Final Report  
Academic Program Review  
Center for Materials Sciences

Review Process

The Center for Materials Science prepared a self-study following program review guidelines. An external review team visited the campus, reviewed the self-study documents, interviewed unit personnel and University administrators, and submitted an external review report. The Program Review Committee (PRC) read the self-study and the external review, and met with the director of the center and the Dean of Arts & Sciences. This document reflects the PRC’s findings and recommendations.

Self-Study

Mission

The Center was formally approved in 1994 with the explicit mission of increasing the external funding profile of the University. The decision to create a materials sciences center was in accordance with a 1990 report of the National Research Council singling out materials science as one of the main research areas of the future to enhance the competitiveness of the United States in science and technology.

The primary mission of the Center is to provide an interdisciplinary home for any researcher at BGSU who has a primary interest in studying materials, whether it be their characterization, synthesis, production or simulation. Although its primary function is to foster research, the Center sees itself as contributing to the teaching mission of the University both at the undergraduate and graduate levels. Currently that mission is basically supportive since the unit does not have its own major.

In addition, the Center is the administrative headquarters of the Ohio Materials Network, a consortium Ohio academic institutions established to provide access to state-of-the-art equipment to any materials researcher in Ohio.

Finally, the Center has instituted an exchange program with the Institute of Crystal Materials of Shandong University in Jinan, People’s Republic of China. Postdoctoral fellows from China come to study at Bowling Green and faculty from Bowling Green go to China.
Facilities and Resources

There is no direct space allocation made to the Center for Materials Science. The Center faculty utilize research and instructional laboratories and classrooms that are part of each participating department’s allocations.

The faculty and students of the Center rely on a variety of information resources, primarily the University Library holdings, the science and technology library holdings of the University of Toledo, and interlibrary loan.

Faculty and Staff

President Olscamp authorized the hiring of four new faculty members in 1994, and a grant from the Board of Regents Investment Fund provided start-up funds for two of the junior faculty. The four new junior faculty members were spread among four departments in two colleges. In addition, the Center drew associated members from faculty already on staff. At its peak in 1996, there were 14 associated faculty in the Center. Retirements, resignation and discharges have reduced the associated faculty to ten, currently. Three of the four original junior hires are no longer with the University.

There are currently four graduate students and two postdoctoral fellows working with Center faculty.

In addition, there is one 1/4 time classified person, who handles the clerical duties connected with the Center as well as those associated with the administration of the Ohio Materials Network.

Research Productivity

Over the past four years, members of the Center faculty have served as Principal Investigator or co-Principal Investigator on external grants that have garnered over $3 million. The amount funded directly though BGSU over the same period was $2.3 million. MatNet has received over $4 million from the Ohio Board of Regents Investment Fund and has also obtained $300K from the National Science Foundation as a consortium to install an Ion Beam Accelerator at Case Western Reserve University.

The number of publications by Center faculty during the past five year period topped 190, or an average of nearly 40/year.

Integration with the Wider University Community

The Center for Materials Science is an interdisciplinary science unit designed to promote research and instruction in materials sciences. The Center sees itself as a central player in insuring the future success of the University as a full participant in scientific research and instruction.
As an interdisciplinary group in the sciences, The Center for Materials Science offers courses and research opportunities for students in all participating departments who want to pursue careers in materials.

**Strengths and Weaknesses**

**Strengths**

- Most materials science units in the United States are centered in engineering. Bowling Green’s center is in the natural sciences, including disciplines such as geology and biology, which are not part of traditional materials science units. The strength of the Center lies in being able to position itself to participate in the newly emerging fields of biomaterials and nanomaterials, which hold promise to become the economic engines of the 21st century.
- The major strength of the Center was identified as the research success of the faculty in the areas of polymer stereolithography, biomimetic materials, computational modeling of materials properties, and interface studies in both ceramic and optical materials.

