

Book Review

PERMANENT MAGNET MATERIALS AND THEIR APPLICATION

by P. Campbell

Cambridge University Press, UK, 1994, 207 pp, US\$49.95

When a book on permanent magnets arrives on the desk of a magnetician it will inevitably generate an immediate interest. Progress in the development of permanent magnets has been very rapid in the last ten years and an effort to consolidate and reconcile this quickly developing topic is always commendable. Under such a scenario the reader will probably compare this new edition to the field with previously published textbooks on the subject.

The new book "Permanent magnetic materials and their application" by Peter Campbell, a neat and a rather slim volume will attract the attention of readers by its first-class presentation: the paper and the print are of high quality and the illustrations are excellent. And it can be compared with the monograph "Advances in permanent magnetism" by R.J. Parker published four years ago (for its review, see *Magn. Electr. Sep.* 4 (1993), 128).

Organisation of both textbooks is similar: there are chapters on fundamentals of magnetism, permanent magnet processes, stability, magnetic circuit design, magnetisation and demagnetisation, and applications. Campbell's book also contains a very useful chapter on magnetic field analysis. Modern analytical techniques are described, including the finite element method, with reference to the accurate simulation of permanent magnet materials.

The first chapter on the fundamentals of magnetism introduces the basic parameters and physical quantities encountered in permanent magnetism. Some of the definitions are rather unorthodox and will probably confuse many a reader. Rather curiously, the magnetic induction B is called "magnetic field" (or flux density), while the magnetic field strength H is called "magnetising force". Not only is H not a "force" but, at the same time, in other parts of the book, it is called the "field" or "applied field". Another serious shortcoming is the fact that the author does not introduce units of magnetic quantities and does not even specify in what system of units he is working. The only magnetic unit mentioned in the text is the unit of energy product (kJ/m^3) which, together with the fact that the magnetic permeability of free space μ_0 appears in the equations, will tell the reader that the book is written in SI units. And even here is the author shy to use appropriate terminology and calls μ_0 "a constant of proportionality" without specifying its numerical value and unit. The reader will thus have problems, in his/her computations, to benefit from a rather ambitious theoretical description and numerous equations, particularly in view of a rather confusing situation in magnetic units and their conversion from cgs to SI. In contrast, Parker's book, which is written in cgs units, contains a useful and comprehensive list of physical quantities, their units and their conversion from one system to another.

The chapter on permanent magnet processes contains a useful review of processing technologies, with the main emphasis on Sm-Co, Nd-Fe-B and bonded magnets. The chapter on thermal stability discusses the effect of temperature, composition and surface oxidation on reversible, irreversible and structural changes in permanent magnets. The chapter on magnetic circuit design describes, in a standard fashion, the selection of design procedures, while the chapter on magnetising and testing summarises the magnetisation and demagnetisation techniques as applied to rare-earth magnets. The last chapter gives a rather brief overview of applications of permanent magnets with the main emphasis on rare-earth magnets. Magnetic separators are, regrettably, ignored.

When compared to Parker's book, the monograph by Campbell gives no comparison between different classes of magnets, no list of specifications and physical properties, although some basic technical data appear scattered in the text. This is perhaps the single most apparent and serious weakness of Campbell's book. It thus fails to catalogue the most recent developments in permanent magnetism and the reader will be left wondering, what's new? Campbell's textbook would be of good benefit when read in conjunction with Parker's monograph.

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