

# MATERIALS RESEARCH SCIENCE AND ENGINEERING CENTERS

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## *Program Solicitation*

**DEADLINE:** (Pre-proposals) *September 12, 1997*



NATIONAL SCIENCE FOUNDATION

The Foundation provides awards for research in the sciences and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The Foundation therefore, does not assume responsibility for the research findings or their interpretation.

The Foundation welcomes proposals from all qualified scientists and engineers and strongly encourages women, minorities, and persons with disabilities to compete fully in any of the research and related programs described here.

In accordance with federal statutes, regulations, and NSF policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving financial assistance from the National Science Foundation.

**Facilitation Awards for Scientists and Engineers with Disabilities (FASED)** provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF projects. See the program announcement or contact the program coordinator at (703) 306-1636.

**Privacy Act.** The information requested on proposal forms is solicited under the authority of the National Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and may be disclosed to qualified reviewers and staff assistants as part of the review process; to applicant institutions/grantees; to provide or obtain data regarding the application review process, award decisions, or the administration of awards; to government contractors, experts, volunteers, and researchers as necessary to complete assigned work; and to other government agencies in order to coordinate programs. See Systems of Records, NSF-50, **Principal Investigators/Proposal File and Associated Records**, and NSF-51, 60 Federal Register 4449 (January 23, 1995). **Reviewer/Proposal File and Associated Records**, 59 Federal Register 8031 (February 17, 1994).

Submission of the Public Burden information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award.

The public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Gail A. McHenry, Information Dissemination Branch, National Science Foundation, 4201 Wilson Boulevard, Suite 245, Arlington, VA 22230.

The National Science Foundation has TDD (Telephonic Device for the Deaf) capability, which enables individuals with hearing impairment to communicate with the Foundation about NSF programs, employment, or general information. This number is (703) 306-0090.

# MATERIALS RESEARCH SCIENCE AND ENGINEERING CENTERS

## PROGRAM SOLICITATION

### Directorate for Mathematical and Physical Sciences Division of Materials Research

Materials Research Science and Engineering Centers (MRSECs) support interdisciplinary and multidisciplinary materials research and education of the highest quality while addressing fundamental problems in science and engineering that are important to society. MRSECs require outstanding research quality, intellectual breadth, interdisciplinarity, flexibility in responding to new research opportunities, and support for research infrastructure, and they foster the integration of research and education in the materials field. They are expected to have strong links to industry and other sectors, and to develop a national network of university-based centers in materials research. MRSECs address fundamental materials research topics of intellectual and technological importance, contribute to national priorities by fostering active collaboration between academia and other sectors, and enable researchers to address problems of a scope and complexity requiring the advantages of scale and interdisciplinarity provided by a campus-based research center.

The MRSEC program reinforces NSF's commitment to excellence in interdisciplinary research and education; it is national in scope and significance, requiring coordination of the overall effort among Centers; and it complements, but does not substitute for, NSF support for individual investigators, small groups, national user facilities, and instrumentation in materials research.

### FEATURES OF MATERIALS RESEARCH SCIENCE AND ENGINEERING CENTERS

MRSECs are supported by NSF to undertake materials research of a scope and complexity that would not be feasible under traditional funding of individual research projects. NSF support is intended to reinforce the base of individual investigator and small group research by providing the flexibility to address topics requiring an approach of broad scope and duration. MRSECs are university-based, and undertake an interactive, interdisciplinary approach to materials research and education while fostering active cooperation among university-based researchers and those concerned with the application of materials research in industry and elsewhere. An MRSEC may encompass one or more interdisciplinary research groups (IRGs). Each IRG involves several faculty members and associated researchers, addressing a major topic or area in which sustained support for interactive effort by several participants with

complementary backgrounds, skills, and knowledge is critical to progress. The IRGs in a Center may be topically related, or they may address different topical aspects of materials research; they contribute to the synergy arising from the intellectual and educational activities of the Center and its common infrastructure, shared facilities and outreach programs. Thus, the Center as a whole is expected to be more than the sum of its parts.

