Meetings

Materials

It has been just 9 years since a series of grants to universities by the Advanced Research Projects Agency (ARPA) launched the beginnings of a revolution in the study of materials. If one compares the political and scientific climates of 1960 and 1969, they seem almost to fall in different centuries rather than within the same decade. Because of the rapid changes, the time seemed propitious for a review. Thus, a conference was held at the Pennsylvania State University, 14–16 April 1969. Styled a "National Colloquy on the Field of Materials," it was organized by a committee called together by the Materials Advisory Panel of the Pennsylvania Governor's Science Advisory Committee.

Consider the political climate. In 1960, universities eagerly sought funds from the Department of Defense—unclassified, if possible, but even classified projects were not unwelcome at some institutions. As the colloquy began, Stanford's electronics laboratory was being occupied by radical students, demanding that the University end all classified research, and Harvard was under siege from students demanding an end to the Reserve Officers Training Corps.

Consider also the university scene. Still in the late 1950's universities were organized basically on disciplinary or departmental lines. Try today to find a university without its own set of interdisciplinary laboratories or units; more than a dozen can be found at the host institution alone. And the pioneer field of the whole interdisciplinary movement, the focus of this colloquy, has been materials science and engineering.

Even the financial sponsorship was different. In 1960, it was unthinkable that anyone but the government, with a seemingly limitless cornucopia, would sponsor such a meeting. In 1969, the State of Pennsylvania, through its Science and Engineering Foundation, sponsored the meeting on the basis that support of leadership in materials science could mean new industries and new jobs for a state which had, to its sorrow, lost out on aerospace and electronics but was determined to hang on to its lead as the "materials state."

Perhaps Dean Harvey Brooks (Harvard) expressed the change best when he noted in his written manuscript that not since the day of Bacon has society been less willing to accept "the faith that technological progress is beneficial to man." The "side effects of technology" are a matter of such concern that "even the purest scientist will have to become something of a systems engineer with respect to implications of his science."

What a change from 1960, when science still had a Coue-like quality of every day in every way getting better and better!

Notwithstanding an air of philosophy and introspection that hung over the conference, its main papers did in fact illuminate the remarkable knowledge explosion in the field of materials and perhaps in contrast that relatively slow response in administrative innovation.

Among the principal "calls for action" two areas stood out, in spite of the fact that there were no formal motions or votes nor any constituency. I. Warshaw (National Science Foundation) and N. E. Promisel (National Academy of Sciences) stressed the importance of a national "Materials Report" analogous to those in chemistry, physics, and astronomy, and it became clear that such a document is essential even though one could not point to its specific guaranteed value.

Underlying the entire meeting was the groping going on among the attendees for some mechanism to bring together the various subgroups, professional societies, and departments or disciplines, each of which carries its heritage as proudly as the DAR. One speaker drew an analogy—very aptly—with the ecumenical movement among the churches. And, all the same old "States-rights" arguments could be heard; ugly rumors were circulated about "super society" and "swallowing up" and "taking over." In the end, however, it became increasingly obvious that some mild form of federation was not only desirable but essential for the good of all the components of the materials societies. If such a grouping, an American Institute for Materials, were to be formed, it would find the organization of the hard sciences in four or five rather sensible communities organized as federations of existing societies: chemical, physical, geological, biological, and materials.

A second dominant and recurring theme concerned the future trends for materials science and engineering and their relation to national objectives and priorities. While speaker after speaker made vague allusions to the role of materials engineering in solving "social problems"—urban redevelopment, housing, pollution control, and others—and participants discussed these vague allusions even more vaguely, nothing specific emerged along these lines. Indeed, Walter Hibbard, who has just resigned as head of the U.S. Bureau of Mines, stated that he felt that no new materials technology was really needed in the housing field; and Robert Huggins (director, ARPA Materials Science Office) wondered aloud whether the list of national priorities was in fact clear to anyone. It became increasingly clear that the mating of a hard science with the ill-defined "social problems" is going to be infinitely more difficult than the rhetoric attending it now; and in fact the principal national goal for a field such as materials science and technology will be to keep the nation's peacetime economy in this area vital and competitive.

Robert Huggins remarked on the trend observed by all government agencies toward more "conservative" proposals and the study of safe bets. He urged the university community to come forward with the most imaginative proposals, saying that his office, at least, was "in the business of innovation."

S. B. Levin (deputy director, Office of Defense Research and Engineering) referred to the possible serious consequences of the mood on several campuses for reexamination of the relation between the Defense Department and the universities. He alluded to the little-known fact that in 1953 the percentage of total basic research at universities supported by the Department of Defense was 73 percent, whereas in 1968 it had dropped to 15 percent, as other agencies, notably NSF, NASA, and AEC entered the picture. He put the case for the benefit to society, the universities, and the Department of Defense for a continuance of interaction in the basic research area between the nation's universities and those charged with its defense.

Rustum Roy (Pennsylvania State University) referred to the static nature of the mechanisms of interaction between universities, industry, and government, showing that so far only new ideas were the ARPA-stimulated and paid-for "coupling contracts" between university and industry, and a few university experiments of intensive coupling of a laboratory or unit with a selected small group of industries. He pointed to the essential role of interdisciplinary research units (as distinct from degree-granting units) to be set up by universities if they are in fact to be able to respond to society's needs and problems since the former do not come in "discipline-shaped blocks."

As a part of his talk, W. O. Baker (Bell Telephone Laboratories) pointed up the urgent need for new educational programs in the field of crystal growth. Although virtually no pedagogy is going on in the field—he graciously identified the host institution as a "striking exception"—he noted that a recent survey disclosed the need for at least 230 more doctor of philosophy degrees, 150 at the master's level, 190 bachelors, and about 400 technicians in this area so critical to materials progress.

It is perhaps fitting that Baker should have provided both a proper summary and a call to arms for the meeting because of his role in PSAC, in 1958–59, that loomed so large in developing a coherent policy leading to the ARPA grants and the present state of materials science.

"Through materials research and engineering," he said, "we must implement a large part of the revolution of expectations in our nation. This field, in cooperation with the organizing and information-handling capabilities of communications and digital computers, seems to be a principal way to civilize the future. Just as the organic world, in food production and control of disease, may sustain human life, so the material world can enrich it. And there is no spiritual loss if people have more wheels to ease the burdens of their backs, more clothes to sooth the searing of the winds, more houses to seek shelter from the storms. These ends are worthy of our wisest means which lie in materials technology; but we have rewards beyond them too. For we are part of matter and can hardly understand ourselves or our world without a deep comprehension of what surrounds us."

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