development of the lecture materials. The overall project was managed by D. A. Crowl.

The course outline is shown in Table 1. It is divided into two major parts. The first part presents the fundamentals of safety and includes discussions of toxicology, fire, explosion, and toxic release. The second part deals with using those fundamentals in practice and includes a discussion of "designing for safety" and using various safety review procedures (such as hazards and operability studies). The course also includes a discussion on case histories and accident investigations.

The outlines for the five video lectures are shown in Tables 2 through 6. Except for video session 4, the videos are not dependent on the lecture material. The emphasis of the videos was to show the students how safety is practiced on real process equipment. The fourth video lecture on "Experiments for Safety" required some fundamental lecture material prior to broadcast.

SUMMARY

This paper has presented both the industrial and university perspectives regarding the need for teaching safety in the chemical engineering undergraduate curriculum. We have also presented one approach to teaching safety and loss prevention. As a result of NSF support we had a unique opportunity to bring the students into an operating chemical pilot plant, through the use of live TV.

We hope that this approach, and others, will improve the engineers of the future and result in safer chemical process plants.

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ChE book reviews

INTRODUCTION TO POLYMER VISCOELASTICITY, Second Edition

by John J. Aklonis, William J. MacKnight
John Wiley & Sons, Somerset, NJ 08873; $39.95 (1983)

Reviewed by Albert Co
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This book introduces various fundamental concepts in studying the viscoelastic behavior of polymers, with an emphasis on the molecular approach. The book consists of nine chapters.

Chapter 1 introduces the reader to several experiments that display the viscoelastic nature of polymers. In Chapter 2, viscoelastic material properties in transient and oscillatory experiments are defined and are illustrated clearly with simple experiments. The Boltzmann superposition principle is stated; its applications in relating the creep compliance and the stress relaxation modulus and in relating transient and oscillatory properties are demonstrated.

In Chapter 3 the regions of viscoelastic behavior are described and the effects of molecular weight, crystallinity, and plasticizing agents are explained. The concept of time-temperature superposition, the master curves, and the WLF equation are then presented. In Chapter 4, the phenomenon of glass transition is examined, and explanations based on free volume, thermodynamics, and kinetic theories are presented. The effects of structural parameters on glass transition temperature and the relaxation occurring in the glassy state are rationalized in terms of molecular motion and chain mobility. In preparing the reader for subsequent chapters, the statistics of a polymer chain are reviewed in Chapter 5.

In Chapter 6, various treatments of rubber elasticity and the structural factors that affect rubber elasticity are discussed. In Chapter 7, the behavior of typical mechanical models is analyzed and the Rouse-Zimm molecular theories for polymer solutions are discussed. Extensions of these molecular theories to bulk polymers are then considered and the reptation theories are briefly described. In Chapters 8 and 9, the phenomena of dielectric relaxation and chemical stress relaxation are examined, respectively.

Throughout the book, the mathematical treatments are maintained at a level comfortable for undergraduates. Advanced mathematics required for the discussion of a subject matter are elaborated in the corresponding appendices. The problems at the end of each chapter range from simple calculations to advanced problems requiring a certain degree of mathematical sophistication. Readers will find the solutions located at the end of the book to be helpful.

Overall, this book is an excellent introduction to polymer viscoelasticity. However, the treatise is restricted to amorphous polymers. The treatment on crystalline polymers is very limited, and topics such as solution behavior, melt rheology, and birefringence are not covered. Nevertheless, it is a good choice as a textbook for one of a series of courses on polymer viscoelasticity. □