

151

Advances in Polymer Science

Editorial Board:

**A. Abe · A.-C. Albertsson · H.-J. Cantow · K. Dušek
S. Edwards · H. Höcker · J. F. Joanny · H.-H. Kausch
T. Kobayashi · K.-S. Lee · J. E. McGrath
L. Monnerie · S. I. Stupp · U. W. Suter
E. L. Thomas · G. Wegner · R. J. Young**

Springer

Berlin

Heidelberg

New York

Barcelona

Hong Kong

London

Milan

Paris

Singapore

Tokyo

New Developments in Polymer Analytics II

Volume Editor: M. Schmidt

With contributions by
W. Köhler, R. Schäfer, S. S. Sheiko



Springer

This series presents critical reviews of the present and future trends in polymer and biopolymer science including chemistry, physical chemistry, physics and materials science. It is addressed to all scientists at universities and in industry who wish to keep abreast of advances in the topics covered.

As a rule, contributions are specially commissioned. The editors and publishers will, however, always be pleased to receive suggestions and supplementary information. Papers are accepted for „Advances in Polymer Science“ in English.

In references Advances in Polymer Science is abbreviated Adv. Polym. Sci. and is cited as a journal.

Springer APS home page: <http://link.springer.de/series/aps/> or

<http://link.springer-ny.com/series/aps>

Springer-Verlag home page: <http://www.springer.de>

ISSN 0065-3195

ISBN 3-540-66078-X

Springer-Verlag Berlin Heidelberg New York

Library of Congress Catalog Card Number 61642

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in other ways, and storage in data banks. Duplication of this publication or parts thereof is only permitted under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 2000

Printed in Germany

The use of registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

Typesetting: Data conversion by MEDIO, Berlin

Cover: E. Kirchner, Heidelberg

SPIN: 10706200 02/3020 - 5 4 3 2 1 0 - Printed on acid-free paper

Volume Editor

Prof. Manfred Schmidt
Institute of Physical Chemistry
University of Mainz
D- 55099 Mainz, FRG
E-mail: mschmidt@mzdmza.zdv.uni.mainz.de

Editorial Board

Prof. Akihiro Abe
Department of Industrial Chemistry
Tokyo Institute of Polytechnics
1583 Iiyama, Atsugi-shi 243-02, Japan
E-mail: aabe@chem.t-kougei.ac.jp

Prof. Ann-Christine Albertsson
Department of Polymer Technology
The Royal Institute of Technology
S-10044 Stockholm, Sweden
E-mail: aila@polymer.kth.se

Prof. Hans-Joachim Cantow
Freiburger Materialforschungszentrum
Stefan Meier-Str. 21
D-79104 Freiburg i. Br., FRG
E-mail: cantow@mfz.uni-freiburg.de

Prof. Karel Dušek
Institute of Macromolecular Chemistry, Czech
Academy of Sciences of the Czech Republic
Heyrovský Sq. 2
16206 Prague 6, Czech Republic
E-mail: office@imc.cas.cz

Prof. Sam Edwards
Department of Physics
Cavendish Laboratory
University of Cambridge
Madingley Road
Cambridge CB3 0HE, UK
E-mail: sfe11@phy.cam.ac.uk

Prof. Hartwig Höcker
Lehrstuhl für Textilchemie
und Makromolekulare Chemie
RWTH Aachen
Veltmanplatz 8
D-52062 Aachen, FRG
E-mail: 100732.1557@compuserve.com

Prof. Jean-François Joanny
Institute Charles Sadron
6, rue Boussingault
F-67083 Strasbourg Cedex, France
E-mail: joanny@europa.u-strasbg.fr

Prof. Hans-Henning Kausch
Laboratoire de Polymères
École Polytechnique Fédérale
de Lausanne, MX-D Ecublens
CH-1015 Lausanne, Switzerland
E-mail: hans-henning.kausch@lp.dmx.epfl.ch

Prof. Takashi Kobayashi
Institute for Chemical Research
Kyoto University
Uji, Kyoto 611, Japan
E-mail: kobayash@eels.kuicr.kyoto-u.ac.jp

