is on schedule; trial production is expected to begin in the first half of 2002, with commercial production expected to commence in the second half of 2002.

News Source:
"Congressman John Olver Tours Construction Site for American Superconductor's First HTS Wire Manufacturing Plant"
(American Superconductor Corporation Press Release; April 18, 2001)
http://www.amsuper.com

IMAGING

University of California, Berkeley and Lawrence Berkeley National Laboratory (February 8, 2001)

Researchers at UC Berkeley and LBNL have developed a new technique that uses a superconducting SQUID microscope to drastically increase the ease, speed, and sensitivity of immunoassays. The technique can be used to detect minute levels of bacteria, drugs, and many kinds of proteins and chemicals. Several drawbacks to conventional immunoassay techniques can be overcome by the use of a SQUID microscope, and the time required to obtain sensitive results is drastically reduced: from one day to a matter of minutes. The speed of the process means that, potentially, medical doctors could make immediate bedside diagnoses and food processors could detect bacterial contamination prior to outbreaks of food poisoning. The technique would also be invaluable during incidents of biological or chemical terrorism, where agents must be identified as quickly as possible. The SQUID microscope is used to detect magnetic fields produced by nanometer-sized magnetic particles linked by antibodies to their target molecule. Further improvements in the magnetic tags are expected to considerably improve the sensitivity of this immunoassay technique.

News source:
"Superconducting SQUID microscope makes immunoassays easier, faster and more sensitive,

scientists at UC Berkeley and LBNL report" By Robert Sanders, Media Relations
(08 Feb 2001 University of California, Berkley Press Release)
http://www.berkeley.edu/news/

Oxford Instruments plc (April 9, 2001)

Oxford Instruments hosted a scientific forum for MMR scientists at Eynsham near Whitney, Oxfordshire on April 5, 2001. Japanese scientific instruments company JEOL invited 50 of their UK-based customers to the session which included a presentation by Oxford Instruments on the 900 MHz superconducting magnets and a sneak preview on a new laboratory equipped with 900 MHz NMR to be opened later this year.
News Source:
"Information exchange for NMR scientists"
(Oxford Instruments News; April 9,2001)
http://www.oxford-instruments.com/SCNNWP361.htm

Motor Applications

American Superconductor Corporation (April 25, 2001)

American Superconductor Corporation (AMSC) announced that it has received a third contract worth US $3.1 million from the U.S. Navy's Office of Naval Research (ONR) to continue with the development of an HTS motor and related subsystems for the propulsion of electric ships. AMSC expects to complete the contract within the next 9 months and expects to receive additional contracts from the Navy that will culminate in a sea trial of their HTS propulsion system by the end of 2003. The HTS motors are expected to be 1/5 the size and 1/3 the weight of conventional electric motors. They are also expected to provide considerable improvements in maneuverability, fuel efficiency, and numerous other advantages.
News Source:
"American Superconductor Announces Third Contract from U.S. Navy for Development of HTS Ship Propulsion Motors"
(American Superconductor Corporation Press Release; April 25, 2001)
http://www.amsuper.com

MATERIALS

American Superconductor Corporation (February 28,2001)

The discovery of a new superconducting material, called magnesium diboride, with a T_c of about 40K was recently reported by Japanese researchers. Dr. Yurek, President of AMSC, commented that its discovery is very exciting, but that a long time will be required to produce a commercially viable wire from the material. Nevertheless, AMSC is investigating a new method to produce wires from the brittle material based on their previous experiences with other HTS materials.

According to AMSC, some of the potential uses of the new material include MRI and SMES applications. Dr. Yurek stated that the new material could lead to a new product line of SMES and MRI devices.

News Source:
"American Superconductor Comments on New Superconducting Materials Sees Long Term Potential for Boron-Containing Superconductors Company On-Track to Commercialize High Temperature Superconductor Wires for Power Grid Applications"
(American Superconductor Corporation Press Release, February 28,2001)
http://www.amsuper.com/press.htm

Ames Laboratory (March 5, 2001)

Researchers at Ames Laboratory and Iowa State University have developed have developed a method of fabricating MgB_2 powder in a two-hour process. They have also succeeded in making 5-cm long Mg_2B wires by placing boron wires in a magnesium vapor atmosphere. The MgB_2 wires have a minimum density of 80%.

