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Preface

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Engineering Biopolymers

Markets, Manufacturing, Properties and Applications

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# Preface

The biopolymer group of materials are not an entirely new type of material. Instead they are innovative polymer materials within the well-known class of plastics materials. Thus the very same relationships obtain between their microstructures and macroscopic processing, use and disposal properties as have been known from conventional plastics for a long time.

This book is intended to contribute to our understanding for innovative biopolymers as technical materials. In contrast to most of the book published previously on this topic, biopolymers will be comprehensively presented in the framework of this book from the perspective of materials engineering. With a view to the practical application as polymer materials, the engineering property profiles of the biopolymers will be described in detail by comparing them with conventional plastics. In addition to processing and use properties, the descriptions will include manufacture, chemical structure, microstructure, specific and meanwhile multifarious test standards as well as the corresponding regulatory circumstances and disposal properties of biopolymers within the topical context of sustainability.

In order to simply the interested user's ultimate search for suitable biopolymer materials and to ease contact with materials manufacturers, this book also contains an extensive description of the market in terms of the various commercially available biopolymer materials, their manufacturers and processors.

In the early 1980s, the newly developed biopolymers went through a euphoric phase as the future polymer materials independent of crude oil. However, since the materials properties were still unproven and the price:performance ratio of this first generation of biopolymers was sobering, the euphoria soon cooled off and was followed by the further development and/or optimization of the innovative biopolymer materials. In recent years, what is now the second generation of further developed biopolymers has meanwhile experienced dynamic, annual double-digit growth.

In Europe and America, developmental work and consequently also the use of biopolymer materials have concentrated also exclusively on the field of compostable packaging and other short-live products.

Starting in Asia, and meanwhile in Europe and USA as well, the availability issue for the raw materials used for biopolymers is increasingly supplanting compostability as the priority disposal option. For the third generation, instead of biodegradable materials, biobased and durable materials are being developed for engineering applications outside the field of packaging, too, e.g., for the automotive and textile industries.

There are virtually no data available yet on the long-term properties of biopolymers (e.g. creep resistance, stress relaxation, UV resistance, fatigue behavior, thermal resistance).

Also in terms of industrial processibility and the relevant rheological processing data, the information in the area of biopolymers is sketchy from the perspective of polymer engineering.

Since there is a strong competitive attitude among biopolymers manufacturers, till today there are hardly no concerted efforts to collect and provide uniform, comprehensive and comparable materials information in the same place – as is the case for conventional plastics.

Parallel and supplementary to this book, a databank has been developed for biopolymers in cooperation with the M-Base Engineering + Software GmbH in analogy to the internationally known Campus polymer databank for conventional plastics. Since the end of 2009, it presents the properties of innovative, commercially available biopolymers as completely and comparably as possible. Nearly all biopolymers available on the market have been characterized by the authors according to the corresponding test standards. Some results from these investigations are already included in this book in condensed form.

In terms of materials development, biopolymers are still in their early phase. Future materials developments will, as they did with conventional plastics, not only concentrate on new monomers or innovative polymers, but also increasingly on the further development of existing polymers by generative co- and terpolymers, blending and additivizing. To this end, the extensive existing experience in the field of conventional plastics can and should definitely be reverted to.

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