New Commercial Products

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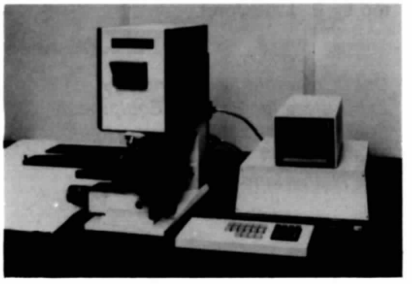
J. Appl. Cryst. (1986). **19**, 281

Automatic Thin Film Measurement System

The newly designed **TF1200 automatic thin film measurement system** from the Polaron Division of Bio-Rad Laboratories measures the thickness of semi-transparent films. The system monitors the spectral reflectivity which is used to calculate the film thickness.



The TF1200 thin film measurement system.

The TF1200 offers the following features: Monochromatic irradiation to minimize sample heating. This yields more accurate data than that obtained with conventional white-light irradiation; An autofocusing system; A built-in viewer to observe the sample surface. The power of magnification is selected by changing the microscope objective. This permits film-thickness measurements over very small areas such as part of an IC pattern; Measurement of absolute reflectivity of small areas. The spectral absolute reflectance is displayed on the CRT; The entering of refractive indices of samples by the operator; A wide range of measured thicknesses (100–33 000 Å); A sample stage to accommodate wafers up to 8 in in diameter.

Polaron Equipment Ltd, 53–63 Greenhill Crescent, Watford Business Park, Watford, Hertfordshire WD1 8OS, England

Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

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Rapidly quenched metals, Vols. I and II.

Edited by *S. Steeb* and *H. Warlimont*. Pp. lxxii + 1090 and lxvii + 791. Amsterdam: North Holland, 1985. Price US $ 96.25, Dfl 260.00 and US $ 66.75, Dfl 180.00.

The study of metallic alloys lacking long-range chemical order, the amorphous or glassy alloys, produced by rapid quenching from the melt essentially began in 1960 after the celebrated work of Duwez and his co-workers. Their samples were produced as small irregular discs or 'splats' and were of limited use.

The introduction of melt-spinning, a technique for producing the alloys in commercial quantities as continuous ribbons, and the realization that amorphous alloys can be stronger, less resistant to corrosion and, in the case of iron-based alloys, may be superior magnetically when compared with their crystalline equivalents has resulted in an explosion of activity both technological and academic over the last decade.

This two-volume work records the proceedings of the Fifth International Conference on Rapidly Quenched Metals (RQ5) held in September 1984 at Wurtzburg with over 650 participants. The last day of the meeting was devoted to applications when the numbers were increased by the attendance of some 50 industrialists.

The material presented in the 540 research papers represents the 'state of the art' at the time and most of the detail is of immediate use only to the specialist and as with all rapidly developing subjects must quickly become dated. However, it is held together with a number of excellent reviews which will stand out as milestones in the development of this multidisciplinary subject.

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The kinetics of industrial crystallisation.

By *J. Nývlt, O. Söhnel, M. Matuchová* and *M. Broul*. Pp. 350. Amsterdam: Elsevier, 1985. Price US $67.25, Dfl 175.00.

A book like this one takes much time to read. The authors have to be praised for their initiative in writing such an extensive literature survey (mainly 1970–1980) on this subject. By doing this they have reduced the gap in knowledge between that of chemical engineers and scientists in the field of solid-state physics and thermodynamics.

Very wisely this book starts with remarks about the dimensions to be used for concentration in the case of crystal growth and mass transfer. The same remarks are made in the introduction to the driving force for a crystallization process; whether the difference in chemical potentials of the substances involved should be used or simply the difference in concentration. The consequences of a simplification are mentioned.

It is clear that a book on the kinetics of crystallization has to deal with the aspects of nucleation of crystals and their growth.

First the formation of new crystalline material is discussed and a distinction is made between primary and secondary nucleation. For primary nucleation the conception of the width of a metastable zone in a phase diagram is put forward and the way this width can be measured is suggested. It becomes clear after the presentation of the basics of phase transition that the data concerning the width of the metastable zone cannot be translated without further research into the industrial situation owing to the influence of mechanical actions such as agitation.

As the main source for nuclei in an industrial crystallizer is formed by the mechanism of secondary nucleation (nucleation due to the presence of crystals) much attention is paid to this subject. Different modes of secondary nucleation are presented such as fluid shear, contact nucleation, collision breeding and also factors influencing the rate of secondary nucleation such as hardness of crystals, temperature, supersaturation, the presence of admixture *etc.* and last but not least the crystal size.

The authors of this book draw attention to many contradictory publications concerning properties related to the crystal

size such as total crystal surface, mass of a crystal *etc.*, but they have not attempted to evaluate all these publications and have not tried to come to final conclusions.

Kinetics of crystallization comprise not only nucleation but also crystal growth. A survey is given of the different theories for crystal growth. They are more than adequate to understand the mechanisms governing crystal growth or to suggest an explanation of observed growth phenomena or to absorb the information received from literature.

In chronological order different theories are presented, starting with the theory of the limiting faces, the Kossel/Stranski theory, and ending up with the solid-on-solid model including the Monte Carlo approach as a method for quantification and with models as volume diffusion, surface diffusion B.C.F., models without and with bulk diffusion.

Marginal attention is given to the problems concerning mass transfer to growing or dissolving crystals as encountered in industrial situations. Also the phenomenon of growth dispersion is little elucidated.

The chapter on crystal growth concludes with a description of methods and means for the measurement of the growth rate of (mainly) single crystals; for instance observation under a microscope, a gravimetric method, a method with a rotating disc or a fluidized bed. As this part of the book (like the other chapters) is well documented it will be easy to retrieve the original publications with further detailed information. The book would have been incomplete if the authors had limited themselves to studies on growth of single crystals.

In industrial practice there is always a suspension of many crystals in a liquid. A separate chapter deals with this subject. The following items are discussed: expressions for the crystal-size distribution, the moments of the distribution, the concept of population balances and ways to deduce crystal growth – and nucleation rate – from population balances. Procedures for two types of test crystallizers are explained; the batch crystallizer and the mixed-suspension mixed-product-removal crystallizer. Warnings are given for not properly sampling and sieving. Left out from the book are the sample treatment (with growth inhibitors) and modern techniques for crystal-size measurement such as apparatus making use of the diffraction patterns of laser beams caused by crystals.

In many books on the kinetics of crystallization there fails to be a chapter dealing with precipitation. This is peculiar, as the same foundations are relevant for precipitation as nucleation and crystal growth. Adapted expressions for these quantities are given in the case of sparingly soluble salts.

The book ends with a short review of the literature on other processes affecting the crystal-size distribution such as ripening, aging, coagulation, agglomeration.

In summary, this is a clear and well written book. It covers exactly what the title suggests. It is not a book on the design and operation of industrial crystallizers and how the supersaturation is created and distributed over the interior of an industrial crystallizer. It describes the response of crystals to a created supersaturation. Someone may complain about the absence of information about the kinetics in the unsteady state, or information on crystallization from the melt. The addition, however, of more pages than the 326 already there would make it unattractive to buy and that would be a situation completely unwanted by E. J. de Jong.

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