Materials Science and Engineering Study Seeks Input from Materials Community

Following is a list of topics being considered by the comprehensive Materials Science and Engineering Study commissioned by the National Research Council. Descriptions of the study, progress to date, and panel objectives and members can be found in the May/June 1986 and November/December 1986 issues of the MRS BULLETIN (Vol. XI, Nos. 3 and 6). A report on the MSE Forum conducted by the Materials Research Society at the 1986 MRS Fall Meeting in Boston, MA will appear in an upcoming issue of the BULLETIN.

The MSE Study continues to solicit input from the broad materials science and engineering community and invites their comments and suggestions on any of the topics listed below, sent to the appropriate panel chairman. All submissions will be acknowledged, and an attempt will be made to inform each submitter of how his/her contributions may influence the direction and results of the study. *(See the November/December 1986 issue of the MRS BULLETIN, p. 41, for a complete list of MSE Study panel members.)*

MSE Study Topics

Panel 1 — Research Opportunities and Needs

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- . . . Research Opportunities
  - Synthesis and Processing — Arthur H. Heuer
  - Characterization — E. Ward Plummer, G. Thomas
  - Properties and Performance — James Rice, John Hirth
  - Analysis and Modeling — John D. Joannopoulos
  - Artificially Structured Materials — Elias Burstein
  - Biomaterials — Sumner A. Barenberg
  - Disordered Materials — Pierre C. Hohenberg
  - Electronic Materials — Mildred Dresselhaus
  - Magnetic Materials — Mildred Dresselhaus
  - Photonic Materials — Robert A. Laudise
  - Polymeric Materials — James Economy
  - Structural Materials — John P. Hirth
- . . . Needs of the Industrial Sector — George Parshall
  - Aerospace — Peter Cannon
  - Automotive — Christopher Magee
  - Biomaterials — Sumner A. Barenberg
  - Chemical, Ceramics, Polymers — George S. Hammond
  - Communications — Robert A. Laudise
  - Electronics — Robert Stratton
  - Energy — Robert I. Jaffe
  - Metals — Ian Hughes
- . . . Needs of the Federal Sector — James O. Stiegler

Panel 2 — Exploitation of Materials Science and Technology for National Welfare

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This panel is attempting to assess the impact that materials science and technology can have on U.S. national security and competitiveness in the global economy. The panel is identifying factors particularly important in achieving effective innovations — especially the successful and rapid commercialization of new products that are based on advances in materials science and technology.

- . . . What lessons concerning institutional and support mechanisms can be learned from examples of successful and unsuccessful efforts to achieve significant innovations?
- . . . What existing institutional and support mechanisms are particularly important in achieving effective and rapid innovations, and which need to be strengthened?
- . . . What new institutional and support mechanisms can be recommended to achieve effectlve and rapid innovations?

To date, much of the discussion has focused on the successes and failures of specific technologies and materials. In addition, there has been an attempt to determine if the institutional setting affects the ability to develop and implement new technology and materials. Panel 2 has also conducted two workshops to broaden the data base for making conclusions.

Topics considered at the first workshop, Case Studies of Selected Materials and Technologies, October 24, 1986 include:

- Liquid Crystals
- Intermetallic Compounds
- Carbon Fibers
- Polymers for VLSI Processing
- Intelligent Materials Processing
- Optical Fibers
- Structural Ceramics for Heat Engines
- NdFeB Magnets
- Magnetic Recording for Data Storage
- Infrared Detectors

Topics considered at the second workshop, Examinations of Selected Institutions and Institutional Factors, December 9, 1986 include:

- . . . Institutions
  - Los Alamos National Laboratory
  - Semiconductor Research Corporation
  - Bell Communications Research
  - Microelectronics Corporation
  - Air Force Manufacturing Technology Programs
- . . . Institutional Factors
  - Legislation and Policy
  - Vertical Integration
  - Venture Capital
  - Role of Professional Societies

In addition to the workshop topics, Panel 2 has considered the following issues:

- . . . Development of Technology — Where do ideas originate? Who champions them? Who determines commercial value?
- . . . Funding of R&D Which Culminates in New Technologies and Products — funding sources, expectations (payoff periods, etc.), how to determine quality of R&D, proprietary versus public research, role of universities,
- . . . How has MSE Fared/Contributed?
- . . . What Needs to be Done?

From these deliberations some tentative conclusions and thoughts have emerged:

(1) Short-term return focus hurts industrial competitiveness.
(2) National security should not be confused with national competitiveness.
(3) Decentralized profit responsibility hurts information/technology sharing and transfer.
(4) Vertical integration can be helpful.
(5) Entrepreneurship and startups may be overrated concepts.
(6) Is too much emphasis placed on proprietary and classified research?

Panel 3 — International Cooperation and Competition

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- . . . Nature of MSE Abroad
  - Competitive Factors
  - Comparative Analysis
- . . . Case Studies of Foreign MSE Impact

Continued

on U.S. Industrial Technologies
... Structural Materials in Commercial Aircraft
Manufacturing of Steel — Richard J. Fruehan
Information/Communication Materials-VLSI — C. Peter Flynn
Magnetic Storage — Robert White
Ceramic Heat Engines — Arthur Diness
Engineering Plastics — Rudolph Pariser
Zeolite as Catalyst — Gabor A. Somorjai

Panel 4 — Research Resources in MSE
Terry L. Loucks, Chairman
Norton Company
1 New Bond Street
Worcester, MA 01606
(617) 853-1000
Federal Research Program — Bhakta Rath
Major Equipment Installations — Martin Blume
Intermediate-Scale Facilities — John Gilman
Individual Principal Investigators — Isaac F. Silvera
Advanced Manufacturing and Processing — Terry L. Loucks
Advanced Instrumentations — J. David Litster
Advanced Processing of Electronics — Robert S. Bauer, B.R. Appleton

Panel 5 — Education in MSE
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Department of Metallurgical Engineering and Materials Science
Carnegie Mellon
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Composition and Profile of Education in MSE
Educational Background for Those Working in MSE
Undergraduate Education in MSE for Materials Majors
Undergraduate Education in MSE for Nonmaterials Majors
Education in MSE at the Graduate Level, in MSE and in Other Departments
Interdepartmental MSE Educational Programs
University/Industry Interactions
Research/Education Interactions
Supply and Demand for Materials Graduates
Facilities, Equipment, Resources for Education
Future Needs, Opportunities, and Directions for MSE

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