
BOOK REVIEWS

The Flammability Handbook of Plastics

Reviewed by Carol L. Brown, The Upjohn Co., Donald S. Gilmore Research Labs., North Haven, CT. Chairman of ASTM Section D20.30.03 on Flammability of Plastics.

REFERENCE: Hilado, C. J., *The Flammability Handbook of Plastics*, 3rd ed., Technomic Publishing Co., Westport, CT, 1982, 191 pp., \$29.00.

This is a basic, introductory guide to the variety of plastics encountered in the world today, to their flammability characteristics, and to the methods of testing available to categorize these characteristics. The book does not intend, nor attempt to delve into the "finer" points of fire science, rather, it presents an overview of the subject as related to plastics.

Types of plastics, discussed by physical as well as chemical classification, are the subject of the opening chapter. Brief descriptions of each classification are given. Tables are included to emphasize sales of plastics, the uses of plastics, and the amount of plastics utilized for each application.

The burning process that occurs during fires of varying magnitude, some of the toxicological effects of combustion on human life, and a listing and description of fire response characteristics are then presented. Again, these chapters are augmented with tables listing such properties as specific heats, decomposition and ignition temperatures, response to various concentrations of gases, heat release, and other properties that can be related to the combustion of plastics.

Hilado then addresses the variety of flammability tests available. Some of these are discussed in greater detail than others. An extensive list of references is included in this chapter which should aid the reader in locating additional needed information.

With this background, the design of the material itself and the consideration of the intended material application are discussed. The subjects of the uses of flame and smoke retardants in plastics are considered, the mechanisms of these additives, and their effects on flammability properties. Criteria for acceptance by building code bodies are explained and some specific classifications for selected markets are listed. Finally, a few pages address product liability.

Each item is discussed briefly in a clear, concise manner. As such, the book can be useful as a quick source of reference to review terminology and to review the variety of test methods currently available. Extensive tables serve as an excellent guide for reference to some of the properties of various types of plastics.

This work is addressed in less than 200 pages, approximately 60% text and 40% tables, necessitating only brief descriptions of each item. This, at times, could become frustrating to the reader, depending upon his background knowledge and areas of interest. For example, in the chapter on flammability tests, some tests are described in detail, others, merely mentioned. Some tests include brief theoretical explanations of mechanism, others do not.

The table of contents lists items clearly, eliminating the need of an index. Not given, however, is a key to the tables which appear

throughout the book. For many, these tables will represent a valuable reference and it would be a decided asset if they could be easily located. It is also surprising that the only references included in this work are those given in the chapter on flammability tests. While perhaps difficult to include, references in other areas would be an added plus, extending the value of this book.

These two items, however, do not distract from the usefulness of this book as a reference source. Anyone involved, directly or indirectly, with the field of plastics should become familiar with its contents and have a copy on hand for reference.

International Progress in Urethanes

Reviewed by John W. Kolditz, senior scientist, Ball Corp., Muncie, IN. Member of ASTM.

REFERENCE: Ashioa, K. and Frisch, K. C., *International Progress in Urethanes*, Technomic Publishing Co., Westport, CT, 1981, 259 pp., \$35.00.

This book is a comprehensive up-to-date text on polyurethanes and polyisocyanurates from Japan. This is appropriate because much research on this type of technology is done by the various chemical corporations there. This book is an anthology of 14 thesis-type papers written on various phases of polyurethane technology. Each chapter has been written independently and stands alone as a separate piece of research.

Each author speaks with great authority on his topic and does a complete experimental procedure reporting the results.

The papers on the chemical reactions of polyurethane include many reactions that are well diagrammed and explained. It would be easy for a polymer chemist to follow the reaction as shown and reach the same like conclusion as the author.

The authors do an excellent job of starting with established state of the art and introducing new work. Finally, each chapter is well referenced.

It should be noted that the chapters do go into great detail and could be confusing to the casual reader. The book is written for the serious polymer scientist who has an interest in urethanes and how the molecules are assembled.

Certain chapters reflect pure research while others lead the reader into applications of the resins, thus, a balance is maintained.

While each chapter is written to stand on its own merit, the book has been organized such that related topics are in the same section. The book devotes the first three chapters to basic polymerization chemistry and the resulting compounds. The next four chapters discuss foams and some of the applications for foam. These chapters give an indication of the extent of the state of the art with foam and some general application of foam. This section also addresses some of the additives used with urethane foam and the property changes resulting from their use.

