- o May add little to the existing incentive to commercialize products.

- o A potentially costly precedent for awarding prizes in other fields (e.g., biotechnology).

D. ESTABLISHMENT OF AN INDUSTRY AND SCIENTIFIC ADVISORY COMMITTEE

Establish an informal industry and scientific advisory committee which broadly represents the pioneering firms and industry consortia affected by superconductivity advances. This group will report on the outlook for high-temperature superconductor applications and suggest government policy directions. The group may also be able to assist in monitoring foreign developments in the field and report any problems of access to foreign R&D.

PRO

Allows the industry concerns to be quickly conveyed to the government.

Could appear as part of an Administration package.

CON

Provide a method of lobbying for special favor.

Superconductivity
NBS Submission to OPTI
May 4, 1987

1. High transition temperature superconductors have the potential to revolutionize a wide range of electrical and electronic products. Several developments must be achieved before that potential can be realized, particularly the improvement in the current carrying capacity ("critical current") of these materials. Until it is known whether this is possible, we will call these high critical temperature superconductors a <u>potential</u> emerging technology.

   Two major problems have to be overcome before the full potential of superconductors can be realized:

   (a) Substantial increase of the critical current density
   (b) Learn how to fabricate in films, strips, wires, etc., while retaining the superconducting characteristics of the bulk material

   Basic data on materials properties and new measurement techniques are needed:

   - Phase diagrams, crystal structure, electronic structure, copper and oxygen conduction electronics, phonon spectra, etc.

   - Processing parameters, such as constituent quantities, temperatures, temperature change rates, surface effects, substrate effects, environmental effects (e.g. humidity), etc.

   - Electrical properties and fundamental studies including interface physics, tunneling characteristics, magnetic field properties, current properties, stress properties, and pulse and ac effects.

   NBS scientists are currently addressing many of these areas.

2. The ultimate commercialization of superconductivity will depend on our understanding of the chemistry, processing, microstructure, and electrical properties of superconducting materials. If our research and technology development is successful, then numerous potential applications come to mind:

   o High-Field Magnets - for research, fusion, high-energy physics, etc.

   o Power Transmission Lines - for elimination of I^2R losses

- Motors - for large industrial applications and ship propulsion (allows more flexibility in ship design)
- Generators - for power stations and airborne applications
- Energy Storage Systems - for peak load balancing in power systems and research applications
- High-Q Resonators - for particle accelerators
- Magnetic Shields - for magnetic isolation of electronic systems and other field-sensitive systems (e.g., atomic resonators)
- Bearings/Levitation - for near frictionless support of loads (e.g., motor and generator bearings, railroad suspension and research applications)
- Signal Transmission Lines - to minimize dispersion in pulse transmission
- Digital Processors and Memory - unique quantum properties offer new opportunities (further concepts needed to achieve something in this area)
- Magnetic Shields - for magnetic isolation of electronic components
- Signal Processors - counters, A/D converters, comparators, etc.
- Sensors - for magnetic field, current, voltage, rf quantities, etc.
- Mixers - for frequency synthesis, heterodyne detection, paramps, etc.
- Standards - for voltage surely, but other standards have been discussed
- High-Q Resonators - for electronic applications, clocks, filters, etc.
- Gravitational Instruments - gravimeters, accelerometers, gyroscopes, etc.

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Gaithersburg Maryland 20899

MAY 0 4 1987

MEMORANDUM FOR Distribution

From: Helmut W. Hellwig *Helmut Hellwig*
Associate Director for
Programs, Budget and Finance

Subject: Patent Advisory - New Superconductors

We are all excited about the boundless opportunities promised by the new-high-temperature superconductors; your contributions and ideas in this field are critical and will surely lead to scientifically rewarding results but also to some very practical applications.

In light of the foregoing, I am attaching the recently issued Administrative Bulletin on "Changes in the NBS Inventions and Patents Committee, Procedures for Disclosure of Inventions and Distribution of Patent Royalties". Although most of your work will be measurement and generation of data, both leading to a better understanding of the new phenomena, some of your work will fall in the area of new materials, processes, and technologies. In these areas the question of patent or publish must be considered very carefully.

