helped those of us with bad memories to sort out (page 75) which of La, Y, Ce, Tb, Yb and Lu are rare earths and we could have been helped by not seeing La_2C_3 (page 79) when it is more rationally written $La_4(C_2)_3$. (The word oxygen has been substituted for carbon on this page.)

In a short book such as this perhaps one has a right to expect few errors; it is gratifying nevertheless to find so few. Anyone (such as this reviewer) who has failed to keep abreast of advances in neutron diffraction will have his eyes opened to a fascinating field of research. The ideas of 'invisible' atoms will appeal to all X-ray crystallographers and there are few fields of scientific endeavour where one can so easily forgive a pun: crystals with invisible atoms are called 'null matrices'.

Whether or not one is contemplating the daunting prospect of seeing all the hundred volumes on one's shelf, this particular volume, which stands independently of the others, will be a valuable addition to every crystallographer's library. It augurs well for the next two volumes we can expect under topic 11: lattice theory and the theory of metals.

S. C. Nyburg

Lash Miller Chemical Laboratories
University of Toronto
Toronto 5, Ontario
Canada

Atomic structure and chemical bonding. By F. Seel. 112 pp. (Translation and revision of 4th German edition by N. N. Greenwood and H. P. Stadler). London and New York: Methuen and John Wiley, 1963. Price 15*s*.

If one were required to compress an elementary non-mathematical account of atomic structure and chemical reactivity into a crown octavo booklet of 112 pages one would be hard put to it to better this book which is a translation of the 4th German edition.

The book will not be of special concern to crystallographers *qua* crystallographers and indeed, although the author gives good coverage to important structural types, he does not stress that crystal-structure analysis has been the basis of our revolution in thought concerning valency. His approach to this is often curious. He claims (p. 54) that it is erroneous ever to regard nitrogen as five-covalent, not as one might expect on crystal-structural grounds, but as 'is evident from Fig. 41 ...'. This figure, needless to say, begs the question. There are several curious quirks of this kind. Examine the logic of the argument on pp. 66–69: (*a*) Li can use unhybridized *s* orbitals to form a metal; (*b*) atoms in general can involve hybridized orbitals to form metals; (*c*) one reason why hydrogen does not form a metal is because its electrons cannot hybridize.

Naturally the subject matter of the book is condensed and a student could hardly make much of it on his own. It would, however, be excellent collateral reading for a lecture course. The text is aided by a generous supply of ingenious diagrams. (Occasionally a bit too ingenious; examine Fig. 14 as an illustration of variable valency in the transition elements.) Here and there one felt the need for more illustrative information. Thus coordinate axes would have helped with *d* orbitals (Fig. 9), as they would when comparing COClF with SOClF (pp. 63–64). The author makes very sensible use of energy data to explain chemical reactions and, although it is all chemically orthodox, it is well set out. Here again an energy-level diagram or two would have helped the discussion.

The sensible layout and good coverage have made this a popular book in Germany. This excellent translation should be equally popular in the English-speaking world.

S. C. Nyburg

Lash Miller Chemical Laboratories
University of Toronto
Torontos, Ontario
Canada

Silicate science. Volume 1. By W. Eitel. Pp. xii + 666, with 375 figs. New York and London: Academic Press, 1964. Price 171*s*. 6*d*. Subscription price 150*s*. to those who have placed orders for the complete set prior to publication of the last volume.

The Physical Chemistry of the Silicates by W. Eitel, published in 1954 was recognized as a *tour de force* summarizing the vast body of knowledge about silicates which had accumulated up to 1952. It is a measure of the enormous growth of this subject that the present large volume is the first of five being prepared, all by W. Eitel, which are now needed to cope with the progress made in the period 1952–62. It its important to realize that the five new volumes (1. *Silicate Structures;* 2. *Glasses, Enamels, Slags;* 3. *Dry Silicate Systems;* 4. *Hydrothermal Silicate Systems;* 5. *Ceramics and Hydraulic Binders*) are not a revision of the earlier work but are entirely supplementary to it. Volume 1 *Silicate Structures* is divided into three sections: *A*. Silicate crystal structures, 218 pages; *B*. Clay mineral structures, 67 pages; *C*. Silicate dispersoids, 327 pages. The arrangement within each section is by means of numbered paragraphs each dealing with a separate topic: the paragraphs are in effect extended abstracts (with illustrations) of one or more papers on a given theme, and related themes are usually found in neighbouring paragraphs.

The largest part of section *A* describes the important silicate structures determined in the ten year period, but this is preceded by chapters on general crystal chemical topics, infrared spectrometry and complex anions in alumino-, beryllo- and boro-silicates. For the arrangement of material in the description of structures the Zoltai method of classification is used. The hitherto commonly adopted Bragg classification of silicate structures is ruled by the type of linkage of SiO_4 tetrahedra (chains, sheets, *etc*.), but inconsistencies arise through the treatment given to aluminum and other atoms when they occur within oxygen tetrahedra. For example, in cordierite AlO_4 groups are not regarded as in the 'silicate' arrangement, but in anorthite they are. The classification by Zoltai takes into account all tetrahedrally coordinated cations in describing tetrahedral arrangement. Thus beryl and cordierite, for example, are described as having framework rather than ring structures, and oakermanite containing linked Si_2O_7 and MgO_4 groups is treated under sheet structures. One result of the new classification is that it causes sillimanite (Si_2O_5 chains) to be separated from its polymorphs, because aluminum is in fourfold coordination in sillimanite whereas in kyanite and andalusite it is in 5-fold and 6-fold positions respectively.

Although the coverage of recent structure determinations is fairly comprehensive, a number of important spheres of