SYMPOSIUM ON STABILIZATION OF POLYMERS

INTRODUCTION

Certainly one of the most critical parameters of polymer technology is that of stability of properties and appearance in service. Much effort has been devoted to the study of various aspects of the stabilization of organic polymers. The progress to date in obtaining increased stability in several commercial polymer systems has been considerable. In light of these achievements, it might be surprising to some that the interest and activity in stabilization research is increasing at a rapid pace. Much impetus for further investigation and continued advancement in this area has come, however, from growing interest in extending the use of polymers as true materials of construction. The movement of polymeric materials into structural applications has brought into even sharper focus the need for better stabilization methods to extend useful performance life under conditions which include a number of potentially degrading environmental factors. Furthermore, the complexities of polymer stabilization are to be met not only in applications involving terrestrial environments. Recently, considerable pressure for more effective stabilization has come from interest in applying lightweight polymeric materials for reliable structural service in the diverse environments of space.

Despite the fact that much effort has been devoted to research in polymer stabilization, four general comments can be made:

Stabilization through the use of additives is still highly specific with regard to polymer type.

Mechanisms of polymer degradation and of stabilization are at best only partially understood.

Many of the combined effects of degrading environments have not been sufficiently investigated and related to polymer performance.

We cannot yet design polymer architectures possessing inherently all of the necessary stability in proper balance with desired functional properties and processability.

The necessity for a better understanding of the complex problem of polymer stabilization has, therefore, become more acute as polymeric materials find increased usage in more critical applications. The research efforts reported on in the following papers contribute significantly to this understanding as they touch upon a number of vital aspects of the total problem. Included are considerations of the specificity of stabilizer types in the ultraviolet light stabilization of various plastics by Strobel and Catino. An interesting review of possible mechanisms for loss of stabilizer effectiveness is included in this work. The work by Neureiter and Bown on investigation of mechanisms for stabilizing polyolefins against thermally induced oxidation is an excellent example of the current trend toward more fundamental approaches to solution of practical stabilization problems. The importance of greater understanding of the precise nature of various degrading environments in relation to polymer stability performance is brought out in the papers by Melchore and Garner and Papillo. This becomes especially critical in the design of reliable accelerated test methods for predicting long-term polymer stability and stabilizer performance. The necessity of considering the temperature effect in accelerated testing of ultraviolet light–stabilized polymers is also brought out in the work by Melchore. Finally, the work by FitzGerald and Stehle serves to illustrate a principal factor in stabilization of polymeric materials in general. That is, quite often the ultimate effectiveness of a stabilizer system will be decreased significantly by the countereffect of trace contaminants in the polymeric material which act as powerful degradation promoters. The presence of unknown contaminants, picked up in the polymerization process or during fabrication, may in many cases have caused considerable distortion in our understanding of the inherent stability performance of a given polymer material.

In conclusion, we hope that bringing together the several papers on the broad subject of polymer stabilization will serve to focus attention on the importance of developments in this area. In this way, further stimulus may be provided for constructive thinking on this important topic.

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