Therefore, please file invention disclosures as appropriate and forward them to Al Sher in time for him to provide you with advice and counsel.

Attachment

cc: D. Johnson
J. Lyons
L. Schwartz
J. Burrows

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
WASHINGTON - BOULDER

ADMINISTRATIVE BULLETIN

87-7 | Inventions and Patents

March 27, 1987

[ ] Action
[X] Information

Distribution
A
AF

Changes in the NBS Inventions and Patents Committee, Procedure for Disclosure of Inventions and Distribution of Patent Royalties

(1) The Technology Transfer Act of 1986 provides for inventors and co-inventors to receive certain percentages of royalties which the Government may receive through licensing of a patent. It is NBS policy to set aside 15% of any such royalties for payment to the inventor or co-inventors. In case of two or more co-inventors, each will receive an equal share of this set-aside. Inventors are only entitled to a share when royalties are actually received by NBS; payments will be made on a lump-sum, calendar-year basis. This shared royalty is in lieu of and substitutes for any awards which have been established prior to the passage of the Technology Transfer Act of 1986.

(2) All employee inventions, regardless of their source of funding, are reported formally on Form CD-240, Invention Disclosure and Rights Questionnaire. Form CD-240 must be submitted to the Director of the Major Organizational Unit(s) of the submitting employee(s) for approval and forwarding to the Inventions and Patents Committee.

(3) The Inventions and Patents Committee charter is revised as follows:

Functions

(a) Determines the disposition of invention disclosures: Selects, for action by the Patent Counsel, those invention disclosures which should be protected by patent.

(b) Reports to the appropriate MOU Director its determination that an employee's invention is directly related to an NBS mission.

(c) Performs Ad Hoc advisory assignments related to NBS patent and invention activities as requested by the Director.

Membership

The Committee shall consist of five members, including the Patent Counsel who shall serve ex-officio as Secretary.

The committee is permanently chaired by the Chief of the NBS Program Office. The members of the Committee, except the Patent Counsel, shall be selected by the Director and shall serve three (3) year renewable terms. In selecting Committee members, the Director may consider nominations submitted by the Executive Board.

Procedures

The Committee shall establish rules and procedures, subject to approval by the Director, governing its operations. The Chairperson may call on any NBS organizational unit for information which may be needed for carrying out the Committee's functions.

NBS Administrative Manual, Subchapter 2.10, Inventions and Patents, and the Charter for the Inventions and Patents Committee will be revised to reflect these changes. Additional changes may occur as a result of Departmental policies as they are promulgated.

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

MAY 4 1987

MEMORANDUM

TO : Dr. Philip Goodman
Office of the Assistant Secretary for
Productivity, Technology, and Innovation

FROM : Executive Assistant to the
Assistant Secretary

SUBJECT : Information on Superconductors

Responding to the urgent request you relayed to us from the Economic Policy Council (EPC), I checked with Patent Examining Corps management to determine how many patent applications have been filed on "superconductors." Additionally, you indicated that the EPC is interested in learning when such applications were filed, and the country of origin. The following is the result of my inquiry.

Generally speaking, inventions in the superconductor field date back many years, have received hundreds (perhaps thousands) of patent grants, and are incorporated into a wide variety of technologies. Undoubtedly, the subject of the EPC request involves recent high-tech breakthroughs announced in the media--ceramic superconductor compositions successfully operating in "relatively high temperature ranges." In this emerging technology area, TWO APPLICATIONS HAVE BEEN FILED, BOTH AROUND NOVEMBER OF 1986, AND BOTH OF JAPANESE ORIGIN. You should note, however, that there is a time "lag" to consider. While vigilant Supervisory Patent Examiners have identified the two Japanese applications, others involving new superconductor compositions may have been filed within the past 2-3 month period and are in a "pre-processing" status.

