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Advances in Polymer Science

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Aims and Scope

The series Advances in Polymer Science presents critical reviews of the present and future trends in polymer and biopolymer science. It covers all areas of research in polymer and biopolymer science including chemistry, physical chemistry, physics, material science.

The thematic volumes are addressed to scientists, whether at universities or in industry, who wish to keep abreast of the important advances in the covered topics.

Advances in Polymer Science enjoys a longstanding tradition and good reputation in its community. Each volume is dedicated to a current topic, and each review critically surveys one aspect of that topic, to place it within the context of the volume. The volumes typically summarize the significant developments of the last 5 to 10 years and discuss them critically, presenting selected examples, explaining and illustrating the important principles, and bringing together many important references of primary literature. On that basis, future research directions in the area can be discussed. Advances in Polymer Science volumes thus are important references for every polymer scientist, as well as for other scientists interested in polymer science - as an introduction to a neighboring field, or as a compilation of detailed information for the specialist.

Review articles for the individual volumes are invited by the volume editors. Single contributions can be specially commissioned.

Readership: Polymer scientists, or scientists in related fields interested in polymer and biopolymer science, at universities or in industry, graduate students.

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Martin D. Hager • Sybrand van der Zwaag •
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Editors

Self-healing Materials

With contributions by

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Preface

Self-healing materials, and in particular self-healing polymers, have been intensively investigated over the past 15 years. Several approaches and material systems have been developed, resulting in materials capable of dealing with damage events. In contrast to "classical" materials, the original properties and functionalities of self-healing materials are (partially) restored without significant human intervention. These materials – reminiscent of a science fiction dream – promise high potential for the future, enabling longer life times, reduced maintenance (time and costs), and increased safety.

This volume "Self-healing materials" covers the present state-of-the-art knowledge about different classes of self-healing materials. The first part is devoted to self-healing polymers and presents the main approaches for achieving self-healing: reversible covalent bonds and supramolecular interactions. Two chapters are dedicated to the characterization of these materials and to the modeling of their behavior and properties. The next four chapters deal with applications of self-healing polymers: self-healing sol–gel coatings, encapsulated healing agents for anticorrosion, functional polymeric materials, and self-healing asphalt motorways. Chapters on the relationship between polymer architecture and healing are followed by a chapter on characterization and quantification methods for healing in polymers. Quite unusual for *Advances in Polymer Science*, the final three chapters are not devoted to polymeric materials but could serve as a source of inspiration for the development of novel self-healing polymers. Besides the biological archetypes, bacterially based self-healing concrete and self-healing in metals are discussed.

This special volume on self-healing materials would not have been possible without the excellent contributions from many scientists. We want to express our gratitude to them for sharing their scientific point of view on different aspects of self-healing materials.

We hope that this volume will contribute to the further development not only of self-healing polymers, but also of other material classes that can help to bridge borders between the different disciplines. We are curious to see what novel materials, characterization techniques, and applications will open up in the future.

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