The scope of activities of each MRSEC depends on the capabilities of the proposing institution. Smaller Centers normally consist of a single IRG addressing a particular topic in materials research, involving collaboration with industry or other sectors. Larger Centers undertake a broader program of research and education, and may involve several IRGs. MRSECs incorporate most or all of the following activities to an extent consistent with the size of the Center:

- Programs to stimulate interdisciplinary education and the development of human resources (including support for under-represented groups) through cooperation and collaboration with other institutions and sectors, as well as within the host institution. Cooperative programs involving minority and non-minority institutions are strongly encouraged.
- Active cooperation with industry, to stimulate and facilitate knowledge transfer among the participants and strengthen the links between university-based research and its application; cooperation and collaboration with other academic institutions and other sectors, including international collaboration. Cooperative activities may include, but are not limited to: joint research programs; affiliate programs; joint development and use of shared experimental facilities; access to user facilities; visiting scientist programs; joint educational ventures; joint seminar series, colloquia, or workshops; stimulation of new business ventures; involvement of external advisory groups; and industrial outreach programs.
- Support for shared experimental facilities, properly staffed, equipped and maintained, and accessible to users from the Center, the participating institutions, and other institutions and sectors.

Each MRSEC has the responsibility to manage and evaluate its own operation with respect to program administration, planning, content and direction. NSF support is intended to promote optimal use of university resources and capabilities, and to pro-

vide maximum flexibility in setting research directions, developing cooperative activities with other institutions and sectors, and responding quickly and effectively to new opportunities in materials research and education that are important to the nation's research and technology base. NSF encourages MRSECs to include support for junior faculty, high-risk projects, and emerging areas of interdisciplinary materials research.

The MRSECs constitute a spectrum of coordinated Centers of differing scientific breadth and administrative complexity which may address any area of materials research. The smaller Centers enable specialized areas of interdisciplinary excellence to be integrated into a national network of larger MRSECs. These in turn provide, in addition to research excellence, the infrastructure of equipment, education and outreach needed to ensure that the program as a whole meets its objectives and provides for effective coordination with industrial efforts. The MRSEC program will not normally provide support simultaneously for more than one Center based at any one institution.

MRSEC Directors serve on a national liaison team for the program. The team is responsible for developing a liaison structure with the active participation of each Center, leading ultimately to the creation of a network addressing common problems and opportunities, and facilitating links and cooperation among Centers as well as between Centers and other institutions.

## WHO MAY SUBMIT

Academic institutions in the USA with broad research and education programs in the area of condensed matter physics, solid state and materials chemistry, materials science and engineering, and related areas of science and engineering, may submit *pre-proposals*.

In order to reduce the burden of proposal writing for the materials research community, and the burden of subsequent proposal review and evaluation for reviewers and NSF staff, NSF will accept *full proposals* for MRSECs *by invitation only*, based on the results of the pre-proposal evaluation.

While more than one institution may participate in a single proposal or pre-proposal, one institution must accept overall management responsibility for the Center. A single institution may be involved in more than one proposal.

## WHEN TO SUBMIT

*Pre-proposals must be received at NSF before close of business on September 12, 1997.* Principal Investigators will be notified of the results of pre-proposal review by about November 18, 1997. Full proposals must be received at NSF before close of business on January 20, 1998.

## AWARDS

Individual MRSEC awards are expected to range in size from about \$0.5 million to about \$5 million per year. Awards will be made for an initial period of up to five years. Proposals from existing Centers will be evaluated in open competition

with new proposals during the fourth year of the award, and at four year intervals thereafter (i.e. during year 8,12,etc.). If a proposal from an existing Center is not successful, phase out support may be provided at a reduced level for a period of up to two years after the competition. Awards are based on comprehensive, competitive merit review. Re-competing Centers must demonstrate excellence, significant achievements, and institutional and national impact in materials research; substantive accomplishments in the integration of research and education; active and effective collaboration with industry and other sectors as appropriate; and, in the case of larger Centers, effective development and operation of shared facilities. Achievements under prior NSF support are a critical factor when re-competing proposals are considered. The commitment of each Center to introducing substantially new research topics and undertaking innovative research will also be important in considering re-competing proposals.

