From New Delhi by Susan Maitra

India joins the race for new materials

The prime minister has formed a committee to supervise superconductivity research.

On May 31, the government of India announced the formation of a committee to coordinate the research on superconducting materials now under way in four leading Indian institutions. The purpose of the research is to develop a material which will be superconducting—that is, provide zero resistance to electrical current—at room temperature.

The committee was launched by Prime Minister Rajiv Gandhi and will be headed by Prof. M.G.K. Menon, a particle physicist and scientific adviser to the prime minister. The decision to form such a committee stems from the worldwide attention that superconductivity research work has drawn over the last year. Last year's discovery by two scientists at the IBM Zurich Research Laboratories of a rare-earth ceramic compound that becomes superconducting at 30° Kelvin (−243° Celsius) triggered off an intercontinental race to find new compounds which can become superconducting at higher and higher temperatures. Already a good deal has been achieved, and now scientists claim that compounds can be made which allow electric current to pass at no loss at a temperature of about 90°K.

While the findings of the Western scientists and Japanese researchers have been well publicized, the Indian work has not caught the attention of the Western press, though the results have been remarkable. All four institutions—Bhabha Atomic Research Center (BARC) in Bombay, the Indian Institute of Science in Bangalore, the Indian Institute of Technology (Madras), and the National Physical Laboratory in Delhi—have reported success. The first one to announce was BARC, whose scientists claimed that they have developed a yttrium-barium-copper compound that becomes superconducting at a temperature of 90-105°K.

Scientists at the Indian Institute of Science, led by Prof. C.N.R. Rao, published studies documenting their observation of a transition to superconductivity by lanthanum-based compounds at about 40-50°K, and at 85-100°K by yttrium-based compounds. In early May, Dr. L.S. Srimath, director of the Indian Institute of Technology (Madras), reported that his institution had developed new alloys based on rare-earth elements which exhibit zero electrical resistance at 95°K.

The biggest news was reported on May 29 when scientists at the National Physical Laboratory announced they had observed a superconducting transition at +26°C in some multiphase doped yttrium-barium-copper-oxide compound. The most important test will be to see if the phase identified as the superconducting phase is a stable one.

The NPL researchers caution that the observation of the transition itself does not imply superconductivity at room temperature: It only gives a clue that a phase exists within the multiphase sample that *could be* superconductive at 26°C. Scientists observed a distinct drop in resistance at that temperature, which was double-checked with the inverse AC Josephson tunneling effect, a diagnostic which has been used by scientists in the United States.

India's quest for a superconducting material at room temperature is very practical. India is a large nation with woefully little electric power. India's future economic success depends heavily on its ability to supply abundant electrical power at a high voltage to the most distant parts of the country. In this area alone, superconducting materials can play a vital role.

India also has a fusion program aimed at preparing the groundwork for future adoption of fusion power technology, and for this, development of superconducting materials will be essential.

It is too early to predict whether the yttrium-barium-copper-oxide can be drawn into wire or not, or how good a carrier of high-voltage electrical current it might be. Future developments will answer these questions. Meanwhile, the Indian program will be targeting the fabrication of high-field magnets using these materials.

The superconductivity mission is an important challenge. The country's scientific establishment is in a crisis, since its domination by a handful of bureaucrats and lack of connection with the economic and social fabric of the country—in short, its lack of creativity and accountability—has been questioned. To succeed it will be necessary to encourage scientific ingenuity, keeping the goal in clear focus.

Moreover, Indian industry is lagging far behind. If India wants to benefit from such high-tech research as superconductivity, it must push industry to a level where the research results can become a commercial reality.