

## 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 YO1 5DD, England). As far as practicable books will be reviewed in a country different from that of publication.*

**Multiple-beam interference microscopy of metals.** By S. TOLANSKY. Pp. ix + 147. London: Academic Press, 1970. Price £2.25.

The author states in the preface that 'multiple beam interferometry is both an elegant optical technique and at the same time a valuable technological tool'. Furthermore, he says that its elegance is to be found in its very real economy of means. He then sets out to verify these premises with a detectable enthusiasm.

The book consists of 13 chapters but may be divided into three areas of concern: theory, chapters 1 and 2; technique, chapters 3 to 8; and applications, chapters 9 to 13. The theory is straightforward and adequately covered for the incident illumination case.

The section on technique is, in my opinion, the high point of the book. The author emphasizes that the book contains the 'know-how' resulting from years of study; this is ably demonstrated in these chapters. The heart of the multiple-beam interferometer is an optical flat on which a thin reflecting film has been deposited. The preparation and properties of several types of thin films are described in detail in chapter 3. In this chapter, the use of  $H_2O_2$  (20 vols) is recommended for cleaning the optical flat prior to coating with the thin film. A statement should have been included for the benefit of the technician with regard to the hazards involved in the use of this compound.

Materials suitable for use as the optical flat are discussed in chapter 5. The recommendation of selected pieces of window or picture frame glass as an optical flat for this purpose makes good the claim for 'economy of means'.

The various topographical features observed with this technique have been conveniently categorized in chapter 6. Appropriate mathematical expressions are given for each feature to permit measurement of the pertinent dimension.

I would like to mention at this point the material included in the Appendix. This discussion of a very useful technique suffers in my opinion from the absence of drawings to illustrate the somewhat more sophisticated instrumentation employed. Furthermore, it is most unfortunate that this information was not included in chapter 6 with other

methods for determining whether a feature on a sample is a depression or elevation.

Figure 8. 5 should be rotated 90° to bring it into agreement with the text.

The application of this technique to the study of metallurgical samples occupies the remainder of the book. These examples not only serve to demonstrate the extreme sensitivity of the measurement, but also hint at the range of problems amenable to the method. Even to the casual reader, these chapters provide interesting reading.

The few negative comments should not dissuade those interested in the fine surface structure of metallic surfaces from acquiring this book. It is safe to say that a seasoned experimentalist using this text can soon acquire a marked proficiency with this technique.

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**Electroluminescence, Vol. 50.** Edited by D. V. SKOBEL'TSYN. Pp. vi + 137. New York: Consultants Bureau, 1972. Price \$17.00.

This volume, which constitutes volume 50 of the Proceedings (Trudy) of the Lebedev Physics Institute, is mainly a collection of review papers on electroluminescence of the high field, high impedance type (the Destriau effect). If one is looking for an up-to-date coverage of the subject as far as Russian research is concerned then this text may provide it. However, it offers neither information on nor references to other, more world-wide developments since the middle nineteen sixties. It is surprising how much introductory matter occurs in each chapter. In Chapter I on the kinetics of the Destriau effect there is a general discussion of band theory applied to photo-conducting phosphors which might have been omitted, save perhaps by provision of suitable references. Chapter II will attract some attention from the West since *PN* junction emission in zinc sulphide is a uni-

versal 'pipe dream' for would-be designers of ultimate efficiency light sources. After reading the chapter the dream will remain. The next chapter, concerned with electroluminescence in single-crystal zinc sulphide has two interesting features. One is a picture of a sizeable zinc sulphide crystal, claimed to be 'natural size' cleaved as a 3 or 4 cm sided prism from a larger crystal grown in the Institute for Single Crystals. The other is a report of ultra violet electroluminescence from zinc sulphide attributed to band-to-band recombinations with polaron states involved. The next chapter on temperature dependence of electroluminescence can be bettered by much earlier work of western scientists. There is finally a large chapter on conversion of electrical energy into light which contains little of an original nature.

The obvious defect of the text is the exclusion of up-to-date references to authors outside the USSR and the consequent lack of perspective in the various treatments. The book provides a rather expensive way of learning about electroluminescence research as pursued in the USSR in what is apparently an isolation from world scientific journals and other workers in the field.

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**Industrial crystallisation from solutions.** Von JAROSLAV NYVLT. S. 189. London: Butterworths, 1971. Preis £5.50.

Das Buch soll, wie in seinem Vorwort zum Ausdruck kommt, den Leser mit den Problemen der Kristallisation aus industrieller Sicht vertraut machen, wobei in erster Linie auf die Vermittlung von in der Praxis anwendbaren Informationen Wert gelegt wird und die rein theoretischen Grundlagen unter Hinweis auf das einschlägige Spezialschrifttum soweit als vertretbar zurückgestellt werden. Durch sinnvolle Auswahl und gut verständliche textliche Gestaltung des dargebotenen Stoffs, der durch eine grosse Zahl den Inhalt der einzelnen Abschnitte vertiefenden Rechenbeispiele ergänzt ist, wird diese Absicht erfolg-

reich und in sehr ansprechender Weise verwirklicht.

