War I there was no opportunity to continue research work. Instead WHB was contributing efficiently to the fight against submarines; he invented new acoustic hydrophone detectors and laid the foundations of the ASDIC ('Anti-Submarine Division-ics') techniques, initiated by Langevin in France.

When peacetime returned, WHB was named President of the Royal Institution and brought it back from the decline in which he found it to its present fame: 'RI has produced more fundamental breakthroughs per square foot than any other establishment in the world'.* Eight Nobel laureates have been professors there. With the years, the crystallographer WHB became a 'national figure representing science'. President of the Royal Society from 1935, he had firm views on all aspects of science and education and when World War II came he expressed his views in strong words: 'the authoritarian state tends to decision without enquiry; the democracy tends to enquiry without decision' and Winston Churchill accepted his idea of the SAC (Science Advisory Committee to the government during wartime).

The book fairly reflects the quasi-religious sense of responsibility of WHB proven throughout his whole life. 'He is a great man of science and he is also a very great man.'†

The only criticism addressed by this reviewer to the lucidly written and well documented book on WHB, which G. M. Caroe dedicated to the memory of her brother WLB, is that while the reader is quite happy to see pictures of WHB, of his wife and also of WLB, there are no pictures of the author's other brother, Robert Charles, killed during World War I at Gallipoli (1915) . . . or herself. But this might be the reaction of a French temperament.

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* Sir George Porter, present director.

† Rutherford in a discussion with the anatomist Arthur Keith about who should become President of the Royal Institution.

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An introduction to microscopy by means of light, electrons, X-rays or ultrasound. By T. H. ROCHOW and E. G. ROCHOW. Pp. xvi + 367. New York: Plenum Press, 1978. Price £18·58.

This book offers an introductory account of the various techniques of microscopy of materials. It is completely qualitative in approach and is clearly illustrated with ray diagrams, block diagrams and photographic examples of each of the techniques discussed.

The opening chapters define the various types of microscopy and their characteristics, dealing in turn with the various types of optical microscopy, *e.g.* using transmitted and reflected light, including polarized light. Brief descriptions are given of photomicrography, as well as phase contrast and interferometric techniques.

Later chapters discuss transmission and scanning electron microscopy, again in a wholly descriptive manner, and the book concludes with an outline of field-emission, X-ray and acoustic microscopy.

The book will certainly give a layman an insight into the wide range of microscopical techniques available, although it may be argued that it is of little value to the more serious student. The latter category of reader would require a more critical and up-to-date reference list for further reading than that provided by the authors; this is particularly true for topics such as electron microscopy and field-ion microscopy, where guidance to modern quantitative discussion of the application of these techniques is of paramount importance.

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Introduction to solid state theory. By O. MADELUNG, translated from the German by B. C. TAYLOR. **Springer series in solid state sciences. Vol. 2.** Pp. xi + 486. Berlin, Heidelberg, New York: Springer, 1978. Price: DM 59·00, *ca* US $29.50.

Solid-state science is an enormously broad field, which seems to be growing continuously both in width and depth. Despite the fairly large number of books published in recent years, not least about its theoretical side, there is definitely room for more presentations of the subject, particularly if the perspective is a little unusual.

That is one characteristic of this book by Madelung, which is a revised and partly rewritten translation of three pocket books published in 1972 and 1973 in German. Its strength is the concentration on essential concepts and their relationships. Since, on the other hand, the author's intention was not to write an encyclopedia, a number of topics ordinarily found in other solid-state books had to be left out.

The basic chapters on the one-electron approximation and on elementary excitations fill more than a third of the book. The concept of the quasi-particle is central to the development. In the next four chapters interactions between various kinds of quasi-particles are discussed with reference to those properties of solids which they 'explain': electron–phonon interaction and electrical conductivity, electron–electron interaction and superconductivity, electron–phonon and phonon–phonon interactions and optical properties, and, finally, phonon–phonon interaction and thermal properties.

Part of a chapter is devoted to a field which, strangely enough, receives very little attention in most text-books on solid-state physics, namely, chemical bonding and cohesion in solids. Here there is definitely more than the mere classification into ionic, covalent, metallic and molecular solids. In particular, the discussion on the conceptual difficulties one encounters in this connection is very welcome. On the other hand, it is a bit disappointing to see that the author seems to be completely unaware of the considerable amount of work done in the last twenty years on the theory of chemical bonding in molecules, both quantitatively and qualitatively. Solid-state and molecular physicists definitely have a lot to learn from each other.

