spaces under the operations of the rotation group in three dimensions, the characters of various representations of this group, the character tables of the crystallographic point groups, and the symmetry elements of the magnetic point groups.

The writer has enjoyed, for instance, the simple derivation of the crystallographic point groups given in Chapter 2, the clear discussion of the direct-inspection method given in Chapter 3 with the useful distinction of two aspects of the method [the transformation of tensor components as coordinate products (§ 3.6) and the adoption of convenient generating symmetry elements and reference frames (§ 3.7)] and the appealing discussion of magnetic symmetry given in Chapter 6. The writer has enjoyed rather less, for instance, Chapter 7. Here the illustration of the logic of the proof of Onsager's relations is not self-contained and yet no reference is given to more complete discussions (such as those contained in Callen's *Thermodynamics* or in De Groot's *Thermodynamics of Irreversible Processes*); the discussion of electrical transport in a magnetic field in §§ 7.5 and 7.6 is rather less effective than that given, *e.g.*, in Landau and Lifshitz's *Electrodynamics of Continuous Media* (which is not even quoted among the pertinent references); and the very brief section on transport in magnetic materials seems hardly sufficient to introduce this complex topic.

A careful perusal of several chapters and appendices reveals also that the book lacks a final polish. The writer has come across some conceptual pitfalls, some relevant omissions and a number of bothersome misprints. A few examples will suffice to illustrate the point. It is not quite true, for instance, that the methods presented in Chapter 3 cannot be used to obtain the schemes of tensor components for isotropic or axially symmetric bodies, as the author asserts on p. 26, nor is it quite true that the explicit schemes of tensor components cannot always be constructed from a complete knowledge of the tensor invariants, as the author asserts on p. 31. No mention, and thus no direct use, is made of the very useful theorem by Hermann on the cylindrical symmetry of a tensor property of rank n around a symmetry axis of order higher than n, which is given some relevance in the excellent review by Jagodzinski and Wondratschek in *Handbuch der Physik* VII (1) (see Satz 17.I and p. 53) quoted by the author in the principal bibliography of Chapter 4. No mention is made also of the very few papers in which group theory was first adopted to obtain explicit schemes of tensor components, even though the method presented by the author in § 4.2 follows closely the method originally proposed by the writer in *Nuovo Cimento* (1952) for crystallographic groups, and extended by the author himself to infinite groups. Other relevant omissions are, *e.g.*, on p. 31 where it is not explained how the schemes given for the second and third-order tensors follow from the invariants constructed on p. 30, and on pp. 33, 34 and 37 where no mention is made of Schmidt's orthogonalization procedure which is most useful in carrying out the calculations required. Among the bothersome misprints, one might mention only the legend at the side of equations (3.6*a*) and (3.6*b*), the E matrices for 3^2 and $2'$ on p. 42, the last term on the right-hand side of equation (7.50), the lacking definition of ω for group 23 in Appendix 5, and the incorrect listing of the symmetry operations of the magnetic point groups $mm\underline{m}$, $\underline{6}/m$ and $\underline{6}/\underline{m}$ in Appendix 6. Finally the references in Chapter 3 to the textbooks by Nye, Bhagavantam and Mason are somewhat peculiar since they refer to chapters of these books which do not discuss the general effect of rotational symmetry on tensor properties and the direct-inspection method, and the references in Chapter 4 to the review by Jagodzinski and to Chapters 4, 6 and 7 of Bhagavantam's textbook are also somewhat peculiar since neither Jagodzinski nor Bhagavantam discuss in detail group-theoretical techniques to obtain explicit schemes of tensor components.

One should stress that the minor faults of the book that we have discussed do not, of course, reduce significantly its overall value, and they could, in fact, be easily amended in the successive editions that one feels sure the book will have.

F. G. FUMI

Department of Physics
Università di Genova
Viale Benedetto XV 5
C.A.P. 16132
Italy

Surface and defect properties of solids, Vol 4. By M. W. ROBERTS, J. M. THOMAS and other Reporters. Pp. ix+250. A Chemical Society Specialist Periodical Report. London: The Chemical Society, 1975. Price £ 10.50.

This is the fourth book of a series addressed to workers in the physico-chemical properties of surfaces and interfaces. It consists of six separate chapters, all of them written by expert researchers in the field. The general approach is on the side of a timely account of the state of the art rather than on scholarly completeness. Everywhere the book includes an ample set of references, extending up to 1974.

