Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (M.M. Woolfson, Physics Department, University of York, Heslington. York, England). As far as practicable books will be reviewed in a country different from that of publication.

Proceedings of the Symposium on Low Energy Electron Diffraction, Ramada Inn, Tucson, Arizona, February 1968. *Transactions of the American Crystallographic Association,* Vol. 4. 1968. Pp. v+114. Price $ 5.00 postpaid from Polycrystal Book Service, P.O. Box 11567, Pittsburgh, Penn. 15238, U.S.A.

Low energy electron diffraction (LEED) has been the subject of a rapid growth of interest over the last three years because of its usefulness in the study of interfacial chemistry, semiconductor surfaces and epitaxic growth. These *Proceedings* are a useful set of papers and discussions which highlight the important issues of the moment in this field. They include a particularly valuable review of the methods of interpretation of LEED patterns written by Professor R. M. Stern, who presents evidence that a three-dimensional, two beam dynamical theory of electron scattering can be expected to be a good description of the elastic processes occurring. Other important papers are by Morgan & Somorjai and by Palmberg who present evidence for structural rearrangements at the clean surfaces of platinum and gold respectively. Such structural rearrangements were previously thought to occur only in the covalent bonded materials such as silicon and germanium.

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Theory of elastic waves in crystals. By FEDOR J. FEDOROV. Translated from the Russian by J.E.S. BRADLEY. Pp. 375 + 19 Figs. New York: Plenum Press, 1968. Price $ 25.

The modern developments involving ultrasonic generators and detectors, piezoelectric resonators and phonon interaction with X-rays and other types of radiation all require an understanding of the transmission of elastic waves through solid bodies and especially through crystals. Many standard works on the physical properties of crystals have one or more chapters devoted to the study of the propagation of plane elastic waves through crystals of various symmetries. However, the book under review is remarkable in that it is entirely devoted to this subject. It is based on a series of lectures given to graduate students in Moscow University but it would be misleading to imply that it is a book which students will find easy to read. It has the character of a monograph rather than that of a student text. In a foreword, H. B. Huntington says 'the author has gone to considerable pains to develop in his mathematical background a consistent tensor framework which acts as a unifying motif throughout the various aspects of the subject'. The author also explains in the Preface to the Russian edition that his method is based on general methods of vector and tensor calculus which do not necessitate explicit statement of the tensor components. This generalized tensor analysis makes the reading unfamiliar and, until the language is learned, rather difficult, but it gives a unity to the whole presentation.

There are nine chapters, the first three of which cover the relatively familiar ground leading to Christoffel's equation and its applications. Chapter 4 gives an account of the flow of energy and the form of wave surfaces. In the next three chapters the theory is applied, first to an isotropic medium, and then to hexagonal, cubic, tetragonal and trigonal crystals. Chapter 8 is concerned with the reflexion and refraction of elastic waves from plane boundaries and covers ground not usually to be found in the standard works. The last chapter deals with the calculation of Debye temperatures taking into account the elastic properties of cubic and hexagonal crystals.

The translation appears to be excellent and the production is good except that the suffixes are often rather too small to be seen easily.

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Anharmonic crystals. By R.A. COWLEY. Pp. 44. *Reports on Progress in Physics*, Vol. XXXI. Part 1, p. 123, 1968. Price (single article, paper cover) £1.1*s* or 14*s* 0*d* to members of the I.P.P.S.

Much progress has been made in recent years in the theory of anharmonicity in crystals. The methods developed involve advanced techniques such as the use of thermodynamic Green's Functions, the algebra is complicated, and the relation between the results obtained and experimental observation is often far from clear. Dr Cowley's review of the present state of the art is therefore especially welcome.

The theories of thermal expansion, elastic and dielectric properties, Raman and neutron scattering, and specific heat are discussed in terms of an expansion of the interatomic potential in which only the lowest order terms are retained. The role of anharmonicity in the non-equilibrium thermodynamic properties such as thermal conductivity and second sound is certainly less well understood. Where anharmonic effects are large, the usual perturbation scheme breaks down, and new approaches, not based on expansions of harmonic basis states, have been developed; Dr Cowley