

Desk Reference of
**Functional
Polymers**

Syntheses and Applications

Edited by
Reza Arshady

Desk Reference of Functional Polymers

Syntheses and Applications

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American Chemical Society, Washington, DC



Library of Congress Cataloging-in-Publication Data

Desk reference of functional polymers: syntheses and applications / Reza Arshady, editor.

p. cm.— (ACS Professional reference book)

Includes bibliographical references and index.

ISBN 0-8412-3469-8 (alk. paper)

1. Polymerization. 2. Polymers.

I. Arshady, R. (Reza) II. Series: ACS professional reference book.

QD281.P6D47 1996
668.9—dc21

96-39093
CIP

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Preface

This book was conceived as a comprehensive reference volume on functional polymers for emerging technologies. The term “functional polymers” signifies a broad area of polymer science and engineering involving the design, synthesis, and study of macromolecular materials of increasing structural sophistication and complexity useful for a wide range of chemical, physicochemical, and biomedical processes. “Emerging technologies” are also broadly understood to include new technological developments, beginning at the forefront of conventional industrial practices and extending into anticipated and speculative industries of the future.

With these broad descriptions in mind, a glance through the pages of science and engineering literature shows that the use of functional polymers for emerging technologies represents one of the most active areas of research and development throughout the fields of chemistry, physics, life sciences, and related technologies. In addition to being of technological interest, the subject of functional polymers is a fascinating area of interdisciplinary research and a major source of inspiration and motivation in its own right.

The scope of the present book thus extends far beyond emerging technologies per se. It presents a wealth of new ideas in the design, synthesis, and study of sophisticated macromolecular structures. The conception of the book was based as much on the serendipity of these new ideas as on the need to offer blueprints for the design of functional polymer devices for emerging technologies.

The book contains 42 chapters, logically organized into five parts:

Part One: General Synthetic Methods

Part Two: Radiation Effects and Applications

Part Three: Optoelectronic Properties and Applications

Part Four: Chemical and Physicochemical Applications

Part Five: Biomedical Applications.

Part One introduces a wide selection of functional polymers, their syntheses, properties, and numerous current and potential applications that they relate to. Various topics covered in Part One include a Japanese open-and-shut case, a

stretcher of ladders to ribbons, enzymic synthesis, Ziegler–Natta and living ionic polymerizations, as well as functional polymers based on chloromethylstyrene, germylene, stannylene, silicon, polyamines, polyacids, organometallics, and naturally occurring polymers (cellulose, chitin, chitosan, and gelatin).

Part Two is devoted to photochemistry and photocross-linking of functional polymers, microlithography, and ion implantation. Part Three relates to photophysics of functional polymers, chiral liquid crystalline (LC) polymers, LC networks, and polymers with electrical conductivity, optical conductivity, and non-linear optical behavior. Part Four discusses the use of functional polymers for electron and energy transfer processes, solar energy utilization, chemical sensors, selective flocculation of minerals and chemical synthesis, and catalysis. Part Five focuses on the biomedical uses of polymers such as poly(hydroxyethyl methacrylate) (PHEMA), polyurethanes, plasma-treated commodity polymers, polymeric dental aids, polymer–drug conjugates, and liposomes.

The choice of material for a book of this nature is inevitably influenced by a complex set of judicial and practical factors, and hence the outcome could hardly be expected to be ideal. Thus, to the extent that the chosen topics in the book are consistent and cohesive, I am greatly indebted to the efforts and courtesy of all the contributors who keenly agreed to my revisions (and in some cases re-writing) their chapters. I am also grateful to David Phillips and Maurice H. George (Imperial College, London) for their encouragement and support, and to Gary Rumbles (Imperial College, London) for reading some of the chapters in Part Three. I also wish to thank Robert A. Weiss (University of Connecticut, Storrs, CT) for encouraging the conception of the book.

The publication of the book took somewhat longer than had been planned because of events beyond my control, but independent reviewers assure me that the book will be a rich source of information for some years to come. It had been anticipated that the book would contain a comprehensive overview, and shorter overviews for each of the five parts, presenting an overall picture of the subject of functional polymers at the forefront of emerging technologies, and outlining their general features, potentials, and limitations, but these were omitted because of unexpected processing difficulties. However, considerable effort has been made from the outset to ensure that each individual chapter is self-contained, as far as practicable, with the necessary background information about the functional polymers and emerging technologies discussed, and anticipating future potentials and prospects of these polymers and technologies.

The book contains contributions from polymer scientists from around the world. My hope is that these contributions represent the flavor and fascination of the whole field of functional polymers, their synthesis, properties, and current and potential uses in emerging technologies in chemistry, engineering, biotechnology, and medicine.

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