Inhaltlich gliedert sich das Buch in zwei Teile. Der erste bringt die wesentlichen theoretischen Grundlagen der Kristallisation unter Berücksichtigung von Phasen-, Stoff- und thermischen Gleichgewichten, der Kristallisationskinetik und ferner der Eigenschaften der Kristallisationsprodukte. Der zweite Teil ist der Berechnung von Kristallisationsanlagen gewidmet. Dabei interessieren hier die konstruktiven Details einzelner Apparaturen weniger als allgemeine methodische Grundsätze der Klassifizierung von Kristallisatoren insbesondere vom Standpunkt der Bewegung und Übersättigung des Lösungsmittels, des Durchsatzes und der Kristallbeschaffenheit aus. Die wichtigsten Kristallisator-typen werden unter diesen Aspekten näher betrachtet. Ein Anhang mit Kristallisationsdaten für eine Reihe herkömmlicher Verbindungen, einer Löslichkeitstabelle und einem Symbolverzeichnis ergänzt schliesslich die beiden Hauptteile. Hervorgehoben zu werden verdienen ausserdem die umfangreichen Literaturhinweise am Ende jedes einzelnen Kapitels.

Dieses ausgezeichnete auf alle Weitschweifigkeiten verzichtende Buch vermittelt dem Verfahreningenieur der chemischen Industrie und darüber hinaus jedermann, der sich mit Kristallisationsprozessen beschäftigt, nützliche Informationen über Auswahl und Gestaltung technischer Kristallisationsanlagen. Ihm ist eine weite Verbreitung im Kreise der Fachleute zu wünschen.

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### Quench hardening in metals.

By H. KIMURA and R. MADDIN.  
Pp. 124. Amsterdam: North Holland, 1971. Price f 36.00  
(ca. \$ 11.25.)

This book, the third volume in the series on defects in crystalline solids under the general editorship of Amelinckx, Gevers & Nihoul, is concerned chiefly with the mechanism of quench hardening in the pure f.c.c. metals, in particular aluminum and gold. The first part of the book provides an introduction to the properties of point defects in thermal equilibrium, and discuss the possibility of quenching in vacancies. Experimental results on various mechanical properties

which are affected by quenching are then reviewed, together with some electron-microscope investigations into the nature of the defects in quenched metals. Interactions of dislocations with these defects and with dispersed vacancies are considered, and recent experiments revealing the operation of such interactions in aluminum and in gold are examined in order to explain the mechanism of quench hardening in these metals. The book is a good short review of our present understanding of quench hardening, and full references to the relevant literature are given.

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**Surface self-diffusion of metals.** By G. NEUMANN and G. M. NEUMANN, Pp. 129. Diffusion Monograph Series, Diffusion Information Centre, Switzerland, 1972. Price (Paperback) \$15.00, (subscription rate per year, 4-6 monographs \$42.)

In the last decade or so there have been many developments in the field of surface self-diffusion of metals. Review articles have been scattered in the Journals or in Conference Proceedings and have emphasized particular aspects of the phenomenon. A monograph devoted exclusively to the subject, and reviewing it as a whole, is therefore to be welcomed.

In form this monograph consists of four sections which deal with experimental techniques, results, theoretical models and the compatibility of models and measurements.

In the first section the techniques which have been used to determine surface diffusivity are described and their application critically discussed. Many of them depend directly on the measurement of shape changes promoted by free-energy minimization and this writer feels that the discussion of the surface thermodynamics which is their basis could usefully have been larger. However this is a minor criticism for the discussion given is very adequately referenced, as indeed is the whole volume.

There is a large amount of experi-

mental data on surface self-diffusion representing the investigation of numerous metals over wide ranges of temperature by various techniques. Arrhenius plots yield activation energies and frequency factors which specify a diffusion coefficient. The authors present the data in a useful and attractive tabular form which allows easy reference to the results and conditions of any particular investigation and also facilitates comparisons. It is here that the problems of the subject become clearly apparent, for the variations in the data indicate the important role of surface structure, impurity adsorption, technique and temperature range in determining the measured diffusivity. The solutions to these problems may only be sought through consideration of atomic migration processes in detail and the third section of the book presents a lucid account of the Kossel-Stranski model of the metallic surface and the Terrace-Ledge-Kink model of surface diffusion which has developed from it.

In the final section the extent to which it has been possible to rationalize the data in terms of reduced parameters and identify particular mechanisms is considered, and conclusions drawn about the relative value of the various techniques in what remains an open field. One wonders if the powerful technique of Auger electron spectroscopy, which in principle enables one to follow the migration of 'foreign' adatoms on a 'host' surface might be made to yield useful data in a similar way to that in which the study of certain dilute alloys has yielded useful information about host metals.

To summarize, there is a good deal of information in this volume, and one imagines that it will be useful to both the specialist in the field and to the reader with metallurgical interests in the general area of diffusion who wishes to know the current state of knowledge in this particular part of it. In this connexion it is worth mentioning that this is one of a number of monographs which will be forthcoming from the publisher this year on various transport processes and details are obtainable from them of a 'bulk-buy' which would secure the series at an appreciable saving over the cost of individual copies.

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