Incidentally, you may be interested in the attached listing of U.S. patent classification categories where patents relating to superconductivity can be found -- and where applications involving new superconductor compositions may subsequently be pending.

I hope this report will be useful to the EPC. Let us know if more information (non-proprietary, of course) is needed. (557-3071).

Donald G. Kelly

Attachment

cc: Donald J. Quigg, Assistant Secretary
Rene D. Tegtmeyer, Assistant Commissioner for Patents
Michael Lynch

CLASS	SUBS	CLASS TITLE	ART UNIT
29	599	METAL WORKING	326
62	259.2	REFRIGERATION	344
174	15CA, 15S 126S, 128S	ELECTRICITY, CONDUCTORS AND INSULATORS	215
252	500+	COMPOSITIONS	157
307	245, 277, 306+, 462 476, 541	ELECTRICAL TRANSMISSION OR INTERCONNECTION SYSTEMS	254
310	10, 40R, 52, 54, 64	ELECTRICAL GENERATOR OR MOTOR STRUCTURE	212
323	360	ELECTRICITY, POWER SUPPLY, OR REGULATION SYSTEMS	212
324	248	ELECTRICITY, MEASURING & TESTING	267
331	107S	OSCILLATORS	252
333	99S	WAVE TRANSMISSION LINES & NETWORKS	252
335	216	ELECTRICITY, MAGNETICALLY OPERATED SWITCHES, MAGNETS AND ELECTROMAGNETS	216
336	DIG 1	INDUCTOR DEVICES	215
338	32S	ELECTRICAL RESISTORS	216
357	6, 83	ACTIVE SOLID STATE DEVICES	253
361	19, 141, 276	ELECTRICITY, ELECTRICAL SYSTEMS AND DEVICES	211
363	14	ELECTRICAL POWER CONVERSION SYSTEMS	212
365	160+	STATIC INFORMATION STORAGE AND RETRIEVAL	233
420	901	NONFERROUS ALLOYS OR METALLIC COMPOSITIONS	111
427	62, 63	COATING PROCESS	152
428	930	STOCK MATERIALS OR MISCELLANEOUS ARTICLES	111
501		COMPOSITIONS: Ceramic	118

World-Wide Development Status of Superconductor R&D

May 4, 1987

The new "relatively high temperature' superconductors, prepared from ceramic materials, have spawned a new race to explore and apply this technology. Military and commercial significance are inestimable but may be on the order of, or perhaps greater than, the semiconductor revolution.

The race is world-wide. Both careful studies and hit-or-miss experiments are being conducted. At the extremes, the Soviets have reported preliminary achievment of superconductivity just below room temperature, at about - 30° C. The Chinese are also in the race but their best reported achievement is about - 100° C. The Japanese have reportedly mounted a research consortium to attack the entire problem and, given their expertise in advanced ceramics, may be expected to gain an early lead infabricating the new superconductors.

U.S. reported achievements in new materials are competitive with the Soviets, - 33° C. U.S. laboratories of all kinds are working on fabricating the new ceramics without degrading the superconducting properties. IBM has announced that it has succeeded in spray painting the materials and that plasma spraying is a likely possibility.

Philip Goodman
Senior Technical Advisor

NEXT

DEVELOPING SUPERCONDUCTORS

The United States and Japanese economic systems are competing to develop superconductor technology into important new products.

Because of the U.S. Government's poor record in promoting commercial use of technologies it helped pay for, it has been adopting a policy of decentralized management of technologies created with Government funding. Under these policies, creating organizations such as universities, contractors, and Government laboratories are given the authorities and incentives belived necessary to promote commercialization by firms that might use new technology. The policy depends on the normal response of U.S. industry to market forces to make the best decisions. The President reinforced the policy on April 10 by signing Executive Order 12591 on Facilitating Access to Science and Technology.