The first three chapters deal preferentially with surface studies whereas the rest is concentrated mostly on defects. Among the former, we find first a report by R. Kellerman and K. Klier on transition-metal ion complexes in zeolites. The report lays stress on the ability of zeolites to stabilize metal ions in unusual chemical environments. A critical assessment of recent work for each separate element of the 3*d* series (except V and Sc) is included. The work has obvious implications in the field of catalysis, in which the following report falls. This report, by J. R. H. Ross, deals mainly with the catalytic activity associated with the steam reforming of hydrocarbons. Possible mechanisms associated with these catalytic reactions are discussed. Nowadays, the sentiment has grown strong that surface spectroscopy can be a powerful technique in the study of catalysis. However, most of the studies carried out so far (of which the ones reviewed in Ross's paper are an example) have made little use of it. The next report, by R. W. Joyner and M. W. Roberts, is very relevant to this point. The report describes briefly the fundamentals of Auger electron spectroscopy and, subsequently, gives a number of examples of its applications to surface chemistry. In connexion with catalysis, a subsection is devoted to the study of reaction kinetics and the potentialities of the methods can be inferred therefrom. Concerning the treatment of the Auger process itself, it is worth pointing out that, apart from the usual basic elementary facts, some topics in course of current development (like relaxation effects, interfacial peaks, *etc.*) are mentioned in the report. Even though not treated in detail, its mere inclusion could well arise interest

in the uses of this technique other than as an element marker. Also a suggestive table of comparative potentialities of the different surface spectroscopies, assessed by a set of well known researchers in the field, is included.

The three chapters on defects have in common the utilization of electron microscopy. The influence of this technique on our present knowledge of defects in metal crystals is hard to overemphasize; however, its systematic application to other types of crystals has had to wait a longer time. In the present book, there are two reports dealing with the latter. The first, by J. E. Chisholm, analyses crystallographic shear planes in silicates (mostly by the direct lattice imaging technique) and the second, by L. W. Hobbs, deals with transmission electron microscopy of alkali halides. The latter, extending to almost half of the total length of the book, is a review of the technique as applied to that particular kind of material, supplemented by some examples of its application to the physics of point defects in alkali halides. The review of the technique is rather complete and includes good descriptions of preparation techniques and electron damage. A short, easily readable, summary of contrast theory makes the report more self-contained. Finally, there is a report by R. E. Smallman and P. S. Dobson on the behaviour of metal lattice vacancies during oxidation. Dislocation loops, visualized by electron microscopy, are used as landmarks for the study of the migration of point defects and this provides an example of the use of the electron microscope in the study of point defects.

In our opinion, an important purpose of this type of book should be the fostering of cross-interaction between physicists and chemists. There are fields, such as catalysis, in which this interaction is likely to be very fruitful. Almost all the reports of this book amply fulfil this requirement. In particular, authors should be well aware of their prospective audience in the utilization of their language. To this reviewer, with a physicist's point of view, this is well accomplished in the chemically biased papers and it seems quite likely that the same is true in reverse. In conclusion, the book is recommended at graduate and professional levels to researchers in the field of condensed matter, and is strongly recommended to people interested in problems at the borderline between physics and chemistry of materials.

J. M. ROJO

Department of Physics
Universidad Antónoma de Madrid
Canto Blanco
Madrid
Spain

The theory of Brillouin zones and electronic states in crystals. Second, revised edition. By H. JONES. Pp. xii+285. Amsterdam: North Holland, 1975. Price U.S.$ 37.50, Dfl 90.00.

This book gives an account of what is essentially the basic mathematics of the solutions of the Schrödinger equation for a single electron in which the potential energy has the symmetry properties of a crystallographic space group.

Modifications to the text of the first edition include the welcome addition of short proofs of the basic theorems relating to irreducible representations as well as an instructive example of time-reversal symmetry, a simplified presentation of the theory of the double group and associated spin-orbit interaction, and a short introduction to the concept of the pseudo-potential.

The first edition of this book has been widely used in postgraduate courses on solid state physics for many years. The modifications to the text make the second, revised edition an even more suitable text book for postgraduates who are studying for the first time the theory of irreducible representations of space groups as applied to the calculation of energy bands.

D. J. MORGAN

University College
Cardiff
CF1 1XL
Wales