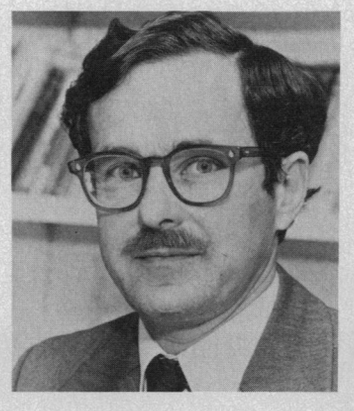
Superconductivity Stars React to the Market

Five years after the discovery of the first high-temperature superconductor, potential applications are beginning to make their presence felt—even in the job market

WHEN ALEX MALOZEMOFF ANNOUNCED ON 7 January that he had left IBM to join American Superconductor Corporation, he became the third top superconductivity researcher at a major U.S. company to jump ship in 1 week. At the end of December, Robert Dynes quit as director of the Chemical Physics Research Laboratory at AT&T Bell Labs to become a tenured professor at the University of California at San Diego. And at the same time, Edward Mead retired as Du Pont's manager of business development for high-temperature superconductors to become an independent consultant. Although the departures were unrelated, the moves all reflect a growing trend in high-temperature superconductivity research: a shift in emphasis from basic research to development of commercial applications.

Malozemoff's jump to American Superconductor is the best example of this. He is leaving a company that has pioneered basic studies of superconductors to direct the development of one of the first bulk products expected to come out of the field: superconducting wire. As IBM's Research Division Coordinator for high-temperature superconductivity, Malozemoff established a reputation as one of the most knowledgeable and respected researchers in the field. He was best known for his work on the problems of "flux creep"—the way magnetic flux lines in a superconductor move around the material, dissipating energy and eventually destroying the substance's superconductivity. (One of the many bizarre aspects of superconductivity is that a magnetic field passing through a superconductor is quantized in individual lines of magnetic flux. If these flux lines are not pinned in place, a current passing through the superconductor can push them around.) With his move to American Superconductor, Malozemoff will be turning this knowledge of the fundamental properties of superconductors toward commercial applications.

The flexible superconducting wires that American Superconductor is hoping to produce could someday be used in super-powerful magnets, zero-resistance electric power transmission, and energy-storage devices. Just 1 year ago, Malozemoff notes, these applications seemed far away because researchers believed it would be difficult for wires made of high-temperature superconductors to carry enough electrical current to be useful. Any large piece of these superconductors consists of many small grains, or crystals, and so-called weak links between the grains appeared to limit the amount of current that could pass from one grain to the next. For that reason, many scientists in this country thought that the first major applications of high-temperature superconductors would be those that used only single crystals. Thus IBM and other companies concentrated on electronic applications, such as superconducting microwave devices or SQUIDs (superconducting quantum interference devices, which are used as sensitive detectors of magnetic fields).



Mobile moguls. *American Superconductor lured Alex Malozemoff (left) from IBM; Robert Dynes left Bell Labs for the University of California at San Diego.*

But technological breakthroughs have suddenly changed that picture. Over the past year researchers have uncovered a variety of processing tricks that help to overcome these weak links and make multicrystalline superconductors that can carry large amounts of current. "The development [of superconducting wires] is now an engineering problem rather than a physics problem," Malozemoff says, and this means that wires—which are in many ways much simpler to manufacture than electronic devices—now seem to be a good bet for early commercialization.

Like Malozemoff, Dynes' move was stimulated by the commercial environment, though in his case he decided to move in the opposite direction—back toward basic research. Bell Labs has been trying to tie all of its research units more closely to business operations, notes William Brinkman, executive director of the labs' physics division, and research managers such as Dynes have been pushed to pay more attention to business needs. Part of Dynes' duties included, for instance, overseeing Bell Labs' participation in a superconductivity consortium with IBM, the Massachusetts Institute of Technology, and Lincoln Labs (see 2 June 1989 *Science*, p. 1037); the goal of that partnership is to develop electronics applications of high-temperature superconductors. Faced with a declining percentage of his time that could be spent on basic research, Dynes chose to go into academia.

Mead's decision to leave Du Pont was driven in part by personal reasons—he was tired of the bureaucratic procedures common to all big companies, he says, and at 62 he was ready to slow down a bit. But, like Malozemoff, he is likely to find himself in the middle of the commercialization of high-temperature superconductors. An independent consultant now, Mead's main job is principal business adviser to the Texas Center for Superconductivity at the University of Houston, the center set up around superconductivity superstar Paul Chu. Although the University of Houston center does conduct basic research, much of its work is aimed at applications and, indeed, UH researchers are responsible for some of the breakthroughs that have brought superconducting wires closer to commercial reality. The center, Mead says, now has more than 150 full-time and part-time employees—a graphic illustration that superconductivity is big business.

There is at least one other common thread running through the career changes of the three superconductivity workers—as well as the many other researchers in the field who have changed jobs in the past 2 years. In a highly visible, highly competitive field like high-temperature superconductivity, Mead notes, the well-known practitioners can move around pretty much as they please. They are the free agents of the science game.

■ ROBERT POOL