BOOKS

Pigment Handbook, Temple C. Patton (ed.), Interscience, New York, London, Sidney, Toronto (1973). Three-vol. set—$150.00.

Vol. 1 Properties and Economics, 985 pages.
Vol. 2 Applications and Markets, 455 pages.
Vol. 3 Characterization and Physical Relationships, 538 pages.

Volume 1 gives an exhaustive review of the economics, historical background, major reasons for use, and manufacturing methods for various classes of pigments including the following: white primary, extenders, inorganic and organic colored, black, metallic, anticorrosive, pearlescent, luminescent, antifouling, mold control, molecular sieve, food and cosmetic pigments.

The nearest similar coverage of pigments of which this reviewer is aware is Volume II of *Protective and Decorative Coatings*, J. J. Mattiello, Editor, Wiley, 1942. Patton's *Handbook* gives a more complete coverage than Mattiello's and includes many new and unusual classes. Particularly noteworthy are the discussion of aluminum and copper flake pigments, natural and synthetic pearl essence, luminescent and fluorescent pigments, Day-Glo colors, thermographic and the infra-red quenching pigments used during World War II in Snooper Scopes and at present for aerial photography and product identification. Particularly useful are extensive bibliographies after each chapter in all three volumes and identification of the current manufacturers of each of the pigments.

Electron photomicrographs, scanning electron photomicrographs, and regular photomicrographs of many of the pigments are given. These would be more useful to a technologist interested in product identification if they could be grouped together in some way and were all taken under the same conditions. There are no color plates in any of the volumes showing the mass tone color of the various colored pigments or their tint color when let down with titanium dioxide. I assume that color plates were omitted because of their cost, but they would be useful in pigment selection. Another useful addition would be a table comparing various properties of the different pigments such as permanence to light, bleeding, resistance to heat, alkali resistance, hiding power, density, and approximate price. This information is available in the handbook but only in the individual chapters by various authors in the section of the chapters listing typical properties. The editor has been successful in maintaining a uniform format for the various chapters in spite of the diverse authorship.

Volume 2, *Application and Markets*, has chapters on masonry coatings, automotive paints, coil coatings, marine paints, structural steel coatings, paints for nonferrous metals and Trade Sales Paints for wood substrates as well as many unusual specialties. Particularly noteworthy and unusual are chapters on electrocoating pigmentation of markers such as crayons and pencils, pigmentation of magnetic tapes, textile printing, and pigmentation of ceramics and glass.

Salient chapters in Volume 3 are an extensive discussion by H. S. Ritter of the surface properties of titanium dioxide, including a clear explanation of zeta potential, its significance in dispersions, and how it can be modified. Another excellent chapter is the one by Ruth M. Johnston on color theory including a good discussion of the Munsell system, tristimulus matching, metamerism, and Kubelka-Munk theory. The bibliography for this chapter has 119 references. The chapter by Parker B. Milton on opacity hiding power and tinting strength is also a very thorough and exhaustive treatise with 91 references in the bibliography and discussion of Kubelka-Munk theory relative to opacity. Other good chapters in Volume 3 are those on the nature measurement and characterization of pigment particles and pigment dispersions, pigment surface characteristics, and pigment dispersion and rheology.

The *Pigment Handbook* is a significant contribution to the literature on pigments and their uses in coatings, rubber, plastics, textiles, and ceramics. A copy should be available in the library of anyone concerned with the formulation of products containing pigments. It will be useful to the technician interested in pigment selection as well as to the chemical engineer interested in color theory, hiding power, and dispersion forces.

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Process Optimization, With Applications in Metallurgy and Chemical Engineering, W. H. Ray and J. Szekely, Wiley, New York (1973). 371 pages. $19.95.

This book provides a good broad-stroked introduction to process optimization. The authors set out to write a book to introduce the applied aspects of process optimization to chemical and metallurgical engineers and, at the same time, to provide a ready interface with process modeling which they rightly recognize as being vitally important in practical applications. In order to encompass the broad range of topics in a relatively compact volume, the material is presented as a tool box of computing techniques with a brief sketch of theory followed by one or more illustrative examples. By and large, this approach has succeeded very well, although inevitably the coverage is rather thin at places. For instance, an average reader would probably not gain much insight from the brief discussion of duality in Chapter 2. As a senior or graduate level textbook, instructors may find it necessary to supplement the text with selected reading assignments drawn from the references at the end of each chapter. But the readers will share the intimacy and excitement of the many examples taken directly from the authors' own investigations.

After an excellent introduction of the morphology of the subject, the necessary conditions for optima are developed in Chapter 2. The conditions are used in many worked examples throughout the subsequent chapters. Unconstrained and constrained optimization are treated in Chapters 3 and 4. The material covered in these two chapters is now classic, but brief discussions with references at the end of appropriate sections help to bring to the readers the more recent developments. Chapter 5 discusses techniques for exploiting problem structure in optimization. Both serially structured systems and multilevel optimization are covered in this chapter. A surprising omission is the reference to graph theory-based decomposition techniques, particularly since the very example used in Section 5.6 has in fact been analyzed from that viewpoint in chemical engineering literature.

Chapters 6 and 7 cover trajectory optimization of lumped and distributed parameter systems. This material treated is often omitted in senior undergraduate courses. The last chapter of this book is devoted to a discussion of more complex problems. Although the examples used in this and other chapters are largely of metallurgical origin, they are nonetheless interesting and educational to chemical engineers.

