Materials Science Need and Impact

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Two major questions

- Does Materials Science motivate students?
- What does industry want materials students to know?
What does industry want?

- Spring 2004 survey
- Industrial members of ASM
- 257 respondents from a cross section of industries
Top responses

- Understand that defects in materials cause product failures (av. 4.50 on a 5 point scale)
- Understand the impact of materials processing on properties and production (av. 4.26)
- Basic knowledge of relationships between properties, structure and processing applied to specific materials systems (av. 4.04)
- Processes that effect microstructure and properties (av. 4.04).
What knowledge do technicians need?

- Basic understanding of materials and processes
- Communication skills (reading, writing, speaking)
- Computer skills
- Math skills
- Problem solving, critical thinking
In general, our technicians and engineers are grossly undereducated. There needs to be a much greater emphasis in material science, as well as a greater background in practical applications of science.
Engineers join the workforce with an inadequate scientific background, little practical application knowledge and a severe lack of written and communicative skills. Most have little self-discipline and expect their diploma to grant them wealth and privilege.
What will workers need 5 years from now?

- Business-specific materials knowledge
- Courses in materials science
- College degrees
- Problem solving skills
How can we meet these needs?

- Enhanced approaches to science using real materials
- Secondary level materials science courses to enhance interest
- Enhanced training and educational programs at community and four-year colleges
High school materials course

- Taught in approx 100 high schools in the US over 10 years
- Teachers trained by NSF programs and by ASM Teachers Camps
- Basic properties and processing of all classes of materials
Materials Science and Technology: High school course

- Hands-on activities and labs (75%)
- Metals, ceramics, polymers, composites
- Real science connections to chemistry and physics (and biology)
- Students learn that they deal with science when they deal with everyday materials
Student Survey

- 221 surveys returned
- 11th grade (44%)
- Male (65%)

Results from student responses

Figure 1: Results for selected responses to student survey

- Self concept improved
- Saw career opportunities
- Developed problem solving skills
- Developed hand-on skills
- Improved writing skills
- Change in perception of science

Legend:
- No
- Undecided
- Yes
Student Survey

- Would students recommend this class to other students?
  - 76% said yes
  - 19% said probably
  - 5% said no
Student Comments

I love working with materials. I learn so much easier by working with my hands.

It was a non stop action class. Almost everyday we are doing something new. I got to make a lot of cool stuff that I can keep forever.

My friends used this class as a stepping stone to get into the Manufacturing Internship at Boeing.
Other Findings

- Students become more interested in further science study after taking this course
- Significant enhancement in the understanding of science and in career opportunities in science and technology
- Provides a means for motivating teachers to engage students more in real science and to motivate students toward more understanding of science and engineering.
Additional survey of teachers

- 2004 survey
- 62 returned out of 200 surveys
- 76% using materials concepts in their science or technology courses
- 50% have other colleagues in their school using materials concepts in their science classes
- 44% teaching a separate materials science course in high school
- 95% would use materials science concepts in their classes if resources were available
Impact on Teachers

- Students becoming more aware of materials science and technology as a career field
- Teachers like the relationships to other areas of science, math and engineering
- Raises interest in science among their students to enhance learning
Teacher comments

*Students develop a feel for the material world, understand better the importance of studying chemistry, math and physics, and maybe develop new career paths as a result.*
If there is a better way for a student to learn relevant science, I don't know of it. The connections between the class and life are absolutely solid. **MST** is one of the most worthwhile classes I have had the pleasure of teaching. When the teacher enjoys the material so do the students.
Conclusions

- High school materials science motivates students to study more science and to understand basic materials relationships.
- Materials science raises interest in science and enhances student learning and interest in science.
This demonstrates that the MAGSET focus on materials as a gateway to science has considerable potential.

High school material science provides one means for educators to start meeting the stated needs of industry.

And can be an appropriate means for enhancing general science literacy.
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