## INFORMATION ABOUT PROPOSAL PREPARATION

Proposals must be prepared according to the instructions in the Proposal Format and Content section below, and must contain only the material itemized there. Copies of the required forms can be found in the NSF *Grant Proposal Guide* (NSF 95-27 or its successor), available electronically via Documents Online at <http://www.nsf.gov> or directly at URL <http://www.nsf.gov/bfa/cpo/gpg/start.htm>. Procedures for getting NSF information and publications are described elsewhere in this document. For more information about international opportunities (see item 10 under Full Proposal, below), including special funding arrangements for specific geographic regions, refer to the *International Opportunities for Scientists and Engineers* Program Announcement (NSF 96-14), available electronically via Documents Online at <http://www.nsf.gov> or directly at URL <http://www.nsf.gov/sbe/int/nsf9614.htm> or from the NSF Division of International Programs at (703) 306-1709 or NSF TDD (703) 306-0090. The number of this MRSEC program announcement is NSF 97-98. Potential applicants are strongly encouraged to contact one of the Program Directors listed below.

## PROPOSAL FORMAT AND CONTENT

### *Pre-proposal*

The pre-proposal must be single-spaced in 12-point type, and consist of (1) NSF cover page (NSF 95-27, Form 1207 or its successor), showing the name of the proposed MRSEC director (principal investigator), the proposal title and the names of the principal participating institutions; (2) narrative (see below); (3) list of participating senior investigators (faculty level and equivalent) by name, institutional affiliation, and departmental affiliation (additional biographical information is *not* required in the pre-proposal); (4) one-page synopsis of institutional and other commitments to the proposed Center; (5) budget pages and summary (NSF 95-27, Form 1030 or its successor), see below. In a cover letter, list individuals (and

their affiliations) *outside* the participating institutions whose participation in the review of the pre-proposal might constitute a conflict of interests through association with the participants.

In the narrative (item 2 above), provide the following:

- a brief overview of the Center as a whole, including a concise rationale for establishing the Center, and an outline of the existing and planned capabilities of the participating institutions in materials research and education
- a description of pertinent achievements under prior NSF support, where applicable
- a description of each proposed area of multi-investigator, interdisciplinary group research, including names of faculty-level participants and numbers of students and postdoctoral associates in each group (**limit this section to no more than two pages for each IRG**)
- a description of proposed activities in materials education, human resource development, and outreach; proposed collaborations with industry and/or other sectors; shared experimental facilities; international collaboration
- an outline of the proposed arrangements for administration and management of the Center.

**Limit the narrative section as a whole to no more than nine pages total, including tables, illustrations, and references,** regardless of the number of IRGs.

Complete one budget page for year 1 and one page for the sum of years 1-5 of operation of the proposed Center (**2 pages total, using NSF 95-27, Form 1030** or its successor). In addition, complete the *Summary Table of Requested NSF Support* shown below in item 14 under *Full Proposal* (**1 page**), providing separate estimates within the Table for each area of activity which must sum to the total budget.

### **Full Proposal**

A full proposal may be submitted only by invitation. The proposal must be single spaced in 12-point type and must contain the following items in the order indicated. **Proposals that exceed the page limitations will be ineligible for consideration and will be returned without review.**

1. NSF Cover Sheet (NSF 95-27, Form 1207 or its successor). Indicate the total amount requested for the first five years of NSF support in the box entitled "requested amount."

