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.

Kinetics and mechanism of crystallization from the fluid phase and of the condensation and evaporation of liquids. Von R.F. STRICKLAND-CONSTABLE. 347 Seiten. London and New York: Academic Press, 1968. Preis 84 *s.*

Der Autor bezeichnet sein Buch als einfache Einführung für Wissenschaftler, die sich mit Grundlagenforschung auf dem durch den Titel gekennzeichneten Gebiet befassen. Jenen, die die Kristallisation im technischen Massstab durchführen, soll es zur 'background' Information dienen. Max Volmers Buch über die 'Kinetik der Phasenbildung' (1939) und die Arbeiten F.C. Franks über den Mechanismus des Spiralwachstums (1949 und später) dienten dem Autor unverkennbar als Kristallisationskeime, an denen er neue theoretische Erkenntnisse und viele experimentelle Ergebnisse der letzten 20 Jahre ankristallisiert hat.

Ein Blick auf das Inhaltsverzeichnis informiert über die behandelten Themen und den Umfang der verschiedenen Kapitel: Einführung (37 Seiten), Keimbildung flüssiger Tropfen aus dem Dampf (30 Seiten), Keimbildung von Festkörpern (56 Seiten), Defektstrukturen von Kristallen (16 Seiten), Daten über Wachstum aus dem Dampf und über Verdampfung (37 Seiten), Theorien des Kristallwachstums (55 Seiten); im letzten Kapitel (92 Seiten) wird über mehrere unterschiedliche Sachgebiete berichtet: Theorie und experimentelle Daten über die Verdampfung von Flüssigkeiten, Polykristallisation, Wachstum aus Lösung, Dampf und Schmelze, Metallkristalle, Wachstumshemmungen und Oberflächenkeimbildung, Einflüsse von Fremdstoffen, abnormales Wachstum, Züchtung von Einkristallen, industrielle Kristallisation, Polymere und Whiskers. Am Schluss des Werkes findet man neben dem Autoren – und Sachindex ein Verzeichnis mit 235 Literaturzitaten.

Theorie und experimentelle Ergebnisse werden gleichrangig behandelt. Neuere Vorstellungen, die noch nicht ausreichend durch experimentelle Ergebnisse gestützt sind, werden nicht oder nur andeutungsweise erwähnt.

Die theoretischen Zusammenhänge werden vorwiegend mit Hilfe thermodynamischer Grössen und Funktionen formuliert. Die Wahl der Mittel bleibt natürlich jedem Autor überlassen. Für eine einfache Einführung wäre es jedoch wünschenswert, die atomistische Betrachtungsweise stärker zu betonen. Dies gilt vor allem für die Arbeiten von Stranski und Kaischew, die über die ersten einfachen energetischen Betrachtungen von Kossel und Stranski hinausgehen und in denen die Zusammenhänge zwischen der atomistischen und thermodynamischen Betrachtungsweise auf einfache Weise aufgezeigt werden. Das erleichtert dann auch das Verständnis für die Anwendung der statistischen Thermodynamik auf die Kinetik der Phasenbildung. Zu dem zuletzt genannten Problemkreis findet man im vorliegenden Werk ebenfalls Beispiele, die jedoch sparsam kommentiert sind. Diese wenigen kritischen Bemerkungen sollen den Wert des Werkes nicht schmälern. Wie wäre es möglich, ohne Einschränkungen den modernen Wissenstand in 347 Seiten niederzuschreiben?

Ausstattung und Druck entsprechen der vom Verlag gewohnten Qualität. Das Studium der zahlreichen Formeln wird durch übersichtliche Definitionen der verwendeten Symbole sehr erleichtert. Von besonderem Wert sind die jedem Kapitel nachgestellten Zusammenfassungen, eine Einrichtung, die sich zur Nachahmung empfiehlt.

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Growth of Crystals, Volumes 5A (155 pp), **5B** (193 pp), **6A** (182 pp) **and 6B** (189 pp). Edited by N.N. SHEFTAL'. Translated from Russian. New York: Consultants Bureau, 1968. Price $ 72.00 the set; separate volumes 5A $ 17.50, 5B $ 22.50, 6A $ 20.00, 6B $ 20.00.

These four volumes contain the 124 papers presented at the third Moscow Conference on Crystal Growth held in November 1963 and attended by over 800 people. Earlier similar conferences took place in 1956 and 1960. With the exception of an article by Prof. J. Bernal on the structure of liquids all the papers are written by scientists from Russia or the East European socialist republics. The objectives of the conference were to assess the experimental and theoretical bases for crystal growth, to discuss the most important methods for producing single crystals and the evaluation of crystal perfection.

Volume 5A covers growth theory and general aspects of crystal formation in 17 papers, whereas five papers are devoted to the structure of liquids and solutions. In volume 5B the accent is on methods for the study and evaluation of crystal perfection, and some 22 papers cover metallography, X-ray, resonance and optical techniques. In the same volume growth mechanisms are discussed in 11 papers.

