

University Materials Council (UMC)
Fall Meeting: Monday, November 30, 2009
Location: Simmons Room, 3rd floor Boston Marriott, Copley Place.

Minutes Recorded by G.S. Rohrer

Attendance by UMC Members

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Speakers and Invited Guests

Mert	Flemings	MIT	flemings@MIT.EDU
Charles	Hayes	ASM International	charles.hayes@asminternational.org
Todd	Osman	MRS	Osman@mrs.org
Michael	Milligan	ABET	mmilligan@abet.org
Shefford	Baker	Cornell	spb14@cornell.edu

12:45 Peter Davies calls meeting to order

The passings of Robert E. Newnham and Anthony G. Evans earlier this year were acknowledged with a moment of silence.

Introduction of new programs:

UT Dallas has established a graduate MSE department (Yves J. Chabal, Head). They are thinking about establishing an undergraduate program.

Princeton (Craig Arnold) is participating. Princeton has an undergraduate and graduate program through a materials institute.

Announcements:

Davies also announced that the proposed NMAB study of MS&E Departments and Programs in the United States will not be launched, due to lack of funding.

Davies also announced that our spring meeting will be a workshop on computational materials science and engineering education, in response to the NMAB ICME report. Richard LeSar will run this and it will be held at Northwestern University, June 23-24, 2010, hosted by Peter Voorhees.

1:10pm. Merton Flemings (MIT): "Perspectives on Materials Science and Engineering as an undergraduate discipline"

Davies introduced the topic by updating some of the data in Flemings' 2009 paper (see attached data). In summary, there are currently 48 independent Departments with undergraduate programs (Mike Dudley pointed out that SUNY Stony Brook offers an undergraduate engineering sciences degree, not a MSE degree). There are three other independent MSE departments that grant only graduate degrees (it was added that UT Dallas and Delaware also fall into this category). In addition:

- There are 11 Chemical Engineering and MSE departments
- There are 6 mechanical Engineering and MSE departments
- There are 5 MSE grad "Programs" (now four considering UT Dallas)
- Three "others"
- There are 9 programs within colleges or other departments (add Princeton)
- There are two Polymer Science & Engineering

Since 1999, there has been an overall decline from 104 to 88. Most of the decline is accounted for by the decrease in the number of materials specific departments (decreased from 14 to 2) and the decrease in the number of embedded programs (decreased from 27 to 15). There were modest increases in the numbers of joint

and independent departments.

There has been an increase in the number of Bachelors degrees awarded. The trend in MSE is similar to that of Chemical and Mechanical Engineering departments. The increase in bioengineering degrees dramatically outpaces other disciplines.

Flemings began his presentation by outlining the three topics he intended to discuss.

1. Are things different today than they were 15 years ago?
2. A reminder that we are parts of engineering schools.
3. Is MSE a discipline?

With respect to the first point, our field and the world are continually changing. We will have to make tough choices and difficult changes in our departments to keep up with these changes. In this respect, it can be useful to consider history. Fifty year intervals are comprised of two faculty generations and I use this as a framework for the discussion. In the period between 1850 to 1900, the telegraph was invented, the transcontinental railroad was built, the telephone was invented and Carnegie built his first steel plant. Departments taught classes in mining, mineral dressing, rock crushing, etc. In the period between 1900 to 1950, automobiles, airplanes, new metals, and polymers were all developed. There were so many important materials (steel, aluminum, copper, uranium, beryllium, ceramics, etc) that educators struggled with the question of how to teach them all. In this period, we began the process of changing the curriculum from teaching about single types of materials to teaching “metallurgy”, processing and structure. There were difficult changes in this era. Flemings recalled an MIT professor who thought MIT was in serious decline because around 1925, his smelting lab was removed to make room for an X-ray lab. In the period between 1950 -2000, the cold war was ongoing, TV was invented, fewer Americans were involved in farming, and research began to focus on functional materials. It was not clear how to adapt the educational program and there were discussions of extending the curriculum to five years. In the sense that it was clear that things had to be done differently, it was very similar to the situation today. As you go forward, change certainly needs to come and you will need to do things differently. One may ask why we should bother changing. We must change because, if we do not meet the needs of society, we will not get the students and the research funding that are needed to survive.

Turning to point 2, it is important to keep in mind that we are engineers. There was clear evidence from world war II that new science and engineering not only contributed significantly to victory, but that science and engineering were also needed for peace and prosperity. Within materials science and engineering, there was a new emphasis on engineering science that was unsettling to many people in the practical engineering fields. This process went too far in many places. The excitement of modern engineering, of building things, was lost as the focus moved to fundamental scientific principles that can be more abstract. This undoubtedly was

an important factor that contributed to a decline in enrollment. A strong science base is, of course, important to MSE, but we should not try to compete with Physics and Chemistry. In fact, the past has shown that trying to emulate pure science has not been successful. What we need now is neither a focus on hands on engineering 'craft' (as in the beginning of our field) nor a focus on pure science (as has more recently been the case), but a creative blend of the two. While we need science, it should not be over emphasized. We should promote the excitement of creating things.