NSF also requires that one copy of each of the following forms be attached to the front of the proposal bearing the original signatures: a) Information about the Principal Investigator/Project Director (NSF 95-27, Form 1225 or its successor), b) Certification Page (NSF 95-27, Form 1207, page 2 or its successor), and c) Special Information (NSF

95-27, page 10 or its successor). Please refer to NSF 95-27 or its successor for more information.

2. *Table of Contents*. Key the page numbers to the major sections of the proposal that follow.

3. *Executive Summary*. Provide a clear rationale for and description of the proposed MRSEC and its potential impact. Briefly describe the institutional setting of the Center, its proposed scope and organization, activities in research and education and their integration, development of human resources, shared experimental facilities, collaborative activities with industry and other sectors, links with related major research centers on or off campus, and management plan. **Limit: 3 pages.**

4. *List of Participants*. List each senior investigator (faculty level or equivalent), by full name, and his or her institutional and departmental affiliation. **Limit: 1 page.**

5. *Achievements Under Prior NSF Support*. Describe achievements under prior NSF support that pertain to the present proposal. (Recompeting proposals should also list publications and patents from prior NSF support under Appendix C, below). **Limit: 5 pages.**

6. *Interdisciplinary Research Groups* (IRGs). The Center may encompass one or more IRGs. For each IRG proposed, provide a concise description of the long-term research goals and intellectual focus, and describe the planned research activities in sufficient detail to enable their scientific merit and significance to be assessed. Describe the role and intellectual contribution of each senior participant in the IRG, and briefly outline the resources available or planned to accomplish the research goals (it will be helpful to underline the name of each senior investigator wherever it occurs). **The need for an interactive, interdisciplinary approach involving several investigators, and the means of achieving this, should be clearly established.** Place the IRG in the context of the Center as a whole, and describe interactions with other groups and institutions. At the beginning of each IRG section in the proposal, name the senior personnel who will participate, and state the proposed number of postdoctoral and graduate student participants. **Limit for each IRG: 10 pages, including references.**

7. *Education, Human Resources, and Outreach*. Describe the proposed activities of the Center in education and human resource development, including plans for participation by undergraduates, pre-college students and teachers if appropriate, and members of under-represented groups. Outline plans for seminar series, colloquia, workshops, conferences, summer schools and related activities, as appropriate. Describe any additional outreach programs not included in other sections of the proposal. **Limit: 3 pages.**

8. *Shared Experimental Facilities*. Describe the shared experimental facilities to be established, including specific major instrumentation, and plans for the development of instrumentation. Describe plans for maintaining and operating

the facilities, including staffing, provision for user fees, and plans for ensuring access to outside users. Distinguish clearly between *existing* facilities and those still to be developed. **Limit: 3 pages.**

9. *Collaboration with Industry and Other Sectors.* Describe the proposed interactions and collaborations with industry, and, where appropriate, with other institutions and sectors, including national laboratories. Define the goals of the collaboration, and describe the planned activities. Describe the roles of the senior participants, the mechanisms planned to stimulate and facilitate knowledge transfer, and the potential long-term impact of the collaborations. **Limit: 3 pages.**

10. *International Collaboration* (complete this section if appropriate). Describe the nature of the collaboration and the expected international and scientific or engineering benefits to the research and education program. Include a description of the research facilities at the foreign site, as appropriate, and of the division of effort and expertise among the collaborators. **Limit: 1 page.**

11. *Seed Funding and Emerging Areas.* Through this mechanism, NSF intends to provide flexibility for the Center to respond quickly and effectively to new opportunities. Briefly describe other proposed research plans and related activities, showing clearly how they are related to the mission of the Center. These may include (but are not limited to): seed support for junior faculty and for investigators changing fields; high-risk research projects; emerging areas of interdisciplinary research; experimental programs to link the university effort in materials with industry and other sectors; the development of tools for remote access to instrumentation; and innovative interdisciplinary educational ventures. **Seed funding through the Center is not intended to provide a substitute for NSF individual investigator funding; the criteria and mechanisms for selecting and evaluating projects must be clearly addressed in**

