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The Role of Engineering Design in Materials Science and Engineering Curricula

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Undergraduate materials engineering curricula diverge from materials science curricula in two important ways. An underlying requirement is to prepare the graduates for industrial positions, so they need a good grounding in processing and statistical methods, as well as a strong set of hands-on skills in materials characterization and metrology. The other distinguishing feature of an engineering education is the focus on design rather than research. In the case of materials science and engineering, the design deliverable is often a process design, a materials selection, or a failure analysis. Some of the features of education for design include the exercise of thinking about the customer's needs, functional requirements of the product, the cost of production, and the broader context of the design project in society. These ideas can be integrated or at least introduced early in the curriculum and in many different types of courses. Materials Science and Engineering programs have the dual requirement of educating both future scientists and future engineers. Graduating baccalaureate students need to be ready for engineering practice, yet many also are being readied for graduate study and research. One aspect of this ambiguity is that *research* and *design* activities are not always as clearly differentiated as they are in other engineering programs. How can one undergraduate curriculum be successful at both? One key distinguishing element in engineering practice is *engineering design*. Design activities occur in many aspects of the profession and may be practiced by both scientists and engineers; however it is engineering curricula, not science curricula, that tend to explicitly focus on developing the skills and methods of design practice in students. Accredited programs within colleges of engineering are required to emphasize engineering practice and design, while still providing the necessary conceptual development of the underlying science. Current practices and emerging ideas concerned with these aspects of materials education will be presented in this talk.