Japanese poised to dominate in superconductors as well?

Tokyo

WHAT is happening in high-temperature superconductor research in Japan? Is Japan Incorporated ready to conquer the world? Not yet. Research is under way on a broad front but is largely uncoordinated, as government agencies and ministries manoeuvre to stake out territory and preserve their interests.

Since a group of researchers at Tokyo University confirmed superconductivity at about 30 K in a copper-oxide ceramic at the end of last year, research on the new materials in Japan has exploded. The April and May special issues of the *Japanese Journal of Applied Physics* contain nearly 200 papers on the new superconductors by several hundred scientists in about 80 laboratories throughout Japan. And barely a day goes by without the announcement of another 'breakthrough'.

Much of the effort, however, involves unnecessary duplication. On 4 March, the Science and Technology Agency's National Research Institute for Metals in Tsukuba announced that it had succeeded in making a high T_c ceramic, only to find that the same announcement had been made the day before by its Tokyo research institute. Researchers at the two laboratories were apparently unaware that they were making the same ceramics even though both had representatives on the agency's research committee on high-temperature superconductors. The committee, with representatives drawn from the universities, industry and the agency's laboratories, was formally set up in February but began informal meetings at the end of last year. The committee's principal job is to organize workshops and symposia; the first symposium was held on 1 May with I. Bednorz of IBM Zurich as guest speaker.

According to Koichi Kitazawa of Tokyo University, one of the committee members, the Science and Technology Agency has been very quick off the mark and has played an important role in disseminating news. The right 'atmosphere' to win financial support from the Ministry of Finance is being created. The new superconductors also provide a golden opportunity to boost the agency's National Research Institute for Metals whose fortunes have been declining along with those of the iron, steel and aluminium industries. On 28 May, the agency announced the establishment of a 50-man research centre at the Tsukuba site next spring to carry out basic and applied research on the new ceramics.

When it comes to funding research, though, the agency has been beaten off the mark by, surprisingly, the Ministry of

Education. Casting aside its conservative image, the ministry has taken the extraordinary step of extending a major fixed-term grant, something that has only previously been done in the case of a natural disaster. A special research project to investigate new superconducting materials headed by Professor Nakajima of Tokai University (formerly of Tokyo University) is to be extended at a cost of ¥180 million (\$1.3 million). In addition, Professor Kazuo Fueki of the Tokyo University group has been awarded ¥36 million by the ministry for this fiscal year (April 1987–March 1988). And Professor Shoji Tanaka, leader of the Tokyo University group, is a strong candidate for one of the ministry's special distinguished grants which are announced at the end of this month. Running from three to five years, the grants are usually worth ¥100–200 million (about \$1 million).

But the biggest government backer of technology development, the Ministry of International Trade and Industry (MITI), has yet to show its cards. MITI has long been a strong supporter of superconductor research. Companies such as Toshiba and Hitachi, nurtured in MITI's magnetohydrodynamic project, and aided by Japan National Railway's bid to build a high-speed train levitated on superconducting magnets, have gone on to supply many of the magnets for US particle accelerators. Josephson junction research has also been supported within the national supercomputer project. Although US companies, including IBM, abandoned similar work, researchers at NEC, Hitachi and Fujitsu remain confident that a Josephson junction computer can be built by the twenty-first century.

MITI money is also being funnelled to private companies through the Electric Power Central Laboratory in Tokyo, thereby allowing eight companies all to continue production of conventional superconducting wire, despite the comparatively small size of the Japanese market. It was from them that the first reports of the manufacture of high-temperature superconducting wires emanated. First off the mark was Fujikura Densen with La-Sr-Cu oxide encased in drawn-out tubes of copper and steel. Then on 2 April, Toshiba released pictures of wire fashioned from Y-Ba-Cu oxide. Although the current-carrying capacity of the wire was initially very low (a few amps per square centimetre), within a month Toshiba had reached 520 A cm⁻² and now Hitachi claims the record at 4,000 A cm⁻² for ceramic wire (0.8 mm diameter) encased in silver.

Despite these projects, however, MITI

Just five years from superconductor cable

Washington

THE US Department of Energy (DoE) is showing unusual alacrity in pushing for research on the new superconductors. Motivated by constant but uncertain rumours of furious Japanese activity, DoE officials have taken some considerable steps towards an organized national effort in this new technology.

A series of conferences to promote collaboration between the national laboratories, universities and industry is already under way, but DoE has now gone beyond this cheerleading role and has given Argonne National Laboratory a specific brief to produce a practical superconducting wire, operating in liquid nitrogen, in five years. (Argonne researchers have already made 'wires' by embedding superconducting grains in a plastic base.) The aim of the programme, in which Brookhaven and Ames (Iowa) Laboratories will also participate, is to make a cable suitable for electric transmission lines.

DoE also announced last week that it is setting up a computerized database to help US scientists to cope with the huge flow of results. Secretary of Energy John S. Herrington said that the normal channels of scientific communication are being overwhelmed, and that the DoE, by expanding its existing systems, could expedite the flow of information. The database will be accessible through electronic mail, and will be open to anyone who pays an entry fee.

The impetus for these initiatives is apparently coming from the top. At DoE headquarters, 'research applications' and 'Japan' are whispered in the same breath, and the current political climate is ideal for any venture which seeks to encourage US industry.

David Lindley

has yet to formulate a policy on the new superconductors. Some of the problems are internal. There are fears that a new project may siphon off funds from projects already established — to the Ministry of Finance, superconductors are all the same be they ceramic or otherwise.

After a hearing of the science and technology committee in the lower house of the Diet on 28 May, Professor Shoji Tanaka called for a national project to develop applications, such as a magnetically levitated train. Also present at the hearing was Yoshihiro Kyotani, head of Japan's linear motor car (MAGLEV) project. But ruling party politicians suggested that the project should be international and might even be proposed at the Venice summit next week.

Tanaka denies that he is suggesting that Japan set up a research association similar to the well-known VLSI (very large-scale integrated circuit) project of the late 1970s