the φ angle until a strong intensity is detected.

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Crystallographers

This section is intended to be a series of short paragraphs dealing with the activities of crystallographers, such as their changes of position, promotions, assumption of significant new duties, honours, etc. Items for inclusion, subject to the approval of the Editorial Board, should be sent to the Executive Secretary of the International Union of Crystallography (J. N. King, International Union of Crystallography, 5 Abbey Square, Chester CH1 2 HU, England).

Dr **C. L. Christ** died in June 1980. He retired in 1979 from the US Geological Survey where he had been employed since 1949 as a research scientist and administrator. He received his PhD in Chemistry from The Johns Hopkins University in 1940. Many of his 140 scientific papers were on crystal structures and crystal chemistry of minerals, particularly the inorganic borates. With **R. M. Garrels** he published a pioneering book on *Solutions, Minerals and Equilibria* in 1965.

Dr **W. A. Hendrickson,** of the Naval Research Laboratories, Washington DC, is the first recipient of the A. L. Patterson Award. His award address, entitled 'Anomalous Scattering and Protein Structure', was presented at the American Crystallographic Association meeting at Texas A & M University on 23 March 1981.

Book Review

Crystal growth: a tutorial approach. Edited by *W. Bardsley, D. T. J. Hurle* and *J. B. Mullin.* Pp. ix + 408. Amsterdam: North Holland, 1979. Price US $ 53.75, Dfl 110.00.

A great number of different publications, issued annually, deal with the growing of single crystals and single-crystal films. However, scientists and engineers who are specialists in the field of crystal growth well know the enormous value of personal contacts and sharing of experience, the opportunity for which is offered during the systematic International Schools of Crystal Growth (ISSCG). The organising of such schools has become a good tradition of the International Union of Crystallography and of the International Organisation for Crystal Growth.

ISSCG-1 was held in the Netherlands in 1971 and dealt with the fundamental problems of crystal growth, particularly with the theories of growth and nucleation. The ISSCG-2, held in Japan in 1974, considered mainly technical questions and the investigation of the real structures of crystals. At the basis of ISSCG-3, USA, 1977, were the questions of the thermodynamics of crystal growth. Thus, the list of problems considered during these schools has touched on the whole circle of crystal growth science.

Besides the printed lectures of ISSCG-3, the book here reviewed presents one of the first attempts at a systematic account of a course on 'crystal growth', addressed to students and postgraduates specialising in this field. This has determined the structure of the book. The first part of the book is concerned with the basic techniques of crystal growth and with the ways in which thermodynamics constrains and dictates the choice of technique for a particular material; it also considers the kinetic and dynamic aspects of the growth process. The common points developed in the first part are illustrated further by concrete examples of single crystals that can be obtained, which are important for practical applications, using widely developed industrial techniques. The book also contains detailed descriptions of a number of up-to-data methods for the investigation of the structure of single crystals and films.

The background of the book is the connection between the properties of compounds and the corresponding crystallization conditions. Practically all the known crystal and thin-film growth methods are considered from this point of view; the details are set out in chapters 1 (Gatos) and 4 (Hurle). Here, advantages and limitations of different methods are described in connection with the compounds' properties, the required sizes of crystals, their imperfection, orientation, composition, level of purity and economics.

The same thing characterizes chapter 2 (White), which deals with phase equilib-

ria. Here should be noted the good arrangement of material by the author, which permits him to transfer smoothly from the common notions of physical-chemical analysis determinations to the different types of phase equilibria. Moreover, step by step, he proceeds from simple systems to more complicated ones, so that, at the end, he considers a wide number of concrete phase diagrams of complicated multicomponent systems having important practical significance. Undoubtedly, the virtue of this chapter is the consideration of binary systems containing volatile components. Such diagrams are rarely considered in the literature, although such conditions quite often occur in practice in crystal growing.

In chapter 3 (Roy), a large number of examples are used to illustrate the selection of growth techniques, basing this on the physical and chemical properties of investigated compounds. Defining the common approach to the choice of the optimal growth technique for a given compound, the author notes the main factors determining the choice to be:

1. equilibrium phase diagrams, determining phase stability conditions of the desired phases;

2. phase transitions in, and the defect chemistry of, the phase;

3. the structure/composition relations of the phase;

4. significant physical properties as determined by 1, 2 and 3.

Questions that deal with the mechanism and kinetics of crystal growth are considered in chapter 5 (Jackson) which focuses attention on the nucleation of crystals, on crystal-surface structure in equilibrium conditions and during the crystallization process, and on the kinetics of processes taking place on this surface. These questions are considered on the basis of both theoretical and experimental results. The examples of computer simulation of growth processes are rather interesting.

Chapter 6 (Carruthers) deals with the dynamics of crystal growth, considering in detail the connection between the real structure of crystals (cell growth, block structure and growth layers) and the conditions of heat and mass transfer in the liquid phase and on the crystallization front. These matters have a very important practical bearing on the growing of large, perfect single crystals, as one can obviously see in the chapter that follows.

The next three chapters, 7, 8 and 9 (Brandle, Stringfellow and Blank, respectively) deal with the problems of growing the bulk single crystals and single-crystal