Techniques for growing crystals are described in volumes 6A and 6B, the former being primarily concerned with growth from solutions and composite melts, the interest being centred on oxides of various types, *e.g.* Al_2O_3, ZnO, garnets and aluminates. Growth from single-phase melts is concerned chiefly with the alkali halides. In all, Volume 6A contains 32 papers.

The preparation of crystals of semiconductors, mostly *via* growth from the melt, is treated in 23 papers of Volume 6B; attention is given to Ge, SiC, GaAs, GaP, CdS and other substances of importance in semiconductor technology. Metals receive scant attention but three papers covering the production of monocrystals of high melting point metals (W, Mo) and the chemically reactive rare earth metals are included. The final section of 6B comprises 11 papers concerning the growth of dendrites, profiled crystals and films.

The objectives of this Russian conference were the same as those of the International Conference on Crystal Growth held in Boston, U.S.A., during 1966. In spite of the three-year interval separating them the Russian work foreshadows the interests of the later conference, no doubt because of similar convictions regarding the importance of crystals for basic research and technological devices. The Russian papers, with few exceptions, make little reference to Western work, but an inspection of the proceedings of the Boston conference shows the converse to be equally true. These translations (which incidentally read very well as far as language is concerned), although appearing long after the original papers, should help to remedy this situation.

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Growth and imperfections of metallic crystals. Edited by D. E. OVSIENKO. Translated from Russian. Pp. 260. New York: Consultants Bureau, 1968.

If metals receive little attention in the above conference proceedings then the present collection of papers, first published in 1966, affords compensation. Roughly one half is devoted to growth mechanisms and growth procedures, the latter involving growth from the melt or *via* recrystallization. Apart from one paper on the rare earth metals the work described concerns non-transition metals with low melting points. Little reference is made to the preparation of single crystals of alloys. The latter half of the book treats dislocations in crystals, their occurrence, and dependence upon growth conditions; reference is made not only to metals but also to diamond, silicon and graphite.

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Plasticity of crystals with special reference to metals. By E. SCHMID and W. BOAS. Pp. xiv+353. London: Chapman & Hall, 1968. Price 50*s*.

This book is a re-issue of the well-known classic German work first published in 1935 and translated into English in 1950. Since it has been out of print for some considerable time, it is appropriate to question the purpose to be served in republishing it at this time, particularly as the field of plasticity of crystals is now well catered for by many excellent books on dislocations and plastic flow. The first four chapters deal with the fundamentals of crystallography, elasticity, single-crystal preparation and the determination of crystal orientation, respectively, and are as useful today as they were 30 years ago. The fifth chapter treats the geometry of the mechanisms of crystal deformation, *i.e.* glide and twinning, and the analysis also remains valid today.

The latter two-thirds of the book (Chapters VI to IX) describe the results of special investigations carried out at the Berlin Technical High School during the 1920s and 1930s by the research group which included Schmid, Polanyi, Masing, Wassermann and others. Intense activity since 1950 in the field of plastic deformation has replaced much, if not all, of the work described, but it is easy to see that this outstanding school played a very great part in laying the foundations of our present day understanding of the deformation behaviour of metals and alloys. Moreover, there are many topics discussed such as (i) the intersection of twins to nucleate cracks (Rose's channels, 1922), (ii) deformation twinning in face-centred cubic metals (1924) and (iii) 'amorphous' plasticity accompanying recrystallization or phase transformation (1926–31), which were more or less forgotten for 30 years until rediscovered during the 1950s.

It is difficult to recommend the book to students because of its limited usefulness as a text book covering the modern aspects of crystal plasticity. Its main worth is in providing an account, now somewhat historical, of the ideas and results developed by the German school. The re-issue will however delight many research workers who were previously unable to obtain a copy of this classic book for themselves and hence get a feeling for the atmosphere of this exciting period of metal science.

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The graphic work of M. C. Escher. Second impression. Oldborne, 1967. Price 42 *s*.

This is a revised and expanded edition of a book, originally published in 1961, presenting reproductions of the work of the graphic artist Maurits Escher. There are now eighty-four prints, four of them in colour, and a dozen or so pages of text in which the author explains his aims and describes individual reproductions.

Many crystallographers will be familiar with Escher's periodic drawings through the monograph prepared by Professor MacGillavry for teaching crystallographic symmetry. Anyone who finds delight in the artistry of the periodic drawings and in the ingenuity with which Escher manages to fill completely periodic space with animals and birds will surely be fascinated by this wider range of examples of his work.

Each picture incorporates some specific idea and more often than not this is closely analogous to one of the intrinsically beautiful forms or laws of mathematics and physics. One finds, for example, visual expression of convergent series, topology, projections, gravity, relativity, and optical phenomena in addition to, and often in combination with, the author's more familiar expressions of periodicity and symmetry.

Escher is particularly interested in the presentation of three-dimensional objects in a two-dimensional print. He exploits various devices which suggest the third dimension and he sometimes combines several viewpoints in one print with the inventiveness of a Picasso. But he also makes fun