An analysis of public policy issues and how they affect MRS members and the materials community...

Condensed Matter and Materials Physics Study Seeks Community Input

The Committee on Condensed Matter and Materials Physics* (CCMMP) was formed by the National Research Council in May 1996 to perform a scholarly assessment of the field. The Board on Physics and Astronomy is in the midst of reassessing the areas covered by the 1986 Brinkman survey of physics (Physics through the 1990s). The report of the CCMMP will serve as the component of the reassessment that addresses condensed matter and materials physics as part of a physics survey done once a decade.

The study will cover:

- an illustrative recounting of the major accomplishments in CMMP research in the last decade, such as high T_c superconductivity, chaotic and nonequilibrium phenomena, nanostructures, probe microscopies, and fullerenes;
- the impacts on technology in the form of novel materials, processes, devices, and phenomena which arose from research in CMMP;
- an evaluation of the modes and infrastructure of CMMP today, followed by recommendations on needs and opportunities to increase their effectiveness in the rapidly evolving support environment; this evaluation will include discussions of large national facilities, as well as small facilities and individual principal investigator research support;
- an examination of the demographics of the CMMP student population, including the trends in foreign student numbers, choices of thesis field, employment following graduation, and other fields into which physicists migrate and succeed;
- the career opportunities for graduates and needs for new faculty;
- the implications for the training of students with emphasis on the university-industry interface and future employment;
- a discussion of the process of innovation and the relationship between fundamental research and application in CMMP. Given the changing role of major industrial laboratories, what is the proper balance and what criteria should be included in formulating processes to prioritize among research opportunities in the face of constricting federal support; and
- a clear discussion of the key intellectual frontiers for the field focusing on those half dozen or so with revolutionary potential for impact which extends beyond the field into either other sciences like chemistry, biology, and particle physics, or into technology areas like computing, energy, and manufacturing.

The CCMMP began its work in June 1996 with a two-day workshop on accomplishments and opportunities in condensed matter and materials physics sponsored by the Solid State Sciences Committee and the American Physical Society Divisions of Condensed Matter Physics and Materials Physics (see Public Affairs Forum, *MRS Bulletin*, August 1996, p. 13). There have been forums for community input at several technical meetings—the Fall 1996 and Spring 1997 Materials Research Society meetings and the 1997 March Meeting of the American Physical Society. The committee also has a Website with opportunity for providing input at http://www.nas.edu/bpa/cmmp.html. The final report is planned for release in early 1998.

The first tangible product of the Committee is a research briefing entitled *The Physics of Materials: Science That Affects Our Lives*. The briefing describes how the physics of condensed matter and materials is one of the disciplines that lie at the heart of the scientific revolutions that have changed our lives so dramatically in the last 50 years. The field is special in that it not only involves a search for knowledge that is as beautiful and fundamental as that found in any other branch of science, but it also centers around research that has fundamentally changed the way we live.

The societal impact of CMMP is illustrated in a chapter which describes a day-in-the-life of an entrepreneur and how the various capabilities that she and her family take for granted that have been enabled by CMMP—from computers, cellular telephones, and pagers and the networks that make them useful, to medical instrumentation and transportation. Each of these capabilities is highlighted by a sidebar which describes the role of CMMP in making it possible, such as materials synthesis, various aspects of semiconductors, polymers, biomaterials.

The beauty and fundamental aspects of CMMP are emphasized in a chapter which describes the breadth of the field—from phenomena such as high-temperature superconductivity, to properties of diverse materials such as glasses, polymers, and composites, to nonequilibrium phenomena and matter under extreme conditions. Sidebars describe developments in some of these areas as well as the role of new techniques in computation and scanning probe microscopies. The chapter also describes the way in which CMMP is increasingly interacting with other disciplines such as biology, chemistry, and medicine.

A final chapter describes some of the issues that the field of CMMP faces in a world of accelerating change. The end of the Cold War, the emergence of a global economy, and the development of high technology bases in other countries lead to a dramatically different environment. In addition, there have been and will continue to be significant changes in the research institutions in all three sectors of the enterprise—industry, academia, and government. As we enter the 21st century, the field of CMMP is evolving in several important directions. It is becoming increasingly interdisciplinary, with progress often occurring at the interfaces with other disciplines, such as biology, chemistry, materials science, and atomic and molecular physics. Partnerships across disciplines and among universities, government laboratories, and industry have become essential to assemble the resources and diverse skills necessary to continue the field's advances. The balance of support for large facilities that support research not only in CMMP but in many other fields of inquiry and for smaller facilities and individual investigators needs careful consideration. The briefing concludes that "we face an era of vast opportunity for condensed-matter and materials physics and the technology it enables. Just as the transistor, the optical fiber, and the solid-state laser have strengthened our economy and changed our lives, new developments in quantum engineering, nonequilibrium phenomena, and biomaterials (to name just a few highlights) hold out the promise of revolutionary breakthroughs in the 21st century. To fulfill this promise, the CMMP community will need to build on the unique strengths of universities, government laboratories, and industry, finding new ways to meet the challenges of a changing world."

VENKATESH NARAYANAMURTI

***Venkatesh Narayanamurti** is chair of the Committee on Condensed Matter and Materials Physics.*

*CMMP members are V. Narayanamurti (University of California, Santa Barbara), Chair; J.B. Roberto (Oak Ridge National Laboratory), Vice Chair; G. Aeppli (NEC); A. Bienenstock (Stanford); J.M. Gibson (University of Illinois); S. Girvin (Indiana University); M. Ketchen (IBM); E. Kramer (Cornell University); J.S. Langer (University of California, Santa Barbara); C.A. Murray (Lucent Technologies); A. Parsegian (National Institutes of Health); P.S. Peercy (Semi/Sematech); J.M. Phillips (Sandia National Laboratories); R.C. Richardson (Cornell University); K. Sreenivasan (Yale University); and F. Spaepen (Harvard University).