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Materials science in secondary education

Could materials science join physics, chemistry and biology in the high-school curriculum? University researchers and teachers gathering at a special symposium on secondary education at the Materials Research Society Fall Meeting last November* called for an increased presence of the field in pre-university education. This is the most concerted effort within a worldwide materials science research community that is promoting itself in secondary schools. Yet, despite this burgeoning lobby, momentum is not sufficient to overcome a growing conservatism in education. University-level materials scientists need to get more involved.

Enhanced pre-university education could clearly play a vital role in promoting the field. First, materials scientists must improve their public appeal as they are competing for funding and positions with chemists and physicists, representatives of established scientific fields that, adorned with Nobel prizes, hold a tight grip on the public imagination. More importantly, strong introductory courses before university are the best way to attract numbers and talent to undergraduate lectures and laboratories — something that some physical sciences fields are currently struggling to do (*Nature Mater.* **2,** 1; 2003; *ibid* **2,** 128; 2003).

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COULD TRADITIONAL WALLS IN HIGH-SCHOOL EDUCATION FALL TO ALLOW MATERIALS SCIENCE TO SHINE?

Some researchers have stepped up to the task. Participants in the November symposium showcased ambitious lessons for teaching cutting-edge research ranging from electronic and atomic force microscopes to fuel cells and wind tunnels for teaching the relation of aerodynamics to materials concepts (see *Nature* **432,** 791; 2004). In the US, the National Science Foundation had gone to the unprecedented length of inviting 90 high-school teachers from across the country to attend the meeting. All of the projects were fruits of collaborations between university researchers and educators, mostly through Research Education Training (RET) programs sponsored by Materials Research Science and Engineering Centers (MRSEC) (http://www.mrsec.org/home/).

With shoe-string budgets at the schools, these collaborations have had to be imaginative. Faced with the impossibility of landing a US $10,000 spin-coater used to spread thin films on light-emitting diodes, MIT's RET participants came up with the idea of using off-the-shelf fans — at $10 each (Hannah Sevian *et al. J. Chem. Educ.* **81,** 1620–1623; 2004).

The National Science Foundation has been a key advocate. "Through the study of materials students gain a better understanding of fundamental concepts in physics, chemistry, biology and mathematics by connecting those concepts with real world applications," says Carmen Huber of the National Science Foundation. The NSF's Division of Materials Research developed educational materials such as the *Materials World Modules* (http://www.materialsworldmodules.org) at Northwestern University and the *Strange Matter* exhibit that is now on tour (http://www.ccmr.cornell.edu/education/teachers/mrs.html).

The division also used its university-level research funding to spur university researchers to take part in pre-university education. A US $15 million grant awarded to Northwestern University in October will establish a collaborative Center for Learning and Teaching in Nanoscale Science and Engineering. Many Nanoscale Science and Engineering Centers (NSEC), like the MRSECs, are offering stipends for training courses aimed specifically at developing new curricula.

Still the obstacles are formidable. Attempts to create a new field face the constraints of conservative state curriculum. With the adoption of President George Bush's *No Child Left Behind* policy, enacted in January 2002, even less leeway will be given to new ideas. The policy encourages testing based on state-wide standardized curricula so that the overall school's performance can be evaluated. Teachers, worried about their school's performance, and parents, worried about their children's ability to pass university entrance exams, both question whether there is room for the newly proposed programs, which would probably not be tied to the tests. Fighting for flexibility in the curricula will be a job for the teachers, but the involvement of university researchers would surely help.

As the Bush administration's immigration policies stem the flow of foreigners to the United States, university researchers in various fields are starting to sense a crisis. How will they fill their laboratories with qualified students? Increasingly, they will have to look to US schools, but there, interest in science in general has plummeted. The materials science researchers and teachers involved in the aforementioned programs are confident that their approach, hands-on and application-oriented, could garner interest among high-school students. But they need more support from science policy makers, teachers, and, above all, their colleagues. If they succeed, their efforts to introduce materials science curricula might not only benefit their own fields but the sciences in general.

*Materials Research Society Fall Meeting, Boston Massachusetts, USA, 29 November – 3 December 2004; http://www.mrs.org/meetings/fall2004/program/pgm_pp.html