

book review

Handbook of Polymeric Foams and Foam Technology

D. Klempner and K. C. Frisch (Eds)
Carl Hanser Verlag, Munich, 1991,
454 pages, £87.00
ISBN 3-446-15097-8

This handbook claims to cover all aspects of foam science, but in reality concentrates on the chemistry of preparation of various types of foams, and the processes used for their production. The first three chapters (46 pages) are a general consideration of foams while the remaining 14 chapters (360 pages) are considerations of specific polymer systems.

This book was based on an American Gordon conference, so there are many authors, all but one employed by US or German foam manufacturers. The exception is Dr Shutov of the Illinois Institute of Technology who contributes three chapters. The editors merely contribute a 4-page introduction to the subject. The contributions are varied in length, approach and the use of illustrations. The failure of the editors to achieve uniformity and to avoid overlap between contributions is a major drawback of this book. The illustrations are mainly simple line drawings with relatively few photographs. The use of two colours, as in Schwarz and Ebeling's book 'Kunststoffe Verarbeitung' (1991) would have been of great benefit for the process diagrams.

As this book is so expensive it must be weighed against the existing books in the area, and published conference proceedings. It claims to be valuable for scientists, technicians and students. One group for which it certainly is not suitable is students, in spite of the claim that it can be used as a textbook for a course on foams. The catalogue approach to the subject and the lack of analysis of the underlying principles makes it totally unsuitable as a textbook. It is also unlikely

to be useful for technicians as there is no attempt to explain the basic concepts simply.

For scientists working in foam industries, there are rival specialist books for certain polymer foams. The authors of the chapters on polyurethanes make reference to Oertel's 'Polyurethane Handbook' (1985), which is far more comprehensive and better written. Similarly the structure-property relationships in polyethylene foams have been described at length in Benning's two-volume 'Plastic Foams' (1969). Nevertheless there is no other recent encyclopaedic treatment of all classes of foams, and the longer chapters provide a convenient review of the current technology.

Where I feel the book fails is in the chapters which attempt to bring the contributions together. Chapter 2 on the fundamentals of foam formation by Saunders is only 11 pages long, so is unable to critically analyse the physical theories of bubble nucleation, growth and stabilization. Chapter 3 on the cellular structure and properties of foamed polymers by Shutov is longer at 28 pages but it is far less successful at explaining the geometry of cells than the contributions in 'Mechanics of Cellular Plastics' edited by Hilyard in 1982. Shutov emphasizes the Gas Structural Element (this may be a concept from his earlier Russian books on foams) but he then does not use it, nor do any of the other authors. The diagrams in this section are poor and there is only a half page SEM micrograph of foam microstructures.

I expected the book to live up to its claim of exploring the structure-property relationships in foams but, apart from a couple of chapters, was sadly disappointed. This is a pity when a good start on the cell structure-mechanical property area has been made in Gibson and Ashby's book 'Cellular Solids' (1988), which incidentally is much cheaper. If the reader did not already know about the microstructure of bulk polymers he/she would not realize that some of the

foams were semicrystalline thermoplastics, whereas others were glassy or rubbers.

There is mention of the application areas of foams but no discussion of the selection of the best type of foam for a particular application, or the choice of the density of the foam as part of the engineering design of products (car seats, packaging foams, etc.). The topic of cushion curves, which are used in the design of packaging, is mentioned in the chapters on polystyrene and polyethylene foam, but there is no proper exposition of how to use them or even how the tests are carried out. Therefore the handbook can hardly be said to cover the engineering design of foam products.

The thermal properties of foams are prominent in this book, but the material is scattered. Shutov gives it greater prominence (6 pages) in Chapter 3 than mechanical properties, but it would be far more satisfactory if this material was collected into a single chapter. In contrast, the fire resistance of foams is played down and the tests for fire resistance are only mentioned briefly in the chapter on polyisocyanurate foams.

Judging from the session titles in the conference 'Cellular Polymers II' held at the Heriot-Watt University in March 1993, current research areas in the foam industry include recycling and environmental concerns. There are two sentences on recycling in this book while the use of CFCs for the foaming process is discussed at length. This suggests either that there may have been some time delay between the Gordon conference and the appearance of this book, or that European laws in these areas are more stringent than those of the USA.

I would not recommend this book for individual purchase, because of the lack of an overall view of these important materials. If your interests are in the chemistry of the foaming process and polymerization, the coverage of particular polymers may justify a library purchase.

N. J. Mills
University of Birmingham