A. Prince, 1956, Inst. Met., Monogr. No. 2, pp 230–324) was published in 1956, no bibliography of references since 1955 on multicomponent alloy constitution has been available. The present work includes over 18 000 references from 1956 to December 1973 and also all the 1955 references not included in the previous compilation. References are given for alloy systems, systems containing metalloids, sulphide systems and oxide systems where equilibrium with a metal is dealt with. References to crystal structure determinations, the inorganic synthesis of ternary compounds and property–composition relations that provide constitutional data have been included in addition to those on phase equilibria. Binary alloy systems are not included since these are fully referenced in *The Constitution of Binary Alloys* (M. Hansen & P. Anderko, 1958, McGraw-Hill. First Suppl., R. P. Elliott 1965; Second Suppl., F. A. Shunk 1969), nor are references to equilibria between oxides since these are surveyed in *Phase Diagrams for Ceramicists* (E. M. Levin, C. R. Robbins & H. F. McMurdie, 1964, The American Ceramic Society. First Suppl. 1969; Second Suppl. 1975).

References to ternary systems occupy 88% of the total, quaternary systems 10% and quinary, senary, septenary and octonary systems the remaining 2%. Within each system the references are grouped in the alphabetical order of the chemical symbols for the components – a simple arrangement which obviates the need for an index to the systems included in the bibliography.

In compiling the bibliography the author has used two abstract journals – Chemical Abstracts published by the American Chemical Society and Metallurgical Abstracts, published initially by the Institution of Metallurgists and latterly as Metals Abstracts published jointly by the Metals Society and the American Society for Metals.

This bibliography is without doubt a standard work of reference which will form a necessary part of any scientific or technological library. It not only reflects on the great industry of its author but also his judgement in the selection of the references – a judgement which has been acquired as a result of his extensive knowledge and interest in the field of heterogeneous phase equilibria.

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Heteroepitaxial semiconductors for electronic devices.

Edited by *G. W. Cullen* and *C. C. Wang* (with contributions by V. S. Ban, S. Berkman, J. Blanc, G. W. Cullen, M. T. Duffy, N. Goldsmith, W. E. Ham, C. C. Wang and P. J. Zanzucchi). Pp. VIII + 299. Berlin-Heidelberg-New York: Springer, 1978. Price DM 158.00, US $ 79.00.

The intention of the authors of this book is to describe in some detail the preparation and characterization of heteroepitaxic thin films, mainly of silicon, but also of III–V and II–VI semiconductor compounds on sapphire and spinel substrates. A further intention is to demonstrate the intimate correlation between the particular properties of these epitaxic films and the technologies applicable to them in order to develop successfully electronic and optical devices. The most important film materials and their applications are Si for integrated MOS devices, GaP for LED's, GaAs for photocathodes, ZnO for electrooptic thin-film modulators, and AlN for surface acoustic wave (SAW) devices. In addition, this book contains broad information on epitaxic layers of other materials on sapphire and spinel.

After a brief introduction, Cullen gives a very comprehensive chapter of 100 pages on Si layers. The growth and surface preparation of the substrates and their reactions with epitaxic gases are discussed in detail.

In chapter 3, Wang presents the compound semiconductor layers. Numerous binary and even ternary III–V compounds are considered and the particular advantage of organometallic materials is pointed out.

In chapter 4, special films for SAW and electrooptical devices are discussed.

Chapter 5 treats the methods for characterizing film thickness, evenness, crystallinity, impurity content and properties of passivation layers.

A detailed chapter (6) of 50 pages is that by Ham on the electrical characterization of the films.

Gas flow dynamics are treated in chapter 7, and the last chapter is a study on misfit, strain and dislocations which, in addition to SOS, also discusses Si/Si and Si/Ge epitaxy.

The authors show up limiting factors in this field of technology, but they also point to chances of further developments. The title does not reveal that this book is really a detailed standard work on silicon-on-sapphire and related epitaxic material problems. It will be helpful for those working in this field or planning to do so, and for those looking for the properties of silicon or other semiconductors on transparent isolating substrates for new device applications or for their possible introduction into their production lines.

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Developments in electron microscopy and analysis 1977.

Edited by *D. L. Misell*. Proceedings of the Institute of Physics Electron Microscopy and Analysis Group Conference held in Glasgow, 12–14 September 1977 (EMAG 77). Conference Series No. 36. pp. xiii + 441. Bristol and London: The Institute of Physics, 1977. Price £11.00, $21.00.

An interesting question which arises prior to attending a Conference or reading the Proceedings of an Electron Microscopy Conference is how much time will be spent on instrument development – the search for the ultimate, how much time will be spent justifying relatively new techniques such as STEM and FIM and how much time will be devoted to the user, be he industrial or academic, who uses electron microscopy as a tool. Unfortunately EMAG 77 spent far too much time on the first two rather than the last mentioned. I say 'unfortunately' since it is, at the end of the day, the user who sustains the former interests and doesn't let the instrument die a natural death through non-use. Although the ideal in accelerating voltage or electron-beam source is of interest, most users or potential users are interested in an instrument which is adequate for the job without being phenomenally expensive. Cosslett states the same in his initial assessment of the state of the art by pointing out that the lagging of the acceptance of STEM in metallurgy and mineralogy is because of a lack of 'hard' results of which there is a vast quantity from traditional instruments.