Prof. Kwang-Sup Lee
Department of Macromolecular Science
Hannam University
Teajon 300-791, Korea
E-mail: kslee@eve.hannam.ac.kr

Prof. James E. McGrath

Polymer Materials and Interfaces Laboratories
Virginia Polytechnic and State University
2111 Hahn Hall
Blacksbourg
Virginia 24061-0344, USA
E-mail: jmcgrath@chemserver.chem.vt.edu

Prof. Lucien Monnerie

École Supérieure de Physique et de Chimie
Industrielles
Laboratoire de Physico-Chimie
Structurale et Macromoléculaire
10, rue Vauquelin
75231 Paris Cedex 05, France
E-mail: lucien.monnerie@espci.fr

Prof. Samuel I. Stupp

Department of Measurement Materials Science
and Engineering
Northwestern University
2225 North Campus Drive
Evanston, IL 60208-3113, USA
E-mail: s-stupp@nwu.edu

Prof. Ulrich W. Suter

Department of Materials
Institute of Polymers
ETZ, CNB E92
CH-8092 Zürich, Switzerland
E-mail: suter@ifp.mat.ethz.ch

Prof. Edwin L. Thomas

Room 13-5094
Materials Science and Engineering
Massachusetts Institute of Technology
Cambridge, MA 02139, USA
E-mail: thomas@uzi.mit.edu

Prof. Gerhard Wegner

Max-Planck-Institut für Polymerforschung
Ackermannweg 10
Postfach 3148
D-55128 Mainz, FRG
E-mail: wegner@mpip-mainz.mpg.de

Prof. Robert J. Young

Manchester Materials Science Centre
University of Manchester and UMIST
Grosvenor Street
Manchester M1 7HS, UK
E-mail: robert.young@umist.ac.uk

Preface

The two volumes "New Developments in Polymer Analytics" deal with recent progress in the characterization of polymers, mostly in solution but also at surfaces. Despite the fact that almost all of the described techniques are getting on in years, the contributions are expected to meet the readers interest because either the methods are newly applied to polymers or the instrumentation has achieved a major breakthrough leading to an enhanced utilization by polymer scientists.

The first volume concentrates on separation techniques. H. Pasch summarizes the recent successes of multi-dimensional chromatography in the characterization of copolymers. Both, chain length distribution and the compositional heterogeneity of copolymers are accessible. Capillary electrophoresis is widely and successfully utilized for the characterization of biopolymers, particular of DNA. It is only recently that the technique has been applied to the characterization of water soluble synthetic macromolecules. This contribution of Grosche and Engelhardt focuses on the analysis of polyelectrolytes by capillary electrophoresis. The last contribution of the first volume by Coelfen and Antonietti summarizes the achievements and pitfalls of field flow fractionation techniques. The major drawbacks in the instrumentation have been overcome in recent years and the "triple F techniques" are currently advancing to a powerful competitor to size exclusion chromatography.

The second volume starts with the introduction of a fascinating new technique developed by Köhler and Schäfer to monitor different averages of the Brownian diffusion coefficient of polymers in solution exhibiting a broad molar mass distribution. The technique is based on a scattering experiment by thermal grating, thus simultaneously monitoring Brownian and thermal diffusion of macromolecules. The last contribution by Sheiko addresses recent advances in atomic force microscopy. Besides some theoretical and experimental background the visualization of single macromolecules is discussed and complemented by the characterization and the patterning of surfaces.

Mainz, April 1999

Manfred Schmidt

Contents

Polymer Analysis by Thermal-Diffusion Forced Rayleigh Scattering W. Köhler, R. Schäfer	1
Imaging of Polymers Using Scanning Force Microscopy: From Superstructures to Individual Molecules S. S. Sheiko	61
Author Index Volumes 101–151	175
Subject Index	187

Contents of Volume 150

New Developments in Polymer Analytics I

Volume Editor: M. Schmidt

Hyphenated Techniques in Liquid Chromatography of Polymers

H. Pasch

Field-Flow-Fractionation Techniques for Polymer and Colloid Analysis

H. Cölfen, M. Antonietti

Capillary Electrophoresis in Polymer Analysis

H. Engelhardt, O. Grosche