Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

Acta Cryst. (1983). A**39**, 187

Coherent inelastic neutron scattering in lattice dynamics. By B. DORNER. Pp. viii + 96. Berlin, Heidelberg, New York: Springer, 1982. Price DM 44.00, US $20.80

Bruno Dorner has spent the last decade as helper and collaborator to numberless experimenters wishing to measure phonon dispersion curves by neutron coherent inelastic scattering. This book condenses the wisdom learnt from these experiments with excellent detailed chapters on the analysis of phonon dispersion curves through lattice dynamics, the calculation of phonon intensities, and the analysis of phonon linewidths. The work is presented as a sandwich, with experiment and theory intermingled, each illustrated by sample experiments taken from the work of the author and his collaborators. One must say what the book does not attempt to be. The introduction is very brief and the reader must look elsewhere to find out what a phonon is, or how you go about measuring a phonon dispersion curve. I was disappointed that the chapter on triple-axis spectrometer techniques, which the author is so well qualified to write, consists of only 8 pages in which to cover history, monochromator performance, higher-order contamination, resolution, focusing and horizontal and vertical curved focusing monochromators. Never mind, the real meat of the book comes next with a masterly account of the measurement of phonon intensities in complicated structures. This represents a really welcome addition to the literature. For a native German Dorner's English is faultless, his Germanic origin only showing in his precise logical style. Within its self-imposed limitations this is an excellent book. I hope one day Dorner will give us a complete account of the history, development and use of this most successful field in solid-state physics.

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Acta Cryst. (1983). A**39**, 187

Neutron cross sections, Vol. 1. By S. F. MUGHABGHAB, M. DIVADEENAM and N. W. HOLDEN. Pp. x + 850 approx. New York: Academic Press, 1981. Price US $58.00.

The famous *Barn Book Resonance Parameters* report BNL-325 has now been re-issued in a fourth edition in a standard book format, published in two volumes covering atomic numbers $Z = 1$ to 60 and $Z = 61$ to 100. This definitive set of data for nuclear and reactor physicists describes in a parameterized form the many sharp peaks or resonances in the neutron cross sections. The method of parameterization derived from the Breit–Wigner theory of neutron resonances is clearly described in the initial chapters. The resonance parameters given here can then be used by computer codes to recalculate the neutron cross section or any derived function of it. The book also contains definitive values for the thermal cross sections which are also of great interest to condensed-matter scientists. The book is clearly a product of the latest technology with all the hundreds of tables faultlessly presented as only computers can. The second volume contains an innovation in a table of strong resonances from all the elements ordered in energy. This will clearly be of great importance to the new field of resonance radiography by helping scientists to identify unknown isotopes in their samples.

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Acta Cryst. (1983). A**39**, 187–188

Neutron scattering. (Vol. 15 of **Treatise on Materials Science and Technology**). Edited by G. KOSTORZ. Pp. xxv + 523. New York: Academic Press, 1979. Price US $66.50.

Neutron scattering has plenty of disadvantages as a technique in materials science. It is expensive, restricted to a few centres at reactor and accelerator institutes, and, for most users, somewhat bound in red tape. Experiments can rarely be done at the whim of the experimenter but only after lengthy form filling, deliberations of committees and negotiations of scheduling times. Why then is there in the words of the foreword 'current mounting excitement about neutron scattering studies' in materials science? This book explains why. It is the sheer breadth of the neutron techniques and frequently the uniqueness and directness of neutron results which make them worth all the trouble. I can never forget my own past, when after spending years measuring exchange interactions in a particular salt by spin resonance, I was able to get a much better result in weeks on a neutron spectrometer. It is the neutron's ability to penetrate centimetre-sized samples that has given neutron scattering a special place in applied materials science. Now neutron scattering, especially neutron small-angle scattering, is

gaining acceptance by metallurgists, for example because of its ability to reproduce in hours from a specimen cut with a hacksaw data more representative than that obtained after days on the electron microscope.

This large book of 523 pages is a collection of articles describing in detail the various fields of neutron scattering. Materials science has been equated with solid-state physics and the authors, almost without exception physicists, treat their subject with careful detail. The introductory chapter by Kostorz & Lovesey (67 pages) gives us an excellent introduction to the theory of neutron scattering, but I was disappointed that it made essentially no attempt to relate the neutron techniques to the other experimental techniques of materials science.