**the management plan.** Include the names of key personnel for the first year. **Limit: 3 pages.**

12. *Management.* Describe the plans for administration of the Center, including the functions of key personnel and the role of any advisory committee, executive committee, and/or program committee or their equivalent. Describe the procedures and criteria used to select, administer, and evaluate the Interdisciplinary Research Groups and other research programs of the Center, including seed funding and collaborative programs with other groups and institutions. Plans for administering the shared experimental facilities should be described under item 8. Describe plans for administering the educational programs and outreach activities of the Center, as appropriate. **Limit: 3 pages.**

13. *Institutional and Other Sector Support.* Outline institutional and other commitments to the Center, including matching funds, space, faculty and staff positions, capital equipment, access to existing facilities, commitments for collaboration and outreach programs, and other commitments. **Limit: 1 page.**

14. *Budget.*

Provide line item budgets on NSF Form 1030 (see NSF 95-28, Proposal Forms Kit, NSF Form 1030 or its successor), available electronically at <http://www.nsf.gov/bfa/cpo/gpg/fkit.htm#forms-10>, for each of the following items:

- Year 1
- Total for years 1-5 inclusive

Provide separate budget pages for the Center as a whole and for each participating institution in cases where a sub-contract exceeds \$100,000 per year.

Also, *in tabular form as follows*, summarize the overall support levels planned for each of the major activities of the MRSEC as a whole:

Summary Table of Requested NSF Support		
ACTIVITY	YEAR 1	5 YEAR TOTAL
IRG I (Title)		
IRG II (Title) (repeat for each IRG)		
Shared Experimental Facilities		
Seed Funding and Emerging Areas		
Education, Human Resources, and Outreach Programs		
Administration		
<b>TOTAL</b>		

For each entry in the Table, include indirect costs. Column totals must equal the total budget requested from NSF for the period shown. Include major capital equipment under shared experimental facilities. Support for graduate students should normally be included under research, not under education and human resources.

## Appendices

### A: Biographical Information.

Include a biographical sketch for each senior participant, listing up to ten publications most pertinent to this proposal.

**Limit, 1 page for each senior investigator.**

### B: Current and Pending Support.

List current and pending support for each senior investigator (see NSF 95-28, Proposal Forms Kit, NSF Form 1239 or its successor).

### C: Publications and Patents under Prior NSF Support.

For re-competing proposals only, list publications and patents under prior NSF MRSEC support.

### D: Letters of Support.

Include only official letters of support verifying specific commitment of resources from participating institutions.

## EVALUATION OF PROPOSALS

### Review Procedure

*Pre-proposals* will be evaluated by mail and/or panel review.

*Full Proposals* will be evaluated in several stages of merit review, which may include mail review, panel review, reverse site visit (presentation at NSF), site visit, and review by NSF and by the National Science Board. A proposal may be declined at any point in the review process.

### Merit Review Process

Proposals submitted in response to this program announcement will be subject to the NEW merit review criteria approved by the National Science Board on March 28, 1997 (NSB97-72). The new merit review criteria are:

### What is the intellectual merit and quality of the proposed activity?

The following are suggested questions that the reviewer will consider in assessing how well the proposal meets this criterion. Each reviewer will address only those questions which he/she considers relevant to the proposal and for which he/she is qualified to make judgments.

How important is the proposed activity to advancing knowledge and understanding within its own field and

across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

### What are the broader impacts of the proposed activity?

The following are suggested questions that the reviewer will consider in assessing how well the proposal meets this criterion. Each reviewer will address only those questions which he/she considers relevant to the proposal and for which he/she is qualified to make judgments.

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

### In addition to these generic review criteria, reviewers will be asked to use the following criteria.

Pre-proposals will be evaluated in terms of their potential to meet the criteria for full proposals. Achievements under prior NSF support will be critically assessed when re-competing proposals are evaluated.