Our focus should be on helping our students deal creatively with the complex elements of our field, understand how they interact with the outside world, and to build things in a sustainable way.

Turing to point 3, the answer the question is, yes, MSE is a discipline. The reason is that it has recognized intellectual unity, it has a recognized community of practitioners, and it has active scientific discourse through conferences and journals. It is a discipline because there is an "invisible college" of researchers that share common interests and practices that are distinct from other disciplines. Our activities are recognized as a discipline by industry. Furthermore, this discipline does not flourish under the leadership of another department or discipline with different objectives and industrial contacts. For example, mechanical engineering and materials engineering are disciplines of building things, but of building on different length scales. MSE departments are strengthened by interdisciplinary interactions, but should not be led by other disciplines.

A discussion followed

There was a question regarding the divergence of educating researchers for grad school and practical engineers to work in industry, which is frequently metallurgy. Flemings suggested that we should not overemphasize metallurgy in the face of other sub-areas of the field. Also, in the past we gave up courses on mineral dressing, rock crushing, and floatation, in the future we will have to give up some other things.

There was a discussion of the divergence of hiring top scientists to compete in current fields of research while still educating engineers in topics that will be useful in their careers. Flemings answered that we should design our curricula around the core of discipline as represented by the four vertices of the tetrahedron. It accommodates science, practical examples, and virtually all fields of engineering. New students may not know the Fe-C phase diagram or the details of the inner workings of the nucleus within a cell, but they should be able to function in any of the engineering disciplines as a materials expert if their education is centered on the tetrahedron.

1:40pm. Discussion: How can we best cooperate to retain strength and relevance in all MSE undergrad programs.

Davies made the point that at the undergraduate level, there is essentially no competition between MSE departments. He suggested that we should share educational materials at this level (as MIT does) to help make all of our departments stronger.

Angus Rockett said that we should be sharing recruiting materials. Robert Hull said that education in the first year, before they have selected a major, is the most important. If we share at this level, we will be working together to compete against other departments. It was pointed out that a strong four-year curriculum is also part of the recruiting process because happy and engaged juniors and seniors are essential to recruiting freshmen.

It was also noted that there are two different recruiting situations. Schools such as Illinois and Florida recruit at the HS level. In these cases, students must select a department before they even arrive on campus. At many other schools, freshmen remain undeclared and can be recruited during the first two semesters.

An argument was presented to maintain traditional strengths (metallurgy, etc.), as this provides a base of stability during volatile times. A counter argument was made that narrowly focused departments are at the greatest risk of forced mergers with other departments. In fact, there are no longer any metallurgy or ceramics departments.

MSE departments have been granting an increasing number of Doctoral degrees, but the numbers of Masters degrees is roughly constant.

The question was raised about whether we should have all of these departments, when some of which are sub-critical with respect to enrollment and graduation rates. Davies remarked that the field has never had more opportunity. Enrollments are increasing and we should do what we can to strengthen the field while it is growing.

2:20pm. Todd Osman (Executive Director MRS)
"Recent initiatives and activities in MS&E at MRS"

MRS is continuing to grow in membership and meeting attendance. Hoping to have 6,000 attendees at this meeting. 40 % if these are international.

(see attached slides for details)

- Planning to publish gender equity workshop report in the MRS Bulletin.
- MRS is an associate member of ABET (collaborative with ACeRS/NICE).
- MRS belongs to an education coordinating committee – joint with other societies
- MRS has launched a four part NOVA series on Materials Science.
- MRS published an official diversity statement.
- MRS will conduct an annual gender equity survey for NSF and publish it annually.

Shef Baker (President, MRS):

A proposal for ways that UMC and MRS might interact in the future.

- annual gender equity survey
- recruitment resources (creation of, and a repository for, such material)
- propagating materials curriculum to materials education housed in other departments (chemistry and physics)

Logistical support

- UMC does not have a home society
- Offer meeting support and web site support. Up to \$10,000 per year in staff meeting facility and website support.
- UMC remain autonomy

There are other potential synergies in advocacy, outreach, translating research to education, and undergraduate recruiting. UMC would still coordinate with and leverage capabilities of other materials societies.

2:40 pm Discussion

Baker remarked that with respect to cooperation between MRS and the others (ACerS, TME, ASM, etc.), efforts are being made to find common ground, but it must also be recognized that these societies are all on different trajectories.

It was commented that the materials advance is excellent for our students and that MRS should probably join in with this.