Other chapters are on *Crystallography* (60 pages) by Jane Brown, *Phonons and structural phase transitions* (53 pages) by Currat & Pynn, *Phonons and defects* (33 pages) by Nicklow, *Small-angle scattering* (59 pages) by Kostorz, *Diffuse elastic scattering* (43 pages) by Bauer, *Polymers* (39 pages) by Julia Higgins, *Hydrogen in metals* (34 pages) by Skold, Mueller & Brun, and on *Neutron devices* (45 pages) by Freund & Forsyth. All the authors must be congratulated on achieving a consistent style, notation and level. The book will remain for many years an invaluable compendium of the neutron techniques for materials scientists.

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Acta Cryst. (1983). A**39**, 188–189

Physics of intercalation compounds. Edited by L. PIETRONERO and E. TOSATTI. Pp. ix + 323. Berlin, Heidelberg: Springer-Verlag, 1981. Price DM 60, US $28.

Interest in the products of intercalation reactions, during which atomic or molecular species enter the interlamellar space of a layer structure, has grown dramatically over the last decade. The prime reason for this interest is that intercalation changes the electronic properties of the matrix layers because of charge transfer between the intercalant and matrix. The intercalant may also exhibit properties not present in the bulk because of geometrical constraints imposed by the matrix. Thus the materials scientist can create synthetic metals from non-metals and synthetic superconductors from non-superconductors. However, there has been a growing awareness that the understanding of intercalation phenomena poses a challenge on a broader scientific front. For example, chemists have found that the products of these reactions are frequently compounds of well characterized composition and properties. They are interested in extending the range of known compounds, in understanding the reaction mechanisms that lead to their formation and in describing chemically the reaction products. Solid-state physicists are interested in extending the range of properties explored and in understanding and ultimately predicting such properties.

These objectives are not mutually independent and, because progress in this field demands collaboration between scientists of differing backgrounds, there has been a growth of interdisciplinary international conferences to present and discuss the latest work. There were two such conferences in 1980: one on Intercalation Compounds of Graphite in the United States and a more general conference on Physics and Chemistry of Layered Materials in Japan. The proceedings of both these conferences have been published recently, and the present volume continues this policy by presenting, as No. 38 of the *Springer Series in Solid State Physics*, the papers given at the International Conference on the Physics of Intercalation Compounds held in Trieste, Italy, in July 1981.

Unlike the two earlier publications, which are typeset, this publication uses camera-ready copy. This has allowed reference to be made to the two earlier conferences and so a significant number of references are to papers written in the eighties. Thus the editors succeed in their declared aim of providing a place where the most recent publications and up-to-date references can be found. However, although there is an index of the 87 authors and a contents list which gives the titles of 43 papers, there is no subject index. The papers, which are contributed by 39 research centres in ten countries, are grouped under six headings: (1) *Structure and general properties* (9 papers); (2) *Electronic properties* (12 papers); (3) *Stability and phonons* (6 papers); (4) *Ordering and phase transitions* (8 papers); (5) *Magnetic resonance* (3 papers); (6) *Transport, conductivity and superconductivity* (5 papers). It is a great pity that author-selected keywords were not used to provide a basic subject index for there is no simple way of discovering, for example, what materials have been studied. Moreover, the above grouping is not without its inconsistencies because some papers treat their chosen subject rather broadly.

Some 70% of the papers are experimentally based and two-thirds of these include experiments on the compounds formed when graphite is intercalated with the alkali metals Li, K, Rb and Cs. These compounds are attractive to the physicist, not only because they exhibit many interesting structural features which influence physical properties, but also because they give reproducible properties even when prepared in different parts of the world – an essential prerequisite for serious studies of physical properties.

These reactions all exhibit the phenomena of staging, where intercalated layers of constant composition are separated by n graphite layers in stage n. For the heavier alkali metals, M = K, Rb and Cs, the composition is $C_{12n}M$ for $n > 1$ so that staging can generate a large number of different compounds for study. The intercalate layer density in such compounds is lower than in stage 1 where the composition C_8M allows the intercalate to form a superlattice over the graphite surface. At these lower densities, the intercalate layer is disordered but undergoes an ordering transition, not only at low temperatures but also at moderately high pressures (~10 kbar/1 GPa). This recently discovered pressure transition, which changes the layer composition in $C_{24}K$ from $C_{12}K$ to C_8K with a corresponding change of stage number from 2 to 3 in order to preserve the overall composition, is discussed here.