AD-A276 116

UMENTATION PAGE

Form Approved
OMB No. 0704-0188

...is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including this burden to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
26 October 1993	Final: 1 February 1992-31 October 1993

4. TITLE AND SUBTITLE
A Cross-Disciplinary Report on the Mathematical Sciences Applied to Materials Science Part I

5. FUNDING NUMBERS
DAAL03-92-G-0013

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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U. S. Army Research Office
P. O. Box 12211
Research Triangle Park, NC 27709-2211

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
29397.1-MA

11. SUPPLEMENTARY NOTES
The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This project produced a National Research Council report from the Board on Mathematical Sciences, *Mathematical Research in Materials Science: Opportunities and Perspectives*, that documents and presents technical details of fruitful collaborations between the mathematical sciences and materials science, and indicates areas of mathematical sciences research holding the most promise for advancing materials science. Written primarily for mathematical and materials science researchers with an interest in advancing research at this interface, as well as for federal and state agency representatives interested in encouraging such collaborations, it focuses on directions for potentially promising collaboration between materials scientists and mathematical scientists, and encourages both communities to increase such collaborations. It emphasizes that both the mathematical sciences and materials science communities have much to gain from an increase in cross-disciplinary collaborations, and presents recommendations for facilitating mathematical sciences research that bears on important issues in materials science, including recommendations on how to attract students and young researchers to this area. It seeks to encourage research directions in the mathematical sciences that complement vital materials science research, and raise awareness of the value of quantitative methods in materials science. The NRC report is available through National Academy Press.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Mathematical Sciences, Materials Science, Cross-Disciplinary Research, biomaterials, ceramics, complex fluids, composites, fracture, metals, polymers, processing, synthesis.	9
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

94-06153

94 2 24 116

A CROSS-DISCIPLINARY REPORT ON THE MATHEMATICAL SCIENCES APPLIED TO MATERIALS SCIENCE

FINAL REPORT

BY

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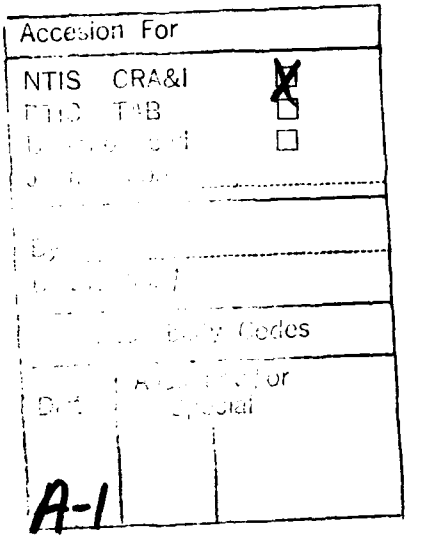

OCTOBER 26, 1993

U. S. ARMY RESEARCH OFFICE

GRANT NUMBER DAAL03-92-G-0013

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BODY OF REPORT

A. STATEMENT OF THE PROBLEM STUDIED

The Board on Mathematical Sciences (BMS) of the National Research Council (NRC) conducted a study and produced a BMS report that: (1) identifies and describes areas where the mathematical sciences have significantly aided materials research; (2) identifies areas of the mathematical sciences in which increased research would accelerate progress in materials science; (3) identifies obstacles, if any, to increased collaborative research; and (4) makes recommendations for facilitating collaborative work, including recommendations on how to attract students and young researchers to this area. Particular attention was paid to the areas of materials synthesis and processing. The resulting BMS report, *Mathematical Research in Materials Science: Opportunities and Perspectives* (NRC, 1993), builds upon and extends the previous BMS report *Applications of the Mathematical Sciences to Materials Science* (NRC, 1991).

An interdisciplinary committee of the BMS composed of quantitative materials scientists and applied mathematical scientists was convened by the BMS to perform the study and produce the report (see part D below). Their BMS report, *Mathematical Research in Materials Science: Opportunities and Perspectives* (see part C below for its Contents), is based upon the committee members' extensive experience plus solicited input from invited experts. Ancillary and supporting information was drawn from other recent reports including *Materials Science and Engineering for the 1990s* (NRC, 1989) and the recent report of the Office of Science and Technology Policy (Federal Coordinating Council for Science, Engineering and Technology, 1992). The committee's 144 page report was written at a level accessible to researchers in the mathematical sciences or materials science, especially those who have yet to explore the interface of the two areas. Copies of the report have been widely distributed to university research departments in both fields and to federal agencies and industry groups that sponsor research in the mathematical sciences and materials science. Additional copies of the report are available from National Academy Press.

B. SUMMARY OF THE MOST IMPORTANT RESULTS

The Board on Mathematical Sciences (BMS) convened the Committee on Mathematical Sciences Applied to Materials Science (see roster in part D of this final report) to perform the study and produce the BMS report described in part A. The first committee meeting was May 27-28, 1992 in Washington, DC, where a report outline, sectioned by themes/phenomena and with keywords identified for each section, was produced. The committee simultaneously prepared a list of approximately 225 people from whom 2-page write-ups were requested following that meeting. The essays received from the approximately 100 individuals who responded were melded into sections, focussed on keywords, with committee edits/additions made as needed to produce a "first rough" draft report whose sections conformed to the May 27-28 report outline. Committee edits/additions were made, and the committee met January 11-12, 1993 at the Beckman Center, Irvine, CA, and produced a "1st Final" report draft that was afterward worked into a final draft. That final draft underwent National Research Council review, was revised as appropriate in light of the reviewer comments, edited for publication, and published as a 144 page BMS report by National Academy Press. Additional copies of the report are available from National Academy Press.

This NRC report, *Mathematical Research in Materials Science: Opportunities and Perspectives* (NRC, 1993), documents and presents technical details of fruitful collaborations between the mathematical sciences and materials science, and indicates areas of mathematical sciences research holding the most promise for advancing materials science. Written primarily for mathematical and materials science researchers with an interest in advancing research at this interface, as well as for federal and state agency representatives interested in encouraging such collaborations, it focuses on directions for potentially promising collaboration between materials scientists and mathematical scientists, and encourages both communities to increase such collaborations. It emphasizes that both the mathematical sciences and materials science communities have much to gain from an increase in cross-disciplinary collaborations, and presents recommendations for facilitating mathematical sciences research that bears on important issues in materials science, including recommendations on how to attract students and young researchers to this area. It seeks to encourage research directions in the mathematical sciences that complement vital materials science research, and raise awareness of the value of quantitative methods in materials science.

C. LIST OF ALL PUBLICATIONS AND TECHNICAL REPORTS

National Research Council. 1993. *Mathematical Research in Materials Science: Opportunities and Perspectives*. Board on Mathematical Sciences. Washington, D.C.: National Academy Press. 144 pp.

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D. LIST OF ALL PARTICIPATING SCIENTIFIC PERSONNEL SHOWING ANY ADVANCED DEGREES EARNED BY THEM WHILE EMPLOYED ON THE PROJECT

(No Advanced Degrees Earned During the Course of this Project)

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