The question was raised about what this logistical support would involve. The answer was that it is whatever we would like within the \$10,000 budget. MRS is obviously good at organizing meetings and maintaining web sites. It is anticipated that the UMC meeting would be held at the Fall meeting most of the time.

Throughout the discussion, most of the speakers advocated for the proposal.

Action item: the executive committee will develop a memo of understanding with MRS for consideration by the entire UMC.

3:15pm. Chuck Hayes (ASM): "Student recruitment through high school teacher summer camps"

(see slides for details)

- Materials camps target high school teachers and students
- The program and its impact have been continuously growing for ten years
- The goals are to expose young students to applied science and have fun through hands on experiences. The goals are not to teach an introductory class.
- Participates are mostly chemistry teachers who know nothing about solid state chemistry.
- A substantial effort has been concentrated in Ohio and funding has been received from Battelle.
- The total cost of a camp is 15k to 60k (depending upon whether it is residential or

not). The host university supplies 5k, space, and staff help.

- The core faculty is comprised of Master Teachers.
- Curriculum is based upon Materials Science and Technology Teachers handbook by PNNL.
- Materials that are available include a C-kit (corrosion module) and a metal casting education module (a special microwave oven for melting Al has been developed specifically for this)
- The program has been having impact in recruiting into MSE departments
- High school materials classes have been developed.
- 133 teachers in 19 states will teach materials science stand-alone classes by 2010.
- A roster of all participants is available for the past ten years.
- The main goal is to fill the human pipeline in our field.
- Summer 2010 schedule will be finalized in January
- ASM has also started an undergraduate design competition, with 5k, 3k, and 1.5k prizes.

3:45 pm. Kevin Jones (Univ. Florida): “Effective techniques for recruitment of undergraduate MSE majors”

(see slides for details)

- Jones showed what he presented to students at an open house for recruiting.
- Rationale for improving enrollment: Many new budget models depend upon undergraduate enrollment. We must have enough students, although we probably do not want to be overwhelmed by enrollment either.
- Mechanism: UF invites all of the students that have been accepted into the college of engineering (and families) to an open house on a Sunday afternoon. This is in May, before they have arrived on campus.
- The open house includes a hands-on experience, a lab tour, and opportunities to meet current undergraduate students (as well as other information).
- The event has a three hour agenda, followed by a pizza reception

4:00 pm. Richard Le Sar: UMC Spring Workshop, “Incorporation of Integrated Computational Materials Engineering into MSE Curricula” (to be held at Northwestern University, June 23-24, 2010): Overview, goals, format, agenda, planning.

(See slides for details)

- Planning has begun for this summer’s workshop. The focus is on computational materials education.
- First, Le Sar recapped the ICME report. ICME offer the chance to link materials development and integrated product development.
- The UMC has an action item in the ICME report, so the meeting that we are planning is the first step towards taking this action.
- The desired outcome is a concrete set of suggestions for better incorporation of computational materials into our curriculum.
- He presented a proposed agenda

4:20pm. Gender equity - report of sub-committee on metrics in MSE (Angus

Rockett).

(See slides for details)

- Departments should have written policies for dealing with family issues.
- Grievance procedures should be in place also
- Improve mentoring is important
- Family friendly policies should be established
- 90 % of what we need to do should be done by our Universities and Colleges.
- UMC policy might help to prod institutions

Julia Weertman made some suggestions regarding the UMC survey. We should have a gender breakout of faculty by rank and gender. Similar for graduate students. We should also do a gender breakdown for applicants for new positions.

It was also suggested that agencies should fund “re-starts” for women that have taken time off for family needs.

Action Item: present a final report on recommendations at the spring meeting

UMC survey – report of sub-committee on survey revisions (Bob Snyder, Rudy Buchheit).

(see slides for details)

This item was curtailed because of time constraints. A sub-committee will review our annual survey and how the data is reported back to you. It was acknowledged that we are overdue for a systematic revision.

Action Item: present a final report on recommendations at the spring meeting and include proposals with respect to publication of some of the data

4:50 pm. Michael Milligan, Executive Director ABET. Discussion of governance changes at ABET, relevant issues for MSE departments.

(see slides for details)

- Milligan is attempting to get as much information from as many constituencies as possible.
- Milligan just started this position in June 2009.
- He is trying to build better working relations with the member societies.
- There has been growing international activities. These involve mutual recognition agreements (accreditation decisions rendered by one signatory are acceptable by all signatories) and direct accreditation outside the US. Last year 105 schools outside the US were accredited.
- ABET is an association of societies, it has 31 full time employees and there are 48 members of the board of directors.
- Governance is being questioned by technical societies, with respect to the value of ABET membership.
- ABET plans to create an academic advisory council.
- Milligan invited comments, which and be sent to: executive-director@abet.org.

5:30 pm. Adjourn for Dinner at Sorellina