The last two chapters deal with localized states associated with point defects and surfaces, and disordered materials.

A number of the many topics left out of the presentation are mentioned and the reader is referred to a fairly complete bibliography. Ten pages of problems are provided, without answers. For some of the more advanced problems references to books or journal articles are given.

Madelung's stimulating introduction to solid-state theory is definitely recommended both to newcomers in the field and to those who perhaps are well acquainted with parts of the field but who would like to know more about other sides and to connect that with what they know already.

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Solid Surface Physics. Springer Tracts in Modern Physics. Vol. 85. Edited by G. HÖHLER, with contributions by J. HÖLZL, F. K. SCHULTE and H. WAGNER. Pp. vii + 221. Berlin, Heidelberg, New York: Springer, 1979. Price DM 68·00, *ca* US $37.40.

Volume 85 of this series on solid-state physics consists of two substantial surveys. The first (by J. Hölzl and F. K. Schulte) is devoted to the modern state of studies of the electron work function (WF) of metals, which is an important parameter of the electron structure of metallic surfaces. In the second (by H. Wagner) a number of physical and chemical properties of the real surface are described on the basis of the stepped-surface model.

Review 1. Rapid progress, both theoretical and experimental, has taken place in WF studies during the past thirty years as a consequence of new experimental surface methods, ultra-high vacuum techniques and industrial interest (especially in catalysis and electronics).

This survey differs from previous ones in the breadth of its contents and by its concentration of interest on the most recent advances. The theoretical problems are considered in chapter 2, after a brief introduction (chapter 1). The density function formalism, in which electrons are viewed as an interacting gas in the field caused by the ion cores, is used for calculations of the WF. Also the self-consistent wave-mechanical model and some other methods of WF calculations are described.

WF values are tabulated and compared with some new experimental data. The agreement is close in most cases, though sometimes serious deviations occur (Li, Au). The changes of the WF that are caused by adsorbates on the surface of pure metals and alloys are discussed in detail, but the problems of polycrystalline metal surfaces and of the thermodynamics of electron emission are not considered.

The third chapter is devoted to experimental procedures. Methods of WF measurement are divided into two groups: absolute methods (thermionic emission, photoemission, field emission) and relative ones (diode methods, condenser methods). The peculiarities of the various types of measurement are discussed very carefully.

Experimental results of WF measurements from pure metals with clean surfaces, together with a brief summary of various theoretical models, are given in chapter 4, and an analytical comparison is carried out. Moreover, variations of the WF with temperature, and the mechanical stress dependence of the WF are considered, and data connected with phase transitions are discussed. WF values are tabulated for nearly all metals.

The fifth chapter is devoted to the WF variations caused by adsorption on clean metals. WF data are used to determine parameters of the adsorbates. Results are given for a large number of adsorbate systems.

WF measurements in binary alloys are described in chapter 6. Some useful recommendations on preparative procedures are given. WF data as a function of certain alloy parameters are discussed and, as an example, WF measurements are used to obtain a thin alloy film diffusion coefficient and its temperature dependence.

On the whole, this fundamental work, containing more than 500 references, will be useful for specialists in the physics and chemistry of solids, thin films and adjacent fields.

Review 2. This review is devoted to studies of periodic stepped surfaces. The crystallographic description of regular steps and experimental facts confirming the reality of steps are given in chapters 1 and 2. Electron microscopy and, especially, low-energy electron diffraction techniques are discussed as the most effective methods for the study of stepped surfaces.

Properties of the clean stepped surface are presented in chapter 3. The thermal stability of steps and the transitions between stepped and 'hill and valley' structures are considered on the basis of the model of temperature-dependent small free-energy differences of both states. Also in this chapter, theoretical calculations and measurements of the WF are given for stepped surfaces. The WF and surface state density are shown to depend upon the step character, and for semiconductors new steps occur in some cases.

The interaction of stepped surfaces with foreign atoms or molecules is discussed in the fourth chapter. The main attention is paid to adsorption kinetics and reaction processes, owing to their technological importance in heterogeneous catalysis, epitaxy, and corrosion. The concept of 'active sites' in heterogeneous catalysis is considered to set up the connection between catalytic properties and special surface states. The steps and the kinks are high coordination places, and they can be especially active during 'structure active' reactions. Though most of the experimental facts are only qualitatively interpreted the differences in physical properties and kinetic processes related to a given low index plane and the corresponding stepped surface are distinctly shown.

To understand the physical reasons responsible for the many phenomena associated with steps, it is necessary to have additional experimental facts and more systematic