BOOK REVIEW

Introduction to Engineering Materials: Behavior, Properties, and Selection

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REFERENCE: Murray, G. T., *Introduction to Engineering Materials: Behavior, Properties, and Selection, Engineered Materials Series 2,* Marcel Dekker, Inc., New York, 1993, ISBN: 0-8247-8965-2, 688 pp.

This text includes the best of many worlds: a quality introduction to materials engineering and selection, and up-to-date comparisons of material properties. The theme of this book is comparative properties. The 13 chapters and many case studies are rooted in clear and concise presentations of four major classes of materials, i.e., metals, ceramics, polymers, and composites, followed by information on electronic materials and environmental degradation of materials. The chapter on "Comparative Properties" highlights the differences among the various materials and the book is capped with an excellent chapter on "Material Selection."

The design engineer, with minimal background in materials science, as well as the materials engineering student, will gain important insight into the proper selection of materials for a given application or process. Entry-level engineers in industry will find this text uniquely suited to assist them in understanding materials and their properties.

The chapter on "Imperfections, Diffusion, and Plastic Deformation in Crystalline Materials" focuses on the mechanisms of diffusion and plastic deformation in crystalline bodies that are dependent on crystalline imperfections. This chapter pivots on the well-known fact that "defects at the atomic level in crystalline materials have a pronounced effect on their mechanical properties." The description and definition of point defects, line defects, and dislocations are well illustrated and lead to a better understanding of plastic deformation in metals and ceramics. Deformation, annealing, and fracture in metals and ceramics are reviewed and aid the materials scientist in making decisions on the proper choice of a material.

Composites are described in a special chapter which discusses many aspects of this topic including definitions and sources. Composites are best understood through a discussion of "the rule of mixtures," based on the author's fiber model. Highlights of the discussion are that: "The fiber must be securely bonded to the matrix. The fiber must be either continuous or overlap extensively along their respective lengths. There must be a critical fiber volume for fiber strengthening of the composite to occur. There must be critical fiber length for strengthening to occur." Polymer, metal, ceramic and graphite matrix composites are well characterized and the chapter concludes with a detailed outline of composite fabrication and failure.

The author attained his goal of clearly explaining the materials selection process, including cost analysis, with case histories involving materials selection. All chapters conclude with a list of appropriate definitions, questions, and problems as well as suggested reading.

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