News Source:
"AMES LAB RESEARCH LEADS TO BETTER UNDERSTANDING OF NEW SUPERCONDUCTING COMPOUND"
(Ames Laboratory News Release; March 5, 2001)
http://www.external.ameslab.gov/news/release superconducting.htm

Lucent Technologies (March 8, 2001)

Bell Labs has discovered the world's first polymer superconductor, known as polythiopene. Although the T_c of polythiopene is as low as 2K, the versatile characteristics of the material create various possibilities for industrial applications.

News Source:
"Scientists at Lucent Technologies' Bell Labs create the world"s first plastic superconductor"
(Lucent Technologies Press Release; March 8, 2001)
http://lucent.com/press/0301/010308.bla.html

MRI and Sensors

4-D Neuroimaging (February 26, 2001)

4-D Neuroimaging announced that the American Medical Association (AMA) has approved the issuance of billing codes for the use of magnetoencephalography (MEG; also known as magnetic source imaging, or MSI). MEG will be used during surgical procedures for the treatment of epilepsy as well as functional brain mapping before neurosurgery.

News Source:
"4-D NEUROIMAGING ANNOUNCES ISSUANCE OF CPT CODES FOR MAGNETOENCEPHALOGRAPHY"
(4-D Neuroimaging Press Release; February 26,2001)
http://www.4dneuroimaging.com/html/2-26-01.html

Intermagnetics General Corporation (March 2001)

Intermagnetics General Corporation has succeeded in the design and manufacturing of a compact 3.0 T magnet. The magnet has been installed in the world's most compact, ultrahigh magnetic field MRI system, introduced by Philips Medical System at the annual meeting of the Radiological Society of North America held last November. The device has received US Food and Drug Administration 510(k) approval. This system can be used for brain imaging.

News Source:
"INTERMAGNETICS' ADVANCED COMPACT SUPERCONDUCTING MAGNETS AT HEART OF PHILIPS' INNOVATIVE ULTRAHIGH-FIELD MRI SYSTEMS"
(Intermagnetics General Corporation Press Release; March, 2001)
http://www.igc.com/

Stanford University (March 20, 2001)

Stanford researchers have developed a method for constructing cheap MRI devices. The group uses two non-superconducting magnets, one to create a strong magnetic field with a low level of homogeneity and the second to create a low magnetic field with a very high level of homogeneity. The main operating principle is that the magnet field used by MRI devices does not need to be both strong and homogeneous simultaneously.The researchers are presently working to improve image quality.

News Source:
"Two magnets are cheaper than one: Stanford engineers construct an inexpensive MRI scanner"
(Stanford News, by Louisa Dalton; March 21, 2001)
http://www.stanford.edu/dept/news/pr/01/mri321.html

Varian, Inc. (March 2001)

Varian, Inc., and Oxford Instruments, Plc, have jointly opened a life science laboratory containing a 900 MHz nuclear magnetic resonance (NMR) spectrometer. The instrument will be used in research on the structure, function, and dynamics of large biomolecules. The laboratory will also be used for research on superconducting magnets, RF consoles, and NMR probe development.

News Source:
"Varian, Inc., and Oxford Instruments Open Life Sciences Lab Housing World's Most Powerful NMR Spectrometer"
(Varian, Inc. Press Release; March, 2001)
http://www.varianinc.com/corp/news/allpr.html

Electronics

Irvine Sensors Corporation (March 7, 2001)

Irvine Sensors has received a $2 million U.S. government R&D contract for the development of an ultra-high-speed "SuperMemory™" using low-temperature, serial superconducting electronics. The project is part of Irvine Sensor's "SuperRouter™" initiative.

News Source:
"IRVINE SENSORS RECEIVES $2M R&D CONTRACT FOR SUPERMEMORY™" High Performance, High Speed Memory Modules Stack Superconducting Chips"
(IRVINE SENSORS CORPORATION NEWS RELEASE; March 7, 2001)
http://www.irvine-sensors.com/super_mem.html

Telecommunications

Superconductor Technologies Inc. (March 2001)

Superconductor Technologies Inc. (STI) announced a new alliance with Paradigm Wireless Systems, Inc., (PWS) to provide balanced link solutions to wireless operators. The announcement was made at CTIA (Cellular Telephone Industry Associaton) Wireless 2001 in Las Vegas. STI's SuperFilter ® System optimizes uplinks, while PWS produces power amplifiers that optimize downlinks. In addition, STI also announced a new product family: SuperLink™ Solutions. SuperLink enables carriers to maximize the capacity of their networks. Previously, on March 13, STI also announced a new "HTS-Ready"™ 850 Series Duplexer for use in high-power base station transmitters. Also, on March 7, STI announced the opening of a sales office in Sao Paulo, Brazil. The company has formed an agreement with TWS International, Inc., to provide design, development and engineering services for STI customers in South America.