**Weaknesses**

- Without space resources of its own, the Center is fully dependent upon the circumstances existing in the various departments at a given time, and this is perceived as limiting its autonomy.
- The Center does not offer a graduate program. All of the graduate students who work in the Center are funded through their home departments. It is of the utmost importance for any faculty researcher in the Center to have access to doctoral students in order to successfully initiate a research program.
- According to the self-study, there have been no specific allocations for the purchase of library materials and journals in Materials Science over the past five years. Because of these financial constraints, the libraries have been placed in a situation where new journals are nearly impossible to obtain. This situation must be addressed if the Center’s researchers are to be competitive on the national and international stage.
- The size of the “core” faculty in the Center (originally the four junior faculty, down to one at the time the self-study was written, and up to two at the time the final report was written) is not sufficient to provide the “critical mass” necessary for the program to become self-sustaining.
- There is a need for a more closely coordinated organization with greater synergy and common purpose, and for collaboration on a larger scale.
- The infrastructure of the Center, as originally organized, resulted in a lack of communication between the Center and the contributing departments on questions of personnel. The self-study asserts the Center’s need for full input, including voting rights, on any decisions concerning its members.
Budgets and Financing

The operating budget for the Center is $50,000/year which is derived from income from an endowment fund that was set up by the Board of Trustees in 1994. The ongoing research projects of Center Associates are funded by external grants.

Strategic Plan

• The Center proposes the formation of a joint Cooperative Doctoral Program in Materials Science with the University of Toledo and the Medical College of Ohio. This plan would enable the unit to best exploit the possibilities for graduate student funding support under the new guidelines being implemented by the Ohio Board of Regents. A strong multi-institutional doctoral program in materials science will be of great benefit to the industries and the people of northwest Ohio.
• The traditional industrial base in medium to heavy industrial production in northwest Ohio presents a need and an opportunity to develop distance learning capabilities for continual re-education. Effective use of distance learning capabilities on BGSU and UT campuses will allow Materials Science to provide efficient, formal instruction programs not only for full-time doctoral students, but for other part-time students who may be employed in local industries.
• The establishment of a new joint program in Materials Science would provide access to doctoral students for all faculty researchers in the Center.
• The combined institutional aspect of the program will lead to a more comprehensive research profile by utilizing the complementary activities at each school with a strong core of researchers that more than amply provides the “critical mass” for success in the field.
• This type of program would attract more doctoral students of all types to each university, and the enhanced research profile will contribute to such important auxiliary funding sources as overhead return.
• The enhanced national reputation that the program will generate can only help the other science and technology research programs at each institution by attracting more and better students.
• The Center anticipates increased research activity and external research funding.
• Combining the efforts of three regional institutions in the materials area will ensure that the size of the “core” will be sufficient to allow for the a comprehensive program in materials science that can be competitive on a national level. The instructional component will include distance learning offerings that are designed to reach engineering and technical communities with conventional courses as well as mini-courses on specialized topics. Although the center does not propose such an eventuality at present, a natural evolution for the consortium would be to form an inter-institutional School of Materials Science.
• Critical for the success of this plan is the recruitment of new faculty to replace the three lines lost (one of which has been replaced since the self-study was written). Start-up costs are significant: $200K for junior faculty and more than $400K for senior faculty. The Center proposes to submit a request to the OBOR
5% “Excellence Pool” for funding that is sufficient to cover the start-up costs for the BGSU faculty positions, and for any new faculty members that would become available at the University of Toledo or Medical College of Ohio.

- For the present, the Center for Materials Science at BGSU and the Center for Materials Science and Engineering at UT would retain their interdisciplinary status.
- All new faculty appointments would be joint appointments with the Center for Materials Science and a home tenuring department. The Center proposes that tenure and promotion decisions for these new faculty be made with the full participation of the faculty in the Center. The Center proposes that any evaluation committee in these cases should consist of at least 50% voting representation from the Center for Materials Science.
- In order to promote a coherent research focus, the Center proposes folding in two of the junior positions at BGSU into one senior researcher position in the area of surface characterization, including atomic microscopic techniques. Such a person would complement the existing research strengths in polymers, optical thin films and interface studies. The remaining junior position should be filled by someone in the emerging field of nano-particle synthesis and rheology.