The dynamic recording of events is useful since these often occur far too rapidly for complete visual detection and, consequently, appreciation. The eye very often misses the essential features. The

computer simulation of problems to facilitate a solution is a feasible approach since it can aid the visual interpretation. It is, however, a questionable feature to remove operator interaction with the instrument since one operator's likes are another's dislikes and mathematical solutions do not always produce happy operators. In the chapter built around these ideals, features such as automatic focusing and correction of astigmatism and on-line image processing are dealt with. Automated features of SEM operation such as image analysis coupled with microanalysis and SEM operation are left to a chapter on *Analytical Techniques* for a reason best left to the wisdom of the organizers.

Electron energy loss is dealt with in various chapters and a trait is appearing which should disturb many metallurgical users who have awaited the breakthrough to obtaining useful analytical information from usable specimen thickness. Attention is gradually being focused more on the biological and polymeric materials as more negative results on other materials are obtained as, for instance, detection of non-random phases failing due to inherent instrument limitations. The useful application is still apparently limited by poor signal to noise ratio and the need to use extra thin specimens with its associated inherent probability of possible atomic rearrangements within the material.

In the two chapters called *High-Resolution Materials Studies* and *Application to Materials* there are papers presented from which a feeling of a necessity to justify STEM is left. Unfortunately, in this respect, Brown's initial paper sets the pattern, *Progress and Prospects for STEM in Materials Science*. Since people with separate instruments have turned their attentions to application and development of techniques, the specialized functions on these instruments can be kept at a high level of development. This is not to say that useful techniques are not outlined in the chapters which also deal with, for instance, FIM studies. Useful work is reported on the use of tilted beams to enhance contrasts at grain boundaries as well as the study of vanadium carbide precipitation in iron alloys. Ceramics studies have long been the prerogative of SEM using both cathodoluminescence and micro-analysis; however, the application of TEM and STEM to study these materials has long been overdue. Now that the problems associated with specimen preparation have been overcome, useful results are emerging.

Steeds and the group at Bristol pursue with dedication electron/X-ray crystallography, producing five papers around the subject in the chapter on *Crystallography in the Scanning and Transmission Electron Microscopes*. Booker and Stickler presented a paper which will be welcomed by the users of SACP's on an optimum experimental procedure for producing them. This will surely lead to an increase in their use to obtain valuable crystallographic information.

The local analysis of material features has been a constant source of development. Computer control of microanalytical equipment and on-line analysis expedites rapid results and an adequate supply of them to give acceptable statistics. The Swedish PASEM group and Bishop's group at Harwell deal with these problems. However, for the user, the most important paper is embodied in a continuation of the TI tradition initiated by Duncomb in concentrating on the requirements of industry triggered by their own industrial needs. In the work presented they outline instrument developments carried out to facilitate easy, accurate, routine light-element analysis, which, to date, has evaded the user of the conventional SEM with a wavelength-dispersive spectrometer. The paper also presents a wealth of practical examples to prove the point.

Having accepted that polymeric material is easily damaged by the electron beam, attention has been focused in *Specimen–Beam Interactions and Radiation Damage* on getting the information prior to damage or using coating techniques to slow down the process of electron-beam damage. Consequently, interesting results are now being presented concerning the structure of these materials. The nature of the breakdown of the materials is also being used to reveal information on the structure of polymeric materials and their inherent internal stresses. The last paper in this chapter on the reaction between carbon extraction replicas and intermetallic precipitates raises an interesting question on the validity of precipitate analysis in unclean atmospheres where carbon deposition occurs.

As a matter of statistics it is of interest to note that of the one hundred papers presented, nearly 25% were produced in Cambridge and a few less in Oxford whilst foreign contributions were few and far between. This is unfortunate since the presented material is not truly representative of the universal state of the art. Conference proceedings are always worth a look through since most EM users and micro-analysts can find something of interest, if it's only a reiteration of accepted facts.

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Industrial crystallisation: the present state of the art. By *J. Nývlt*. Pp. 182. Verlag Chemie, Weinmeim, New York, 1978. Price DM 46.00.

The book comprises the following chapters: *Introduction* (2pp.), *Theory and Practice of Industrial Crystallisation* (4pp.), *Selecting a Suitable Type of Crystalliser* (30pp.), *Decision Upon the Mode of Crystallisation* (26pp.), *Types of Crystallisers* (12pp.), *Crystalliser Size and Performance* (70pp.), *Further Factors* (6pp.), *Symbols* (5pp.). References (altogether 273, on 182 pages).

The most important section, according to the number of pages, is *Crystalliser Size and Performance*. Here, kinetics are well to the fore of the discussion. Also, methods for the measurement of supersaturation are presented in detail, and a paragraph on the modelling of crystallisation is included. The author of the book is an internationally appreciated expert in the field of crystallisation and he is the present secretary of the 'Working Party on Crystallisation' of the European Federation of Chemical Engineering. This paperback is written in an imaginative style and it will gain many friends by its clear representation. It is very well suited to the layman because of its simple treatment and instructive figures. The specialist would sometimes wish for a greater precision [for example, on p. 15, for $\gamma = 2{\cdot}25$ the coefficient of variation (c.V.) should not be 50%, but 47% – for, when the c.V. equals 50%, one obtains $\gamma = 2{\cdot}1$]; or he would have objections to some of the methods used (for example, the determination of the nucleation parameters from the width of the metastable zone, on pp. 83–84).

However, this book will be received with pleasure because its abundance of ideas provides considerable stimulation. It can be recommended to all persons who are either active or consulting in the sphere of crystallisation.

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