News Sources:
"Superconductor Technologies and Paradigm Wireless Systems Announce Strategic Alliance" (Superconductor Technologies Inc. Press Release; March 20, 2001)
"Superconductor Technologies Introduces SuperLink™ Solutions" (Superconductor Technologies Inc. Press Release; March 20, 2001)
"'HTS-Ready' 850 Series Duplexer From Superconductor Technologies Optimizes Base Station Performance in Wireless Networks"(Superconductor Technologies Inc. Press Release; March 13, 2001)
"STI Opens Office in Brazil and Signs TWS International" (Superconductor Technologies Inc. Press Release; March 7, 2001)
http://www.suptech.com

Superconductor Technologies Inc. (April 24 2001)

Superconductor Technologies Inc. (STI) announced their financial results for their first quarter ending March 31, 2001. Gross commercial product revenue increased by 150% to US $ 2.5 million, compared to their results for the same quarter in the previous fiscal year. Government contract revenue decreased slightly from $ 1.3 million to $ 1.1 million for the same period. Total net revenues for the first quarter increased by 69% to $ 2.8 million. Sales of the company's HTS SuperFilter™ products are the main reason for the drastic increase in commercial product revenue.

News Sources:
"Superconductor Technologies Inc. Reports First Quarter 2001 Results"
(Superconductor Technologies Inc. Press Release; April 24, 2001)
http://www.suptech.com

(Myrna Harrod, Akihiko Tsutai, International Affairs Department,ISTEC)

Patent Information relating to Superconductivity

This column focuses on the recent activities in intellectual property such as disclosed patents, registered patents information, recommended patents, topics relating to the patents, in the Superconductivity Research Laboratory (SRL) of ISTEC.

The following registered patents are related to the resin impregnated bulk high temperature superconductors, which feature excellent mechanical properties, highly trapped magnetic flux densities, and applicability to higher magnetic field uses. These activities resulted in Japan's National Project of Research and Development of Fundamental Technologies for Superconductivity Applications, partly supported by the New Energy and Industrial Technology Development Organization (NEDO)

(1) Japan Patent No. 3,144,675: Application No. Hei10-361722 on 18 Dec. 1998, and Registered on 5 Jan. 2001
(2) Japan Patent No. 3,100,375: Application No. Hei11-61135 on 9 Mar. 1999, and Registered on 18 Aug. 2000
(3) Japan Patent No. 3,100,370: Application No. Hei11-175290 on 22 Jun 1999, and Registered on 18 Aug. 2000

On the other hand, SRL/ISTEC has activities in the following intellectual properties in the FY2000. These activities mainly are related to the Japan National Project of Research and Development of Fundamental Technologies for Superconductivity Applications, partly supported by the New Energy and Industrial Technology Development Organization (NEDO), and Research and Development supported by the Ministry of Education, Culture, Sports, Science and Technology. These activities show a slight decrease in the number of registered patents, comparedwith FY1999.

No. of Applications and Registered Patents in FY2000

Fields	No. of Application Patents	No. of Registered Patents
Fundamentals	3	2
Bulk materials	3	9
Wires	7	2
Devices	7	4
Total	20	17

(Katsuo Nakasato, Director, Research and Development Promotion Division, Superconductivity Research Laboratory(SRL) - ISTEC)

Editor's Postscript

The quarterly Superconductivity Web21 contains information related to superconductivity technology, applications, products, etc, providing readers with newsworthy information and a place for exchanging information.

The following general articles and information is in Japanese, because the Superconductivity Web 21 is quarterly reviewed through the monthly Japanese Superconductivity Web21 version.

(1) Word commentaries: Information Technology Revolution, the second strategic plan in Science and Tchnology
(2) Serial articles: A Mysterious Superconductivity Energy Gap, and High Temperature Superconducting SQUID

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