**Seven Year Timetable**

**Year 1**

Establish a Coordination Committee involving BGSU, UT and MCO. Develop a proposal, with a strategic plan, to be submitted to the OBOR “Excellence Fund”. Obtain institutional approvals. Submit an application to OBOR at the end of the year. Inaugurate private fund-raising. Augment library holdings in materials science, particularly in journals and periodicals.

**Year 2**

Contingent on OBOR award, begin a search for a senior faculty position in surface characterization, with the possibility that such person will become the Director.

**Year 3**

Begin a search for a junior position in nanomaterials synthesis and rheology. Establish a graduate curriculum and first-year student recruitment.

**Year 4**

Conduct the first in a series of annual evaluations of the success of the research programs of senior faculty. The doctoral program will be up and running. Begin tele-course offerings to the Northwest Ohio technical community.

**Year 5-6**
Conduct the first in a series of annual evaluations of the research programs of junior faculty.

Year 7

Assess the doctoral program and research profile.

External Review Team’s Report

The external review team was generally positive about the productivity and future potential of the Center, although they noted several areas for change and improvement.

Strengths

The decision by BGSU to implement a Materials Science Center and to tie it to the traditionally mathematically intensive disciplines of Physics and Chemistry was seen as a bold, but eminently logical, move. The external team concluded that terminating support for the Center at this time would be a “tremendous mistake.” At the same time, they noted the need to make structural and organizational changes. They concluded that BGSU has some significant strengths upon which to build a vital materials science effort. Among these are the complementary Center for Photochemical Sciences and the Microscopy Center. They concluded that Bowling Green State University should not be shying away from the study of Materials Science. Modern technology is inextricably linked to materials science. With the rapid growth of biological materials engineering and the interfacing of classical electro-mechanical devices to biological tissue, an understanding of the implications of the long term contact between electronic and mechanical devices and living tissue is just one of the many materials issues that needs to be much better understood. BGSU, with its strong Biology and Chemistry Departments is well placed to realign the focus of its Materials Science Center to take advantage of the current trends in new technologies, for example biomaterials and nano-materials. The University needs to continue its investment in the Materials Science Center and work on recruiting a number of faculty at the junior and intermediate levels who would be well placed to interact with the existing faculty of Biology, Chemistry, and Physics.

In response to direct questions from the Dean, the reviewers endorsed the idea that the interdisciplinary Center was in line with contemporary models of “research at institutions of excellence” and would be more likely to draw funds from national funding agencies. Noting the lack of a “significant external (non-academic) research community in materials science,” they saw an interdisciplinary organization as an opportunity for the Center rather than a minus. “A strong materials science effort in the region,” they noted, “could act as a source for technology transfer, a center to attract smaller companies that do not have research
capabilities of their own, and a source of new startup businesses in the region and elsewhere in Ohio.”

Weaknesses

The reviewers noted that materials sciences programs are traditionally tied to engineering departments and BG’s program is at a disadvantage in this respect. However, they agreed with the self-study’s contention that BG’s science-oriented Center was “bold” and “innovative” and the right move for the future. In addition, the reviewers felt that the organizational structure of the Center needed revamping. “The initial decision to start the Center by giving a faculty position to each of its four departments was probably one of the major sources of problems for the Center.” The reviewers suggested that a more focused research effort was called for, endorsing, in effect, a conclusion reached by the self-study. They were less sanguine about the possibilities of inter-institutional connections with either UT or MCO. Reacting to the relatively low enrollment in the lower-division courses offered by MATS, they noted that a laboratory requirement would help such courses fulfill distribution requirements and would enhance future enrollments.

