GOULD INC. (1983). *MPX-32 Reference Manual* (3 vols). Gould Inc., SEL Computer Systems Division, 6901 W. Sunrise Blvd., Ft Lauderdale, FL 33310-9148, USA.

HALL, S. R., STEWART, J. M. & MUNN, R. J. (1980). *Acta Cryst.* A**36**, 979–989.

JOHNSON, C. K. (1971). *ORTEP-II*. Report ORNL-3794 (2nd revision) and supplementary instructions. Oak Ridge National Laboratory, Tennessee.

MAIN, P., FISKE, S. J., GERMAIN, G., HULL, S. E., DECLERCQ, J.-P., LESSINGER, L. & WOOLFSON, M. M. (1980). *MULTAN80 A System of Computer Programs for the Automatic Solution of Crystal Structures from X-ray Diffraction Data*. Univs of York, England and Louvain, Belgium.

MICROSOFT CORPORATION (1983). Microsoft Fortran compiler for the MS-DOS operating system. Microsoft, 10700 Northup Way, Bellevue, WA 98004, USA.

ROGERS, D. (1981). *Acta Cryst.* A**37**, 734–741.

SHELDRICK, G. M. (1976). *SHELX*. A program for crystal structure determination. Institut für Anorganische Chemie der Universität Göttingen.

WALKER, N. & STUART, D. (1983). *Acta Cryst.* A**39**, 158–166.

Crystallographers

J. Appl. Cryst. (1985). **18**, 53

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 2HU, England.

Winfred O. Milligan died 18 February 1984 in Houston, Texas. Born in Coulterville, Illinois on 5 November 1908, he earned his PhD at Rice University in 1934. For the past 19 years he was Distinguished Research Professor of Chemistry and Physics at Baylor University in Waco, Texas. He was Director of Research at the Robert A. Welch Foundation, Houston from 1955, shortly after its inception, until his retirement in 1982. Professor Hugo Steinfink writes that the Foundation emerged, under his leadership, as the foremost private granting agency in the support of basic research in chemistry in the USA. Professor Milligan's research interests were in X-ray and electron diffraction, electron microscopy, gas absorption and magnetic properties. He made fundamental contributions to the structures of lanthanide and actinide hydrous oxides and hydroxides. He was a fellow or member of, and held offices in, numerous professional societies. He was a charter member of the American Society for X-Ray and Electron Diffraction and a member of its successor society, the American Crystallographic Association.

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 LS9 9JT, England) As far as practicable books will be reviewed in a country different from that of publication.

J. Appl. Cryst. (1985). **18**, 53–54

Structure of crystalline polymers. Edited by *I. H. Hall.* Pp. 313. London: Elsevier Applied Science Publishers, 1984. Price £35.00.

This is an interesting collection of review papers on the subject of crystalline polymers, focusing mainly on measurements of the shape of molecular chains. There are seven chapters in this volume, which are written by researchers whose approach to the subject matter is that of the experimental physicists, *i.e.* they are concerned with the use of experimental techniques that would discriminate between various competing theoretical models. With this rigorous approach, the conformations of the macromolecular chains are examined on the scale of a few angströms and then increased to the level of organization that is visible in the optical microscope, *i.e.* morphological scale of a few micrometers.

The first chapter is written by R. D. B. Fraser, E. Suzuki & T. P. MacRae on *Computer analysis of X-ray diffraction patterns.* This paper is concerned with the use of a digital computer to interpret wide-angle X-ray scattering (WAXS) data. Using raster-scanning digital microdensitometers, the diffracted intensity can be measured at every point on a fine lattice superimposed on the photograph and the information stored in a computer. Methods of analyzing this immense amount of data with particular reference to silk fibers are discussed. This chapter is written with sufficient introductory material that those who may not be directly involved in the same area of research can benefit through its elegant style of presentation.

The second chapter is by I. H. Hall on *The determination of the structures of aromatic polyesters from their wide-angle X-ray diffraction patterns.* This contribution is concerned with the experimental WAXS study of chain conformation in polyesters such as poly(ethylene terephthalate) and poly(butylene terephthalate). A tremendous amount of unit-cell information for a series of polyesters, quite invaluable to polymer scientists, is discussed and critically reviewed. Through his clear style of writing, the author covers areas of his investigation that may involve dangers of misinterpretation and uncertainties of data that can still haunt X-ray diffraction studies.

