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# Long-Term Properties of Polyolefins

**Volume Editor: Ann-Christine Albertsson**

With contributions by

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## Preface

We dedicate the current volume entitled “Long-Term Properties of Polyolefins” to Professor Kausch on his 25th anniversary as editor of *Advances in Polymer Science*. Professor Kausch pioneered the work on molecular effects in the fracture of polymers. This is beautifully summarized in his books on polymer fracture. Professor Kausch is also the perfect gentleman – always eager to help newcomers to make their entrance into the scientific community and to assist his colleagues in their work and accomplishments. With his work, Professor Kausch has demonstrated the importance of “source science” – to present new data – and to present reviews of previously published material. This book is presented in the spirit of Professor Kausch, namely showing a good selection of data and explaining what they mean.

The main focus of this book is the relation between structure and properties and the trend towards better quality and reproducibility. The first chapter describes the metallocene polymerisation catalysts and their possibility not only of tailoring polymer properties but also of manufacturing entirely new materials. Due to improved control of microstructure, it will also be possible to produce specialty polyolefins which could compete with non-olefinic polymers. The next chapter shows how in each new development step catalyst and process innovations have gone hand in hand and how the control over polymer structure and the ability to tailor material properties has increased. For a better understanding of properties and behaviour, the basic of morphology is fundamental and is described in chapter three, followed by chapter four about fracture properties and microdeformation behaviour. Promising model systems for the investigations of the relations between crack-tip deformation, fracture and molecular structure are also presented. Chapter five gives an overview of stabilization of polyethylene crucial for long-term properties. Two main approaches have been used; the first advocates the use of biological antioxidants, and the second relies on the use of reactive antioxidants that are chemically attached onto the polymer backbone for greater performance and safety.

Chemiluminescence is presented as a tool for studying the initial stages in oxidative degradation and is explained in chapter six. However, for many years, tailor-made structures specially designed for environmental degradation have also been a reality. One of the key questions for successful development and use

of environmentally degradable polymers is the interaction between the degradation products and nature and this is illustrated in chapter seven. The development of chromatographic methods and use of chromatographic fingerprinting gives not only degradation products but also information about degradation mechanisms as well as interaction between the polymer and different environments. The obstacles and possibilities for recycling of polyolefins are discussed in chapter eight with special emphasis on analytical methods useful in the quality concept. It is also shown how recycled material could be a valuable resource in the future together with renewable resources. Finally, chapter nine gives examples of existing as well as emerging techniques of surface modification of polyethylene.

These chapters together will hopefully inspire to a new generation of polyethylene by mimicking nature and use of new molecular architecture, new morphology and also “activated” additives in microdomains, with even more reproducible properties within narrow limits and with predetermined lifetimes.

January, 2004

Ann-Christine Albertsson



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