Preface

Use of polymeric foam in today's technology continues to grow at a rapid pace throughout the world. Numerous reasons for this growth include light weight, excellent strength/ weight ratio, superior insulating abilities, energy absorbing performance (including shock, vibration, and sound), and comfort features of polymeric foams.

Foams can be prepared from virtually any polymer; all that is necessary is the introduction or generation of a gas within the polymer matrix. Selection of polymers suitable for industrial foam applications depends upon their properties, their ease of manufacture, and the economics of the foaming system.

Polymeric foams comprise a wide variety of materials, with densities ranging from as low as 1.6 kg/m^3 to 960 kg/m^3 (0.1 pounds per cubic foot (pcf) to 60 pcf). Their main applications include furniture, transportation, bedding, carpet underlay, packaging, textiles, toys and novelties, gaskets, sports applications, shoes, shock- and sound absorbing applications (automobiles, shoe inserts, etc.), insulation, appliances, flotation, decorative moldings, food and drink containers, and business machine housings, among others. Lowest density foams are used in packaging applications and refrigeration insulation, while higher density foams are used for load-bearing structural applications.

Foams are usually classified as flexible, semi-flexible (semi-rigid), or rigid, and can be fabricated to any desired degree of hardness. They can be manufactured by a variety of processes, depending on the application. Typical processing methods include continuous slabstock, pour-in-place, molding, spraying, and lamination.

Since the previous edition of this book over a decade ago, many of the industry's most pressing problems, which include environmentally acceptable blowing agents, combustibility and solid waste disposal, have been addressed and significant progress has been made. However, these are still ongoing challenges and continue to be the focus of many development studies. In particular, while there are numerous effective flame retardants for foams, some of these, in particular the brominated ones, are facing phaseouts in certain places because of health effects. It is clear that flame retardance is still an issue, especially in light of proposed legislation concerning combustibility of furniture foams. Concerning blowing agents, even though the ozone-depleting CFC's and HCFC's have, for the most part, been phased out and replaced with other blowing agents such as carbon dioxide, hydrocarbons and HFC's, there is still need for continuous development of other blowing agents with zero ozone-depletion and global warming consequences as well as low flammability and low thermal conductivity. Although advances in recycling of foams have occurred in the past decade, solid waste disposal continues to be a challenge.

This handbook covers the major classes of polymeric foams and discusses their chemistry, properties (and relation to structure), preparation methods including commercial processes, and applications. Fundamental aspects of foam are discussed in the first three chapters. Specific classes are discussed in Chapters 4 to 17, and include polyurethanes and isocyanate-based polymeric foams, polystyrene, polyolefins, poly(vinyl chloride), epoxy, urea-formaldehyde, latex rubber, silicones, fluoropolymers, and syntactic foams. The final chapter discusses blowing agents for polymer foams.

Information here should interest both industrial and academic scientists and engineers who are engaged in research, basic and applied development, and production of polymeric foams of all types. In addition, individuals engaged in marketing of foams or foam raw materials will find this book of practical value. It can also be used as a textbook for a course on polymeric foams.

The editors hope that this book will stimulate creative thinking and development of new technologies, types of foams, processes, and applications.

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