Book Review

Materials Science

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In this book an attempt is made to present a unified picture of the structure and properties of engineering materials that will be acceptable as an introductory text for all engineering students. Such a book must necessarily encompass many disciplines and thus there are two major problems. Firstly, time and space limitations make it necessary for the authors to decide on the relative priority of the many topics to be covered, and secondly, the authors must avoid a bias towards their own particular areas of interest. Judged in these general terms I feel that the authors have been successful and have produced a relatively well balanced book. There is in fact probably a slight bias towards the electrical and magnetic properties of materials with a very limited chapter on thermodynamics, and a treatment of mechanical properties which mechanical engineers will find somewhat shallow. However, the reader must also beware of assessing the book in terms of his own specialisation or in terms of an engineering course tailored to a particular discipline or department.

When the book is considered on a more technical level the authors have an unfortunate habit of briefly mentioning quite important subjects without really discussing them in sufficient detail. For example the following statements are made with little, or no, further qualification:

(i) "Vacancies are sometimes referred to as Schottky defects and interstitials as Frenkel defects."

(ii) "Under suitable conditions of temperature and pressure and in the presence of a catalyst called an initiator the molecular chains grow by the addition of monomer molecules one by one to the ends of the chains."

(iii) "The mode of deformation of ceramics is highly dependent on structure. The lack of long-range order makes the motion of dislocations impossible. However, these materials can deform by viscous flow processes under proper conditions of stress and temperature."

This has presumably occurred because of space limitations, but to make it more acceptable, references to the more specialist texts listed as "Further Reading" should have been given. Also such important topics as the Hall effect, the influence of structural imperfections on the resistivity of metals, and the phenomenon of plastic deformation by crystallographic slip are not discussed in sufficient depth. For example, no indication is given of how to obtain the Hall mobility or Hall coefficient, and no mention is made of Matthiessen's or Nordheim's rules in the short discussion on resistivity, or of Schmid's Law in the discussion of slip.

In spite of these defects the book does in fact cover the vast field of materials science quite well, with the early introduction of wave mechanics being a particularly attractive feature. The mathematics throughout the text is presented at a reasonable level for first year students, and most of the information is advanced in a clear, logical and easily readable manner.

Finally when assessing this book it must be remembered that there are many books in the field of Materials already. However, I think it is fair to say that the previous books have been written around a particular engineering course, or with a bias towards a particular discipline. Thus for a general course it is necessary to use a combination of several books, which for first year students is both inconvenient and expensive. This book succeeds reasonably well in covering the whole field and is relatively inexpensive.

In conclusion, my overall opinion of this book is that first year engineering students will find it an acceptable introduction to the subject, although if their course were biased towards the more mechanical properties of materials a complementary, more specialised book would probably still be desirable.

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