The book goes into the combustion of urethane and the resulting products of combustion. This is directed to the building industry and safety is stressed.

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The book then closes with some specific uses of urethanes, such as the application of urethane to protect glass bottles upon impact. The uses of polyurethanes as man-made leathers are discussed at some length.

As the book is written as an anthology the reader is not subjected to a single author's bias but has the opportunity to read 14 separate authors. A weakness might be, however, that only Japanese technology is included.

The book accomplishes its purpose in that new state of the art is communicated.

Polymers and Their Properties, Vol. 1

Reviewed by Peter J. Larsen, Lord Corp., Chemical Products Group, Erie, PA. Chairman of ASTM Subcommittee D11.08 on Terminology.

REFERENCE: Hearle, J. W. S., *Polymers and Their Properties*, Vol. 1, Halsted Press, Wiley, New York, 1982, ISBN 0470-27302-X, \$94.95.

Reviewer's Background

My particular discipline is in rubber technology. This includes all phases of compounding and testing. People like me study the polymers that are available and then do to a polymer those things that will make the end product perform as they want it to for a given application. To do this we must have some generalized knowledge of polymer physics and chemistry, although not to the same degree as the polymer chemist, or physicist. We represent, so to speak, the next step in the disciplines that will make a useful product out of polymer materials. While it is true that we will not be so versed in the physics and chemistry of polymers as the polymer scientist, it is equally true that we should be able to understand the polymer chemist if he speaks to us in words that are not strictly the jargon of that specific art. If one is sufficiently skilled in a certain discipline, he should be capable of imparting knowledge of that discipline to someone outside it, particularly one as closely related as ours. However, all too often the effort is never made. Thus, with a few exceptions, scientists of one discipline continue talking only to each other.

Critique

As with most things, this book has its good and bad points. Unfortunately, the negative aspects serve to mask some of the plus factors, making them less apparent. The main drawback appears to be the writing style. The author has failed to take advantage of the tremendous and lucid word pictures that can be "painted" with the English language. The book has a "fog index" [1] of something in excess of 19, which means that the reader would have to be a person who has had that many years of schooling. This would make the audience that would really understand everything being said very small. It is not the majority of people who become involved in 19+ years of schooling, even of a specialized nature. The writing is not

clear and concise. At times it is not even exact, which is something this discipline demands.

When one has a section title that reads, "Why are polymers different?," one wonders, "different from what—each other or other materials?" Also, when one says, "... a simple system for theoretical study would be an isolated polymer molecule—or a collection of them, which would be a polymer gas," it is less than clear. If we *collect* (Webster, "bring together in one body or place"), then we do not have a polymer gas, but a piece of rubber of whatever such a collection makes. A much better word choice would have been *a number of*. Then we would have a polymer gas assuming that only space separates them.

So much of what the author says is understandable only to those like himself who have almost developed a technical jargon whose code cannot be broken by any input from Webster. Sometimes, if you are lucky, the unabridged dictionary will help. The definition in the desk copy of Webster for the word "metastable" was useless. In the unabridged it was somewhat better, but not much.

I had to go to Heinisch's *Dictionary of Rubber* [2] to find out that "Perspex," the word used, was a tradename for a plastic made from polymethylmethacrylate (ICI). The generic name would have been more appropriate and understood by a larger number of people.

With reference to specific questions—references are current—sufficient credit is given for sources of information.

Basically the book is a good one for a relatively small group, polymer chemists, essentially, as a good text book. The drawings and charts generally are good—some are very good. I do not see anything new presented here. It is a good, well organized dissertation on what has developed in the last 30 years or so in this field. It may *impress* those who are outsiders to the discipline but will do very little *expressing*. While the foregoing is true, there surely are those polymer chemists who may not be all the versatile in understanding the mathematical acrobatics that are used to tell too much of the story.

The uninitiated will find the reading heavy, exhausting, and unrewarding. Few will rush to make a purchase.

References

- [1] Gunning, R., *How to Take the Fog Out of Writing*, The Dartnell Corp.
- [2] Heinisch, *Dictionary of Rubber*, Halsted Press, Wiley, New York.

