Book Reviews

High-Strength Oriented Glass-Plastics
(in Russian)

G. D. Andreevskaya

Pp 370 (Nauka Publishers, Moscow, 1966) Roubles 2.12

The title refers to filament-wound reinforced plastics. These materials were invented, it is said, by A. K. Burov in Russia in 1940. Chapter 4 of the book (106 pages) treats their methods of formation in USSR and abroad, describes some vessels made of them (abroad), gives the mathematical relations between the mechanical properties of the composites on one hand and the fibre concentration and orientation on the other, reviews the chemical stability and the electric properties of the composites, and so on. Of the 190 references in this chapter, almost a hundred are to Russian publications, many of which originated from the author's laboratory. Thus, this chapter is an authoritative review of the Russian work and concepts related to filament winding and should be of great interest to anyone concerned with these materials.

The first three chapters are, so to say, introductions to the fourth. Chapter 1 (45 pages) describes the main properties of glass filaments, Chapter 2 (103 pages) the polymer binders, and Chapter 3 (108 pages) deals with adhesion. The author does not restrict herself to properties and materials of direct importance to the present-day filament windings, with the result that the treatment at times becomes sketchy. Thus, the theory of adhesion which is the most likely to be correct is not even mentioned, although obsolete hypotheses are spread over five pages. In too many instances, the author is too impartial; she states that "X believes" or "Y claims" without giving enough information to the reader to decide who, if anyone, is right.

The price of the book (about 16s for a large bound volume) ought to convince many a scientist that studying Russian may mean attractive savings.

J. J. BIKERMAN

Contact and Frictional Electrification

W. R. Harper

Pp xii + 269 (Clarendon Press: Oxford University Press, Oxford, 1967) 70*s*

If two dissimilar insulators are rubbed together, their surfaces become charged. This phenomenon was known to the Ancient Greeks and its name, "triboelectrification", comes from the word $\tau\rho\iota\beta\omega$ meaning "rubbing". Charge generation also occurs for rather different reasons when two surfaces are separated without rubbing. Naturally a good deal of experimental data on static electrification has accumulated over the last two centuries but it has proved surprisingly difficult to develop satisfactory theories to explain the observed phenomena. The development of solid state theory has provided a new approach which was not available to early workers in the field. Two or three modern textbooks are now available which attempt to describe the present state of the subject in a critical manner, but even these make relatively little use of solid state theory. This new book not only makes sensible use of modern theory but also describes old experiments in a way which enhances their value.

Dr Harper states clearly in his preface that he does not seek to make a comprehensive survey of the subject, but rather to present his own theories of the charging mechanism for insulators. In developing his argument he examines all the experimental evidence with care, not hesitating to reinterpret the observed phenomena in the light of modern physical theories. Such a procedure could well result in the convenient burying of data which did not fit the argument, but the author is scrupulously fair in pointing out quite clearly when he is reporting and when he is arguing. Even when presenting theories with which he is at variance, he is completely objective in first presenting the evidence and then arguments for and against. The reader is left to judge the relative merits of these for himself. The author is to be congratulated in having succeeded in presenting a difficult subject clearly and concisely. Because his approach is so methodical his book could well serve as an

excellent general introduction to the subject, although this was not the original intention of the author.

There are three main sections, the first setting out the main problems, the second developing the relevant theories of solid state and surface physics, and the third concerned essentially with interpretation of experimental results. Four chapters are devoted to solid state theory and these are arranged so that readers familiar with this aspect of the subject could omit them without losing the thread of the argument.

The subject of contact and frictional charging of insulators is examined at length and also charging of metals and semiconductors. It would have been useful to have included an examination of current theories of particle adhesion which are clearly very relevant when one is considering contact charging of powders. One could object to the use of cgs units and to the rather inadequate index, but these are minor criticisms. This is a most useful book which can be thoroughly recommended. It should be compulsory reading for anyone about to design an experiment for measuring static charge generation.

A. W. BRIGHT

Hardness Measurement of Metals and Alloys

H. O'Neill

Pp xvi + 238 (Chapman and Hall, 1967) £3

This is an excellent new version of a classical monograph in which the author discusses the physical and theoretical basis for hardness testing and seeks to relate this to the actual results that are obtained from the familiar hardness tests.

In the first few chapters, Dr O'Neill deals with the fundamentals of the standard ball, cone, and pyramid tests and discusses the errors associated with each technique. The later chapters, which deal with the effects of alloying, deformation, and temperature on the hardness of a material, are well written and include sufficient fundamental information to show clearly the usefulness and limitations of hardness tests in assessing these effects. The value of these chapters is extended by the copious cross-references which are collected into bibliographies at the end of each chapter.

The final chapter deals with the standard testing machines and includes a very useful section on the correct standardisation of these machines.

Dr O'Neill quotes the following from a letter of H. Hertz: "Hardness is a property of bodies of which scientific man has as clear, i.e. as vague, a conception as the man in the street. Now as I went on working, it became clear to me what hardness really was."

I feel that this book has made clear what hardness really is and will appeal to all those people who are engaged in mechanical testing of metals and those who use hardness testing as a non-destructive tool.

R. A. FARRAR

Fracture of Structural Materials

A. S. Tetelman and A. J. McEvily Jr

Pp vii + 697 (Wiley, London, 1967) 144s

The authors of the book have taken upon themselves the task of writing a text on fracture which covers not only the microscopic aspects familiar to the metallurgist, but also the macroscopic considerations of fracture mechanics more appreciated by the engineer. Furthermore, they have done it in such a way as to enable some bridges to be built across the gap between these two points of view, and thus reflect the growing awareness of the importance of an interdisciplinary approach to this subject.

The work is divided into five parts. The first approaches the topic from an engineering point of view, covering conventional design concepts and their relation to the occurrence of fracture, the mechanics of fracture, and design and testing for fracture resistance. Part two considers the microscopic aspects of plastic deformation and crack propagation, and how these factors influence the ductile-brittle transition in flaw-free low-strength materials. In the third part, which deals with the physical aspects of

fracture toughness, these two approaches are interrelated as far as is possible within the limitations of the present state of knowledge. Part four considers time-dependent fracture including fatigue, creep, stress corrosion, and various forms of embrittlement. In the last part, the fracture of specific materials is considered in some detail. There are separate chapters on steel, brittle non-ferrous materials, non-metallic materials including glasses, crystalline ceramics and polymers, and finally composite materials.

Each of the thirteen chapters (except for some unknown reason chapter 9) includes a short summary of the main points covered, a point much appreciated in a book 700 pages long which includes a large amount of material covered in considerable depth. This detailed coverage will be much appreciated by all those working in the field, and by students at post-graduate level. Its high value to the specialist reader of necessity makes the book less suitable for use at undergraduate level. Vital though a clear insight of the mechanisms of failure may be, the time needed to absorb a significant amount of the material presented would occupy a disproportionate fraction of any engineering or materials science course.

As might be expected from a book of this length, it is possible to find a number of small defects most of which are of a typographical nature, but a few of which are more serious, for example the lack of correlation between the lettering of Fig. 7. 8a and that in the text.

In summary, this is a valuable book which sets out to do an important job, that of "bridging the large communications gap which has developed between the engineers who must design with materials of a given toughness and the metallurgists and materials scientists who are trying to improve them". In the opinion of this reviewer it succeeds admirably. It is thus all the more unfortunate that its price, which puts it firmly in the library copy bracket, also puts it out of reach of many who would profit by having their own copy of such a fine work of reference.

D. A. WIGLEY