Japan approaches important new technologies differently. The Wall Street Journal reported on March 20, that four days after superconductor advances were announced by the University of Houston, MITI announced its intention to organize a research consortium of Japanese companies, universities, and government labs. A MITI official was quoted as saying, "We've gathered all the leading-edge researchers in Japan. We need to get everybody together to share information and decide how to move."

Here is a beginning list of options to consider for the U.S. response to the Japanese action.

1. Adhere to the evolving U.S. policy of allowing those who create technologies and potential industry users to find eachother and negotiate in their own best interests.

2. Develop a clearinghouse for information about superconductivity technology that could be used to help bring industry and researchers together.

3. Create an evaluation process using Government and private sector experts to help researchers and industry evaluate superconductivity developments as a rapid and economical advisory service.

4. Develop a pool of superconductivity technology, into which universities, Government laboratories, and industry would place their technology, under terms that would guarantee their participating in the benefits of any commercial use of their contribution.

5. Create a market by accelerating Government procurement of products that require the newest superconductivity technology, (e.g. reduced size supercollider).

SUPERCONDUCTIVITY RESEARCH IN JAPAN

Since the February announcement of a major breakthrough in superconductivity research by the University of Houston, Japanese research efforts apparently have intensified. The Wall Street Journal reported in March that Japan's Science and Technology Agency (STA) announced its intent to form a research consortium of Japanese companies, universities and labs to share superconductivity information and plot future moves, while the Ministry of International Trade and Industry (MITI) began polishing up a feasibility study on a superconducting power plant and plans to have a working model built by 1992.

Japan's intent is to organize industry and get the jump on the West in applications and commercialization for the potentially huge market. The Japanese have been refining these technologies for years. Japan reportedly has a train using superconductivity that is almost ready for commercial use, and Japanese shipbuilders have spent $23 million to build a fast ship propelled by superconducting magnets.

According to researchers, the earliest application of the latest discovery could be superconducting computer chips that would enable creation of a shoe box-sized supercomputer. IBM and most other U.S. companies abandoned research in 1983 on the chips in part because of complications in cooling with helium, leaving Japan's NEC, Hitachi and a MITI lab to refine the technology (chip prototypes already have been produced), with little foreign competition.

Labs at Tokyo University, Tohoku University, Hokkaido University and a government research facility have made a number of advances in superconductivity. The WSJ article states that after the Houston announcment, Tokyo University researchers scrambled to figure out what element was used to achieve superconductivity and finally succeeded on March 1. The article also reports that Japanese companies such as Fujikura Ltd. and Sumitomo Electric that are selling conventional superconducting wire to the U.S. have begun crash programs to commercialize the new discovery, and have developed rudimentary wire out of the new ceramic material.

Also, Japanese press reports in late March and early April stated that both MITI and STA plan to establish Japanese Government research institutes on superconductivity in the wake of new discoveries and heated international competition.

Specifically, MITI's Industrial Science and Technology Agency is reported to have started a "Discussion Council on Development of Superconducting Industrial Technologies" chaired by Tokyo University Professor Emeritus Masashi Yamamura in March, setting up a mechanism for technology interchange among researchers at various industry research institutes and universities. In addition, the report stated that MITI will establish an entity to test equipment made from superconducting materials in the Fine Ceramics Center in Nagoya (which opened in April) and is considering subsidization of such research, through the Basic Technology Research Promotion Center. A separate press account indicated that Japan's STA also will establish a research center for superconductivity applications.

Officials at our Tokyo Embassy queried GOJ officials about the press reports. MITI sources responded that they have no definite plans to launch a new program yet, but simply are assessing the current status of work on superconductivity in Japan and the United States. When asked what form a new program might take, they responded that it could become a large scale project, one of the programs on "Basic Technologies for Future Industries" or something with a completely different status.

An STA representative claimed to be unaware of any efforts to establish a superconductivity research center, and suggested that this plan was probably just a trial balloon sent up at the beginning of the Japanese fiscal year, the time when GOJ officials typically think up new initiatives for the following fiscal year.