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Materials Research

". . . When as a debtor nation we must compete vastly better against the products and innovations of a smartening world, it is wise to review our progress in materials science and engineering." This is a quotation from William O. Baker, former chairman of the Board at AT&T Bell Laboratories. The occasion was a conference in October 1985 to commemorate the 25th anniversary of the Materials Research Laboratories. Participants in the conference included a distinguished cross section of industrial, governmental, and academic experts on materials science and applications. The proceedings, recently issued, include historical perspectives, status of scientific and technical areas, and policy matters.* The major fraction of the symposium volume consists of essays on frontier topics in materials science. These provide an interesting sample of recent advances, together with some tutorial essays. I found the chapters on metallurgical research, condensed matter physics, catalysis, and organic polymers particularly informative.

At the conclusion of World War II and for more than a decade thereafter, the United States enjoyed a novel position in commercial competition. West Germany, Japan, and most other developed countries were preoccupied with recovering from damage of the war. During the war, the United States had experienced great success in converting scientific knowledge into technology and important practical applications. From 1946 into the early 1970s, U.S. industrial research and development flourished and were world dominating. Particularly impressive were discoveries in materials science and the creation of such practical items as computers and polymers. Our major industrial laboratories conducted basic research, and they skillfully used interdisciplinary teams to exploit it.

Already in the late 1950s, it was evident that excellence in materials science was going to be crucial to the nation's future defense and commercial competition. Leaders such as John von Neumann, Frederick Seitz, and William O. Baker recognized the need to encourage interdisciplinary materials research at universities. In 1960, the Advanced Research Projects Agency initiated a program, Interdisciplinary Laboratories, designed to foster work in materials science. Later, in 1972, the National Science Foundation assumed responsibility for the program which was renamed Materials Research Laboratories.

In comparison with the true needs and opportunities, the Interdisciplinary Laboratories and their successor have had only a moderate impact. In part this is due to limited financial support—on the order of $20 million per year—a tiny sum compared to industrial R&D. At maximum, 12 universities were included, and the professional staffs numbered 600 faculty members. Recently, this number has been around 400. On the positive side, some 3000 Ph.D.'s have been granted. Two precedents have been established: the program has been supported by block grants, thus avoiding micro-management from Washington; the practice of other interdisciplinary efforts on campus has been fostered. Activity in materials research was slow in maturing. Peer pressure, the university departmental structure, and the quest for tenure and promotions caused many faculty to shun interdisciplinary research. Industrial managers have also often complained of the paucity of faculty activity in polymers and inorganic chemistry, fields that have come to have enormous practical applications while displaying interesting scientific phenomena.

The economic situation in 1986 was far different from that in 1960. Most companies feel pressed by foreign competition and, if anything, are cutting back on fundamental research. They are looking increasingly to the universities for inspiration and new knowledge.

A significant recent development is the emergence of a vital Materials Research Society. This group organizes an important set of meetings characterized by enthusiastic interaction among peers. Other factors inhibiting university materials science efforts could be (and are being) overcome by university administrators.

Because modern equipment is costly, not every university can engage in materials research. Those that do will share a tremendous responsibility for enabling this country to compete in the many products that are part of our daily lives.—PHILIP H. ABELSON

*National Academy of Engineering, *Advancing Materials Research* (National Academy Press, Washington, DC, December 1986).