Like many chemical engineering textbooks published in the last 15 years, there is an attempt to make the book self-contained by appending summaries of relevant mathematics used. But one wonders whether an appendix on matrix algebra is any longer necessary since the subject is now included in most undergraduate curricula. The appendix also contains a list of available optimization subroutines which many readers will undoubtedly find useful.

While some may pick faults with the rigor of the treatment, the emphasis on the problem-solving aspects of optimization has provided a unifying theme to the material covered. There is much to be said for this approach since most chemical engineers will be concerned with optimization only as the means to an end. Practicing engineers will find in this book a compact survey of process optimization, unencumbered by mathematical niceties. The perspective developed in this book would help them both to recognize problems and to communicate with experts. It is safe to predict that this book will stimulate a renewed interest and awareness of the potential in process optimization.

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The New Heat Transfer, Eugene F. Adiutori, The Ventuno Press, (1974). 230 + pages. $19.95.

You can't say that the author doesn't warn you. In the Preface: "It is neither a textbook nor a handbook. It is not intended to impress the reader with my erudition or to dumbfound him with mathematics."

No argument so far. Continue. "It is an attempt to describe the new heat transfer and its application to engineers and educators who are familiar with the old heat transfer. . . . Much of this book is at odds with what has been considered accomplished scientific fact for many decades."

So that's what it is: a Manifesto to overturn the Heat Transfer Establishment (HTE). Abolish the heat transfer coefficient! Exile dimensional analysis! Burn your log-log paper! Thus shall we come to the Promised Land, the new dispensation of wisdom, The New Heat Transfer (TNHT), and The New Engineering (TNE).

It is not for this reviewer to prejudge the future of the Revolution, nor have I much spare time or enthusiasm for defending the HTE. But it does seem to me that the author ought to have studied the battlefield and sharpened his weapons before offering battle. Let me offer one example from the process heat exchanger field. (I will let the film cooling and pool boiling HTE's defend their own turf.)

The author disposes of the heat transfer coefficient on the grounds that it is sometimes a function of the temperature difference. Truly, for some processes—nucleate boiling multicomponent condensation, etc.—h is not independent of ΔT. But for most important industrial processes—single and most two-phase forced convection, h is independent of ΔT, or nearly so. And when h's (and therefore the U) are constant, the design integral can be analytically evaluated, once and for all, for a given flow arrangement, giving us the Mean Temperature Difference (MTD) concept and the LMTD configuration correction factor charts.

But the author does not mention this—is he even aware of it? He writes the integral of the heat flux over the heat exchanger, but he does not give an example of how it is to be evaluated, not even a little old countercurrent double pipe. And there is no mention of the MTD.

And when U is not constant? Incredibly enough, the average heat exchanger designer long ago learned to use the technique of flux balancing if all else fails. [An early published example is Colburn and Hougen, *Ind. Eng. Chem.*, **26**, 1178 (1934).] Designers will commit all manner of outrages to avoid flux balancing if they can because it is tedious, and yet this is exactly what Mr. Adiutori would have us do always, on the grounds that it is simpler and more straight-forward. Incidentally, there is no mention of the use of a computer in this book; certain calculations are rejected as impossibly difficult which in fact are utterly trivial in this light.

Now let us admit that heat transfer people sin quite as often as anyone else. (It may be observed that no revolution to date has done much about that except change the definitions.) But the author reacts in a highly nonlinear way, forbidding in TNHT the use of many concepts and techniques of overwhelming value, simply because they are occasionally misused. (Savonarola?!)

Thus, the author rejects dimensional analysis for all because it has been misused by a few. He does not understand its basic validity and its power of generalization and in effect requires us to limit what we can design to what we have already built and tested.

The catalog of counter-arguments to this book could be extended much further, failing which Mr. Adiutori promises to write more books. His unconventional advertising techniques and his strident literary style guarantee that the HTE will not be able to avoid him entirely. However, the HTE has demonstrated its imperviousness to slings and barbs in the past, and I doubt that it will deign to do battle this time either (or even jostle itself into awareness that there might be one).

This, I submit, is unfortuate. Reading TNHT is not a particularly pleasant technical or literary experience, and it certainly didn't convince me of the error of my ways. But it did make me marshal arguments to dispute Mr. Adiutori. This led back to the basic structure of the heat transfer design process and made me a little more aware of how the pieces fit together. I think that is a useful experience for anyone (and a unique one for many) and one which is less likely to be achieved with a more conventional book. It is on this basis that I can recommend that the heat transfer engineer read some of Mr. Adiutori's book, particularly Chapters 1, 2, 3, and 6. Even Karl Marx couldn't ask for anything more than a fair hearing.

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Chemical and Process Technology Encyclopedia, D. M. Considine, (Ed.), McGraw-Hill, New York (1974). 1261 pages. $35.00.

Given the current paper, energy, and money shortages, in the writer's opinion publication of this book represents a disservice to the nation and the world. It represents ample argument for requiring publishers to file an EIS justifying their desecration of forests and streams and adding to the pollution burden. The book aims to provide a "large portion of highly select information" conveniently and economically, which the writer interprets to mean a sort of poor man's Kirk-Othmer. The treatment of the select (whatever that means) information is at a level of sophistication well below the level of a graduate chemical engineer. It is likely that only in that context "the reader will find all the answers he is seeking within this one volume." As to "extensive ref-