Plastics Materials and Processes

Reviewed by Robert W. Miller, Underwriters Labs., Melville, NY. Vice-chairman of ASTM Committee D-20 on Plastics.

REFERENCE: Schwartz, S. S. and Goodman, S. H., *Plastic Materials and Processes*, van Nostrand Reinhold, New York, 1982, 992 pp., \$89.50.

People working in the plastics industry come from a wide variety of technical backgrounds and levels of knowledge. It is not difficult

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to find a mechanical engineer, polymer chemist, and technician all working together to produce, select, and apply materials for a specific parts. Each has his own area of expertise but, perhaps, only a rudimentary understanding of his co-worker's function. *Plastics Materials and Processes* is a book for persons who want to increase their exposure and knowledge of other phases of polymer production and processing. This is a book that surveys the major aspects of polymer selection and production. It is ideal for students at all levels to obtain an overview of the entire polymer process. Its 992 pages will not make you an expert in any segment of the polymer operation. However, it will provide the basic information necessary for obtaining a solid background. The book includes an encompassing bibliography and reference as part of each section that suggests books and articles to further a reader's knowledge.

The plastics industry can be divided into two major segments covering the: (1) development and production of plastic materials and (2) processing of plastics into fabricated parts. This book attempts to compile the salient parameters of both worlds into a single reference source. It is written in a conversational style and is easy to understand. The book draws upon the many years of the author's industry experience primarily with the Hughes Aircraft Company. Both authors are educators in their own right and they provide a practical, down to earth approach to the subject.

The book starts with a brief history of polymers and presents a timetable of major polymer advances. This is followed by a section on polymer structure and chemistry; the information is presented in a very concise fashion with only broad principles being discussed.

Plastics Materials and Processes contains a good discussion of general purpose, engineering, and specialty plastics; it gives the pros and cons of a wide variety of materials. Each section has a comprehensive list of common tradenames that could be worth the cost of the book itself. There are sections on thermosets, thermoplastics, elastomers, films, fillers, and reinforcements. The major test methods for evaluation plastics are discussed and the authors have included a considerable amount of resin manufacturers' properties in the form of data sheets. The reader must certainly bear this in mind. While the presented data could represent typical properties, a user will need to supplement this information to specify materials and design an acceptable part.

From material testing and property performance, the authors lead us to rheology and molding conditions. Processing is well handled with sections covering injection, extrusion, blow, thermoform, rotational, compression, and transfer molding along with descriptions of foam processes, hand lay-up, or resin spray applica-

tion with fibers. It recommends troubleshooting techniques and procedures for solving processing problems. In the belief that many molding problems can be avoided with a good initial design, the authors have included a section on mold fabrication and engineering part design. Secondary processes are not forgotten; the authors have included a chapter covering fasteners and the joining of plastics with particular emphasis upon adhesives.

Plastics Materials and Processes is an application oriented book. It strives to guide the user through material and process selection to achieve a cost-effective and functionally designed part. This is a book for both neophytes and well experienced persons, and should be a welcome addition to the library of any polymer technologist, engineer, or scientist.

Research Techniques in Nondestructive Testing, Vol. 5

Reviewed by Richard B. Moyer, Carpenter Technology Corp., Reading, PA. Chairman of ASTM Committee E-7 on Nondestructive Testing.

REFERENCE: Sharpe, R. S., Ed., *Research Techniques in Nondestructive Testing, Vol. 5*, Academic Press, London, 1982, ISBN 0 12 639055 X, \$58.00.

Practitioners in the art/science of nondestructive testing have come to regard the publication of another volume in Roy Sharpe's series, *Research Techniques in Nondestructive Testing*, in the same manner as the coming of spring. These books hold promise of new and exciting things to come. The only negative aspect of this issue is its size, containing about 60% of the number of articles in previous volumes. Perhaps we can be encouraged in the thought that the next edition might be published sooner.

The organization of two articles on radiography, three on ultrasonics, one on eddy currents and thermal testing each, plus one on defect significance provides something of interest for all concerned with nondestructive testing whether his focus is research, materials, or inspection.

The unifying theme tying all the articles appears to be the application of nondestructive testing to the detection or assessment of defects for the determination of structural integrity. These articles are another step in lifting nondestructive testing closer to being a quantitative science and less an empirical art.