

## Book Review

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*Thermal Analysis Vol. 1*, Ed. K. G. Wiedemann. 628 p. 355 illustrations and 39 tables. ISBN 3-7643-1085-5. Vol. 2, Ed. W. Hemminger 606 p. 394 illustrations and 70 tables. ISBN 3-7643-1086-3 Birkhäuser Verlag, Basel, Boston, and Stuttgart.

The proceedings of the 6th International Conference on Thermal Analysis brings together 161 papers which are under the following sections: Theory, Instrumentation, Applied Sciences and Industrial Applications (Vol. 1) and Inorganic Chemistry, Metallurgy, Earth Sciences, Organic Chemistry, Polymers, Biological Medical and Pharmacy (Vol. 2).

The growing use of calorimetric methods is apparent—particularly in the life sciences in that there is a separate section covering biological sciences, medicine and pharmacy.

There are six plenary lectures of which three are devoted to aspects of calorimetry. Special mention should be made of the plenary lecture by Dr. P. K. Gallagher which covers the application of thermal analysis to the Communications and Electronics industry. If there was any lingering doubt as to the effectiveness of thermal analysis to solve real problems in industry then the range of examples given in this paper surely dispels this. In addition the Industrial Applications section has a further 20 papers, and other papers throughout the two volumes are also relevant particularly those in the Applied Sciences section. Six of the papers in the Industrial Applications section are devoted to various aspects of polymer fabrication

and use e.g. a study of RTV-silicone rubber in high voltage cable accessories, mechanical properties of polyester-glass composites; other papers report in the same section on potentially hazardous chemical reactions and a further paper on this important topic comes elsewhere, whilst remaining papers of interest cover such diverse subjects as nitric acid in nitrating mixtures, and the study of fertiliser components.

The instrumentation section is very wide in its coverage and reflects the continuing work of manufacturers and others on main line instrumentation e.g. TG, DTA, DSC, simultaneous calibration in TG, convection effects in TG, and errors in TG by absorption. There are some papers outlining instrument developments in newer areas of TA. However, it is somewhat surprising to find relatively few papers on the impact of micro-processors and mini computers on TA instrumentation although this is obviously an area of growing importance.

The continuing development of kinetic studies is well reported in the Theory section.

The second volume covers a wide range of materials from steel to small animals, and from flame retardants to bakers' yeast!

The continuing work of the Standing Committees of ICTA is represented by reports from the Standardisation Committee and the Publications Committee. This latter report includes the latest revision of the list of books and monographs devoted principally to thermal analysis and covers literature in the field to the beginning of 1980.

J. P. REDFERN

*Macromolecular Physics, Crystal Melting*, Vol. III, B. Wunderlich, Academic Press, New York, 1980 (Price \$42.50)

This book represents the third volume in Professor Wunderlich's series on the physics of polymers and is of the same high quality as the previous two volumes. The text is divided into three broad chapters: Equilibrium Melting, Irreversible Melting, Copolymer and Isomer Melting. The numbering of the chapters is continuous in this series so that the above headings are chapters eight through ten. Each chapter is complete within itself and can be considered as a monograph on the subject. Cross referencing both between chapters in this volume and in the other two is excellent as is the index. The publishers have composed the text, figures and tables in an outstandingly clear and elegant manner. The reference sections (separate for each chapter) can be distinguished by gray thumb spotting at the page edge. Unlike so many texts produced in recent years, attention to detail did not end with the author, but it was continued through production to yield a truly reader-usable book.

The text and tables contain an incredible amount of data on polymer melting. This could have resulted in an unusable jumble had it not been so thoroughly sorted and digested by the author. Table VIII. 6, Melting Data of Linear Macromolecules, is an excellent example. Each polymer is listed (over 30), the equilibrium melting data are given (temperature, room temperature amorphous molar volume, fusion volume change, heat of fusion, entropy of fusion), and methods of measurement and full reference to source are presented. Bold face type is used to pick out firm numbers. These same polymers are discussed in the text, the significance of the data relative to theory given and a critical analysis of the conclusions made. The text itself was probably taken from lecture notes after extensive revision. However, because of the very compact style, it requires very careful reading. This is not a text which can be skimmed over lightly.

The discussion of irreversible melting (indeed distinguishing it from reversible or equilibrium melting) is both unique and thorough. Since this is the type of melting usually observed in polymers, the treatment is espe-

cially useful. In addition, the interesting case of crystal superheating is dealt-with in a lucid manner. The various experimental studies using chemical reaction, etching, solution growth, and melt growth are discussed in terms of specific polymers. The melting of crystals which have been subjected to plastic deformation is also covered. The role of time dependent annealing processes and tie molecule strain on the melting of severely deformed crystals are treated for specific cases (polyethylene, PET, etc.). The melting of epitaxial decorated crystals (shish-kebob structure) of stirrer crystallized polyethylene is covered under this heading, as is extrusion crystallization. Other polymers so crystallized are discussed as well. Superheating of the melt transition is treated for large equilibrium and non-equilibrium grown crystals. Changes in melting temperatures of polymers are discussed in terms of the organization of the amorphous phase. Diluent effects are treated, and the text is explained with the aid of three excellent electron micrographs and a very clear schematic drawing of the simultaneous crystallization of a diluent and a macromolecular material.

Chapter ten deals with copolymer and isomer melting. The various types of copolymer structures are defined and these discussed in terms of reactivity ratio coefficients. The physical structure of copolymer crystals is considered as a function of either eutectic or mixed crystal growth forms. Since little is known of the equilibrium melting of copolymers, the non equilibrium case is stressed. Branching and chain defects are considered as a type of copolymer. Random copolymers are discussed by polymer type, i.e. halogenated ethylene copolymers, vinyl copolymers, etc. The melting of a partially isotactic polypropylene is treated as a copolymer case. Regular and block copolymers are covered in considerable detail although the experimental data on ter- and higher block type copolymers is less available. The case of side chain crystallization is not treated in extensive detail. This is a subject best considered from another direction, i.e. liquid crystal copolymers.

The book and the series should find wide use as a ready reference to critical data on polymer melting. With a bit of adaptation, it could be used as a text in a graduate level

course on crystalline polymers. Thermoanalysts working with modern DTA, DSC and TMA equipment should find the series and this volume of particular interest. Many complex thermograms used to illustrate the text are interpreted clearly and at length in terms of the crystal factors given above. Most workers in the area of polymer physics will be interested in some aspects of the book.

Indeed, considering the vast amount of data correlated in the text and the general degree of scatter found in the literature, this text's long term use will probably be as an authoritative compilation which every technical library should possess.

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