MRSEC proposals will be evaluated in terms of the interdisciplinary research group(s) and of the Center as a whole. Support will be determined by merit according to the criteria given below. Given competing proposals of essentially equal merit, NSF staff will be responsible for ensuring that the overall program reflects an appropriate balance among research topics and among Centers of differing size and complexity.

### A: *Interdisciplinary Research Groups:*

- Intrinsic merit of the research. Overall quality of the proposed research, and likelihood that the research will lead to fundamental advances, new discoveries, and/or technological developments.
- Competence to perform the research. Capability of the investigators, technical soundness of the proposed approach, and adequacy of the resources available or proposed, including instrumentation and facilities.
- Interdisciplinarity and degree of interconnection within each IRG. Benefits of a multi-investigator, interdisci-

plinary approach; cooperation and interdependence of the investigators.

**B: *The Center as a Whole:***

- Institutional setting and rationale for the Center. Relationship to existing and planned institutional programs and capabilities in materials research and education; intellectual breadth of the proposed program; potential for stimulating interdisciplinary interaction and collaboration. Potential for institutional, national and international impact.
- Achievements under prior NSF support, where applicable.
- Plans and potential to develop and maintain active collaboration with industry and other sectors; to stimulate and facilitate knowledge transfer among the institutional participants and between the Center and other institutions and sectors; and to strengthen the links between university-based materials research and its application and implementation. Outreach to other institutions and sectors, including
  - international collaboration and cooperation.
  - Plans to establish, operate, and maintain shared experimental facilities and to provide appropriate access to users from the home institution, other academic institutions, industry, and other sectors.
  - Potential effect on the infrastructure of science and engineering, particularly in fostering a broadly interdisciplinary, interactive approach to materials research and education, developing effective educational outreach programs, fostering a climate of interaction and effective knowledge transfer between the university and its partners in industry and other sectors (see above), effective use of seed funding, and fostering increased participation in materials research and education on the part of women and members of under-represented groups.
  - Institutional and other support, management plan, and budget. Institutional and other commitments to the Center. Likely effectiveness of the proposed management plan, including mechanisms for selection of topics and internal allocation of resources, plans for self-evaluation, and plans and potential for maintaining a flexible and innovative program. Appropriateness of the requested budget.

A summary rating and accompanying narrative will be completed and signed by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are mailed to the PI/PD by the Program Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

**Inquiries**

Inquiries about the NSF Materials Research Science and Engineering Centers Program should be directed to one of the MRSEC Program Directors:

Ulrich Strom,  
(703) 306-1832  
ustrom@nsf.gov

Carmen Huber  
(703) 306-1996  
chuber@nsf.gov

W. Lance Haworth  
(703) 306-1815  
lhaworth@nsf.gov

Materials Research Science and Engineering Centers  
Division of Materials Research, Room 1065  
National Science Foundation  
4201 Wilson Boulevard, Arlington, VA 22230  
FAX: (703) 306-0515

Information about MRSECs, including current awards, can be found on the NSF MRSEC WEB site at <http://www.nsf.gov/mps/dmr/mrsec.htm>

**Proposal Submission**

***Pre-proposals***

Submit 20 copies of the pre-proposal, including one copy bearing the signed cover page. The original signed copy should be printed on one side only. The remaining copies should be printed on both sides of the page. All copies should be stapled in the upper left corner only, and should not be bound.

***Full Proposals***

Upon invitation by NSF, submit 20 copies of the full proposal, including one copy bearing the signed cover page. The original copy must be printed on one side only and should not be bound, but should be stapled in the upper left corner only. The remaining copies may be bound and should be printed on both sides of the page. Major sections of the proposal should be separated with labeled tabs. Do not place proposals in ring binders.

Mail pre-proposals and full proposals to:

Materials Research Science and Engineering Centers  
Announcement No. **NSF 97-98**  
National Science Foundation PPU  
4201 Wilson Boulevard, Room P60  
Arlington, VA 22230

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ARLINGTON, VA 22230

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