External Team Recommendations

• The University should commit to the continuation of the Center
• The Center should develop a unified research focus.
• The Center needs to develop a viable Ph.D. program.
• A senior researcher should be hired both to focus and direct the research activity of the Center.
• Departments should be encouraged, on their own, to hire faculty who would contribute to the research activity of the Center. “Without departmental as well as Center support, a new faculty member’s prospects for success are diminished considerably.
• Interaction between the materials science effort and the College of Education and Human Development should be encouraged. It makes a good deal of sense to introduce tomorrow’s educators to the leading edge technologies of the time so that they may pass some passion for and knowledge of materials technology on to the next generation of students.

Program Review Committee Findings

The PRC sees the potential for materials science research. However, the PRC does not, at this time, endorse the continued development of a Center for Materials Science at BGSU.

It is not obvious that the record of accomplishment presented in the self-study is attributable to the existence of the Center. For instance, the self-study reports 190 publications by affiliated faculty over the past five years (page 6). Given that these faculty are all members of different departmental units and have been productive in the past, the PRC was not persuaded that the Center was a contributing factor in this production. Similarly, the PRC was concerned about the
success of the Center in securing external funds. The self-study reports $3 million in external funding secured over the period 1995-2000. The PRC was not persuaded that this external funding can be attributed to the presence of the Center and the affiliation of faculty with it.

Given the loss of three of the junior faculty specifically hired to contribute to the development of the Center, the PRC is not convinced that the Center could be restaffed in a cost-effective manner. The PRC understands that OBOR will not allow funds to be used to support faculty lines, as proposed in the self-study. Therefore, we find that the plan described in the self-study for restaffing the Center is not feasible.

While acknowledging the potential research value of a Materials Science Center, the PRC finds that the potential contribution of the Center to the educational and research mission of the University is not sufficiently promising to make such an investment worthwhile at this time.

The Center does not have but aspires to create a Ph.D. program. Given the absence of a College of Engineering at Bowling Green and the small likelihood of a fruitful collaboration with the University of Toledo, the PRC finds this not to be a viable option. The committee notes that the current director disputes the external review team’s negative assessment of this option.

The PRC finds that the Center has not yet contributed meaningfully to the teaching mission of the University at the undergraduate level. Discounting the courses taught in their own departments by affiliated faculty, the record, to date, seems weak.

**Program Review Committee Recommendations**

1) Understanding that the continuation of the Center for Materials Science is of primary importance in this review, the PRC recommends that the Dean of Arts & Sciences, in consultation with the Vice Provost for Research, choose one of the following three options, no later than the end of fall semester, 2000. The PRC clearly prefers option A, but understands that the costs and benefits of this option must be weighed in the context of other programmatic needs within the College and within the research enterprise of the University as a whole.

   a) **Option A:** The Center for Materials Science should be discontinued.
   b) **Option B:** The Center for Materials Science should be continued contingent upon the support of the Graduate Dean in applying for and securing financial support from OBOR and the support of the Dean of the College of Arts and Sciences in allocating the tenure track lines necessary for the restaffing.
   c) **Option C:** The Center for Materials Science should be given an opportunity to restructure itself by securing external funding, reducing its vision and rethinking the use of its endowment fund income. Existing levels
of support would be continued and the status of the Center re-evaluated after three years.

2) If either option B or C is chosen, the Center should attend closely to the following expectations:
   a) clearly demonstrate the role of the Center in obtaining external grants;
   b) clearly demonstrate the role of the Center in faculty publication and presentation;
   c) in consultation with the Vice Provost for Research, establish targets for productivity;
   d) establish a curriculum and attract students in numbers that meet or exceed established standards for enrollment.

3) If either option B or C is chosen, The Center for Materials Science should report annually to the Dean of the College of Arts & Sciences, with a copy to the Provost, on the implementation of these recommendations.