Acta Cryst. (1983). A**39**, 501

Pulsed neutron scattering. By COLIN WINDSOR. Pp. vii + 432. London: Taylor and Francis, 1981. Price £25·00.

This valuable book is directed primarily toward solid- and liquid-state physicists, chemists, metallurgists, and perhaps a few biologists. With the operation of several modest-flux pulsed neutron sources around the world, which are paving the way for newer, more powerful 'state of the art' pulsed sources, this book will undoubtedly be well received and welcomed by all neutron scatterers (including steady staters). It should do for pulsed sources in the 1980's what *Neutron scattering* by G. E. Bacon did for reactor sources in the 1950's.

The book is quite complete and self-contained. The inside jacket cover states that the volume is meant to be used as a handbook, as it certainly will be. Other important reference books are cited in the introduction and there are 230 references at the end, which indicate the book has been well researched. Examples have been taken from the major pulsed-source projects around the world, including the Russian IBR2 pulsed reactor. The author emphasizes the advantages of the pulsed sources with their 'hot' neutrons, the epithermals, that are painfully missed when doing reactor experiments at energies of 0·1–0·5 eV. The advantages in the thermal and subthermal regions are not so obvious.

The first of ten chapters is entitled *Beyond thermal neutrons* and gives a brief review to the uninitiated of some of the active areas of research utilizing thermal, subthermal, and epithermal neutrons (as determined in the past mostly by steady-state sources); however, the section on crystallography is a little weak. Fig. 1.13 is incorrect in that the Brillouin zones and reciprocal lattices of the b.c.c. and f.c.c. lattices are interchanged with the real-space lattices. Also, the author's definition of a primitive lattice is misleading, if not incorrect. The equation for the spin wave dispersion of an antiferromagnet does not result in a gap at $q = 0$, but Fig. 1.52(*b*), to which it refers, shows a gap.

Chapters 2 and 3 delve into the theory and practical operation of pulsed sources in substantial detail. Chapter 3, in particular, should be very useful to the experimenter at a pulsed source. It appears to this reviewer that, in contrast to a reactor source, a knowledge of the operating characteristics of a pulsed source is of utmost value to an experimenter in order to exploit the unique features of time-of-flight instrumentation. The following chapter, which compares pulsed and steady-state sources is, perhaps, slanted more than it should be to the pulsed sources. Although it is very clear that the latter source is superior in the epithermal regions, it is not clear that the 'crossover' energy will be as low as 12 meV even for a source like IPNS-II (which, in fact, will not be built). Also, at the higher energies the problem of crystal reflectivity will be a severe one for the crystal spectrometers.

Chapter 5 is concerned with radiation hazards, shielding, and detectors. The section on radiation hazards is somewhat superficial, but the rest of the chapter on shielding and detectors is more to the point and well stated. Although shielding requirements may be somewhat different at a pulsed source compared with a reactor, it is very desirable that the shielding be sufficient to allow personnel in the instrument room when the accelerator is running.

Elastic scattering experiments are very well described in chapters 6 and 7 in which the unique properties of time-of-flight detection are discussed for single crystals, powders, liquids and glasses, and small-angle scattering. The nontrivial recoil corrections for liquids and amorphous materials are discussed in some detail. The emphasis on sample geometry for absorption corrections is belabored somewhat since computer programs treating absorption corrections for arbitrary shape have been around for two decades.

The real power of pulsed neutron sources with their great abundance of epithermal neutrons is aptly illustrated in chapters 8 and 9, where inelastic spectrometers of direct geometry and inverted geometry, respectively, are discussed. There are many clever methods described and, as discovered with conventional steady-state sources, time will tell which instruments will be the most useful and which will pass into oblivion. Some of the instruments have already proven themselves at pulsed sources now operational in various countries. The section on high-symmetry scans and constant-Q scans will prove valuable for lattice dynamics studies.

The last chapter of the book *Making the most of a pulsed source* is a very interesting one. It discusses, in particular, pulsed polarized neutron studies, as well as pulsed environments and time-dependent scattering studies. There are two appendices, one on neutron cross sections and the other on key symbols, useful constants, and conversion factors. Since the book is intended as a handbook, it is unfortunate that the two cross-section tables are somewhat limited. It would have been appropriate and useful to have included the available data on ^{3}He, ^{6}Li, ^{7}Li, ^{10}B,^{11}B, ^{17}O, ^{18}O, ^{36}Ar, ^{99}Tc, ^{113}Cd, the various rare-earth isotopes, and the actinides, for example. The table on useful constants and conversion factors lists numbers to six significant figures, but, unfortunately, the value for Avogadro's number and the conversion factor from Joules to meV differ in their fourth and fifth significant figure, respectively, from values given elsewhere in the text.

Much thought has obviously gone into this volume, but a few thoughts could have been omitted. For example, the suggestion that Fe could be a cheaper alternative to Be as a filter would be better left out; its absorption at 4 meV makes it prohibitive. The discussion of the risks of driving or drinking wine in the context of radiation risks is, perhaps, inappropriate.

Accelerators may be cheaper to build than reactors but their operating costs and instrumentation are not. If there is to be a demise of steady-state reactor sources, it will be more for political reasons than for economic or scientific reasons.

About 20 errors or misprints were found, but most were minor and these should be corrected in the next printing.

Overall this is an excellent book and is highly recommended. To undertake such a task takes a lot of courage and to finish it takes a lot of competence; obviously, the author has both. The quality of the paper, type, and binding is impressive and with a price of £25 on the cover jacket, the book is a bargain.

HAROLD G. SMITH

Solid State Division
Oak Ridge National Laboratory
Oak Ridge
Tennessee 37830
USA