The third chapter is by E. L. Thomas on *Transmission electron microscopy of polymers.* Electron microscopy investigations have provided much of the detailed information on polymer morphology. This chapter outlines the key techniques and the theoretical basis for interpreting images derived from either conventional TEM or scanning transmission electron microscopy (STEM). The usefulness and limitations of the various techniques are documented based on the polymer literature. The author surveys many aspects of polymer science issues, which include the 'nodule controversy in amorphous polymer glasses' and defects in polymer crystals such as screw dislocations in polyethylene. Covering 124 papers up to 1983, the reader will find it quite rewarding to go through this review, which discusses pertinent issues of polymer microscopy.

The fourth chapter is written by D. M. Sadler on *Neutron scattering by crystalline polymers: molecular conformations and their interpretation.* This manuscript attempts to answer two basic questions in polymer science, namely, what are the shapes of macromolecules inside their crystal lattice and how do the crystals form that shape? Judging from the beautiful presentation in this chapter, neutron scattering has already made remarkable progress in answering the first if not the second of these questions. Small-angle neutron scattering (SANS) data obtained from the Institut Laue–Langevin in Grenoble are discussed for materials including deuterated polyethylene, isotactic polypropylene, isotactic polystyrene and poly(ethylene oxide), even though only the work on polyethylene is discussed in detail. Also, the effects of annealing are covered only briefly and the chapter is selective in order to give special attention to the interpretation of conformations relating to the mechanisms of crystallization. Effects of orientation on the shape of the macromolecules are also covered elegantly.

The fifth chapter is by I. H. Hall & M. Toy on *The ability of small-angle X-ray scattering (SAXS) to distinguish between morphological models of crystal*

line polymers. In this contribution, the various models of crystalline polymers such as Hosemann's 'paracrystalline model' are reviewed. Throughout, the emphasis is on the dangers of limitations of SAXS and on its ability to discriminate among the various possible structural models. Hall & Toy have done the polymer science community a great favor by writing this review on SAXS and its limitations.

The sixth chapter is by H. K. Herglotz on *Long-wavelength X-ray scattering to study crystal morphology.* The existence of large-scale organizations in a crystalline polymer solid such as spherulites is well known. While 1.54 Å copper radiation is a good match for the interatomic distances, the same cannot be said about repetitive morphological features. This limitation of classical X-ray wavelength renders it profitable to exploit aluminum (8.34 Å) and carbon (44.7 Å) radiations to unravel features of the polymer solid greater than the size scale of the crystallographic cell. This chapter covers reasons for and difficulties with long-wavelength X-ray diffraction to probe crystalline polymer structure. This chapter is quite useful for users of synchrotron radiation, which can also generate long-wavelength X-rays. Again, this paper emphasizes the dangers of misinterpretation that may trap the unwary experimenter.

The seventh and final chapter is contributed by C. P. Buckley & A. J. Kovacs on *Chain folding in polymer crystals: evidence from microscopy and calorimetry of poly(ethylene oxide).* Chain folding has long been a controversy in polymer physics concerning the crystalline state, particularly for polymers recrystallized from the melt. In this chapter, low-molecular-weight fractions of poly(ethylene oxide) are selected for the study of chain folding and have been the subject of extensive and rigorous investigation using SAXS, optical microscopy and differential scanning calorimetry. The results are used to shed light on the central issues regarding the nature of polymer chain folding and unfolding. However, it is still uncertain whether the results of such a study on a single polymer are applicable to crystalline polymers in general.

In summary, the seven chapters in this book are written by ten active researchers who have made significant contributions to the advancement on the understanding of unsolved problems in polymer physics. These reviews are presented both clearly and authoritatively. Hence, most polymer physicists will find this book to be quite an indispensable reference in their library.

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Books Received

The following books have been received by the Editor. Brief and generally uncritical notices are given of works of marginal crystallographic interest; occasionally a book of fundamental interest is included under this heading because of difficulty in finding a suitable reviewer without great delay.

J. Appl. Cryst. (1985). **18**, 54

Molecular beam epitaxy of III–V compounds: a comprehensive bibliography, 1958–1983. Edited by *K. Ploog* and *K. Graf.* Pp. 222. Springer-Verlag, 1984, Price DM 48.00, US $ 17.90.

Dry etching for microelectronics. Edited by *R. A. Powell.* Pp. xi + 299. North Holland, 1984. Price US $ 69.25, Dfl 180.00.