

Book Reviews

Biomaterials Science and Engineering—Joon Bu Park (New York: Plenum, 1984). *Reviewed by C. Batich.*

This book results from an ambitious attempt to include a basic materials science foundation in a text on current biomaterials science. It would be very useful to have such a text available for engineering students who are not materials science majors. However, the occasionally narrow emphasis on mechanical properties, and a large number of technical errors, requires supplemental reading and a degree of wariness. Despite these shortcomings, it is a facile book to read due to the large number of line drawings, tables, and black and white figures. References are plentiful and a general bibliography is also given at the end of each chapter.

A short introductory chapter summarizes major causes of implant failure. The very wide range of materials available, and requirements to be satisfied in a selection process, is presented here also. The next 100 pages cover basic materials science information in four chapters: "Characterization" (e.g., mechanical properties), "Structure of Solids" (e.g., molecular, structural effects on mechanical properties), "Thermodynamics" (which includes kinetic phenomena, phase changes, and corrosion), and finally "Strength and Strengthening Mechanisms." Most of the properties discussed are mechanical and there is nearly nothing on electrical properties such as water permeability of microcircuit encapsulation materials. There are nearly no references in this section to biomedical applications, hence, this section is very similar to selected chapters from a basic materials science text.

Chapter 6, "Structure-Property Relationships of Biological Materials," is one of the best. Park makes the point that natural systems need to be well understood to replicate them. He gives numerous examples of mainly mechanical properties of various tissue types. Despite a number of undefined biological terms, the reader

The reviewer is with the Department of Materials Science and Engineering, University of Florida, Gainesville, FL 32611.

is left with an appreciation of the complex structures in bones and arteries for instance.

Biocompatibility is well covered in chapter 7. Some comments on tissue response are oversimplified enough to be misleading: "... pure metals, which tend to lower their free energy by oxidation..." and residual monomer being implicated as a problem for PTFE powder on p. 181, and then the reaction being called a physically induced response on p. 183.

The next three chapters cover the three main classes of materials: metals, ceramics, and polymers. This is well-presented material but has numerous errors in the polymer section. For instance, chemical structures for polyHEMA, MMA/styrene copolymer, and polycarbonate are incorrect.

Discussions of soft and hard tissues make up the final two chapters of the book and provide a useful, detailed discussion in many cases, e.g., hip and knee implants.

In addition to the text, there are short appendices on constants and SI units as well as problems and answers for each chapter. Some of the answers provide additional material expanding upon explanations in the text. A glossary is unfortunately not included and may be missed by readers with little knowledge of medical jargon.

It is encouraging to see some discussion of the ethical basis for implantation. Although less explicitly stated than in Hench's book (vide infra), such statements as "Although breast enlargement or replacement for cosmetic reason alone is not recommended..." (p. 326) do occur.

There are currently few "single author" texts available in biomaterials. Two good books currently in use are J. Black's concise monograph on *Biological Performance of Materials* and L. Hench and E. Ethridge's somewhat specialized *Biomaterials: An Interfacial Approach*.

Park's book falls somewhat between these two and fills a growing need for including materials science directly. It is hoped that a second edition will correct some of the shortcomings outlined here. Until then, it will still be a valuable publication for workers in the field and students as long as careful reading and supplementary sources are available. A very reasonable price should also be noted.