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Book review

Dénes Lörinczy (Ed.), The Nature of Biological Systems as Revealed by Thermal Methods, Judit Simon (series Ed.), Hot Topics in Thermal Analysis and Calorimetry, vol. 5, Kluwer Academic Publishers, Dordrecht, 2004, 351 pp.

The book consists of a Preface, 13 chapters divided amongst three Parts, and a Subject Index. The preface states the book is "about the application of thermal methods in biology" and the aim is to be a guide for scientists who are not familiar with thermal methods. Part I discusses foods as "multi-component and multi-phase systems where the heat treatment can produce transitions of compounds from one phase to another." Part II presents examples of DSC studies of "structural and functional" properties of muscle proteins. Part III reviews studies of "plant and plant tissues", "thermobiochemical studies of animal cells in vitro, thermal investigations of social insects and an introduction" to "human cartilage from the point of view of arthritis and degenerated lumbar intervertebral discs." Part IV is primarily a theoretical and statistical treatment of "carbohydrate-water systems" and of thermal denaturation of proteins.

Chapter 1 on "Order-disorder conformational transitions of carbohydrate polymers" contains both "some original data produced in the authors' laboratory together with a review of data obtained from the literature". The introduction discusses the helix-coil transition in biopolymers in general and obtaining the domain size from the ratio of the van't Hoff enthalpy to the calorimetric enthalpy. The remainder of the chapter is devoted to detailed discussion of the helix-coil transition in six polysaccarides and a short comment on the "correlation between structure, function and technological application" (89 refs.).

Chapter 2 "is a short review of the TA and relevant combined techniques that can be of help in the study of food and related systems". The chapter is divided into two main parts, DSC and TG each combined with various other analytical methods. Brief sections on isothermal calorimetry and mechanical and rheological methods are included (34 refs.).

Chapter 3 discusses the "Recrystallisation of starch studied with MDSC". The chapter is organized in the form of a research paper for a journal. The introduction reviews results from other methods, the experimental section describes materials and sample preparation and the MDSC and TG methods used in the study, followed by sections on results and discussion and conclusions. The major conclusion is MDSC "enables to follow in situ the slow isothermal crystallisation process of concentrated amorphous starch systems" (60 refs.).

Chapter 4 "systematically analyses applications of thermal analysis and calorimetry in the field of food science and technology. It summarizes and completes preceding papers with the purpose of giving the state of the art". The conclusion states "that thermal analysis and calorimetric techniques are increasingly applied in food science and food technology" (192 refs.).

Chapter 5 discusses the use of DSC for "monitoring protein conformation stability and effects on fat droplets crystallinity in complex food emulsions". The introduction discusses thermal transitions in proteins and fats and gives a brief summary of the principles of DSC. The remainder of the chapter is devoted about half to protein denaturation and half to fat crystallization, mainly in food products (70 refs.).

Chapter 6 discusses "application of the DSC to studies on myosin, actin, and tropomyosin . . . to investigate the molecular mechanism and regulation of muscle contraction. The effects of binding of small ligands and other proteins on thermal transitions of the three muscle proteins are reviewed (94 refs.).

Chapter 7 is titled "Effect of nucleotides and environmental factors on the intermediate states of ATP hydrolysis cycle in skeletal muscle fibres". Discussion of the effects of nucleotide binding on the thermal transitions of myosin between 45 and 75 °C constitutes the first half of the chapter, and discussion of the "effect of free radicals on actin/myosin and muscle fibres" the last half (89 refs.).

Chapter 8 reviews heat production in live plants and plant tissues. Most of the chapter describes results of studies of metabolism by isothermal calorimetry. Short reviews of applications of combustion calorimetry, DSC, TG and IR thermography are included (102 refs.).

Chapter 9 discusses "Thermobiochemical studies of animal cell systems in vitro". Discussion of bioreactors and calorimeters is followed by discussion of the relation of the metabolic heat rate and enthalpy balance to the growth reaction. The growth reaction is then related to medium design and to control of fed-batch culture. The last part of the chapter discusses measurement of oxygen, and the calorimetric-respirometric ratio and its relation to metabolism (95 refs.).

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Chapter 10 reviews studies on the energetics of individual insects during development, locomotor activities, and sleep and hibernation. Energetics of social insect colonies and of their parasites concludes the chapter (96 refs.).

Chapter 11 reports DSC studies on cartilage (44 refs.).

Chapter 12 consists of a quantitative theoretical treatment of heat capacity data on starch, starch/water, glucose, and glucose/water systems. Heat capacity data from 8 to near 500 K are reported. The conclusions relate many of the properties of starch observed in food products to molecular motions and phase transitions (65 refs.).

Chapter 13 consists of a statistical mechanical analysis of the thermal denaturation of proteins (5 refs.).

As in most books with chapters authored by different authors, the quality is uneven. Some chapters are thorough reviews of the literature while others are largely from the authors' own work. Some chapters are difficult to read because of poor English, while others are well-written. The book would have been much more readable if it had been given a thorough proofreading and editing by a native English speaker. It also should have been checked for accuracy and consistency. Symbols and definitions are inconsistent between chapters and do not follow IUPAC recommendations, figure quality is highly variable, non-SI units are mixed with SI units, and nomenclature is incorrect in places. Three of my pet peeves with nomenclature appear in the book, i.e. (1) sensitivity is used in place of detection limit, (2) *micro*-calorimeter is a confusing and undefined term sometimes used to refer to detection limit on heat and sometimes to sample size, and (3) *isothermal* DSC which literally means isothermal differential temperature-scanning calorimeter. In disagreement with the intention stated in the preface, the writing is largely directed to experts in the various fields, with only a nod here and there to the novice, and the writing and nomenclature problems make the book more impenetrable than it needed to be. However, much good science is contained in the book, and the problems are relatively minor. The book serves a useful purpose as a reference work, contains much useful information, and has found a place on my bookshelf of frequently consulted works.

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