



PROGRESS IN COLLOID & POLYMER SCIENCE

Editors: H.-G. Kilian (Ulm) and G. Lagaly (Kiel)

---

Volume 91 (1993)

**Application  
of Scattering Methods  
to the Dynamics  
of Polymer Systems**

Guest Editors:

B. Ewen (Mainz), E. W. Fischer (Mainz),  
and G. Fytas (Heraklion)

---



Steinkopff Verlag • Darmstadt  
Springer-Verlag • New York



ISBN 3-7985-0952-2 (FRG)  
ISBN 0-387-91444-7 (USA)  
ISSN 0340-255 X

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically these rights of translation, reprinting, reuse 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 version of June 24, 1985, and a copyright fee must always be paid. Violations fall under the prosecution act of the German Copyright Law.

© 1993 by Dr. Dietrich Steinkopff Verlag GmbH & Co. KG, Darmstadt.  
Chemistry editor: Dr. Maria Magdalene Nabbe; Production: Holger Frey, Thomas Broll

Printed in Germany.

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

Type-Setting: Macmillan Ltd., Bangalore, India  
Printing: Druckhaus Beltz, Hemsbach

## Preface

The 27th Europhysics Conference on Macromolecular Physics was held in Crete, Greece from September 23–27, 1991. It was organized jointly by the Foundation for Research and Technology Hellas (FORTH) and the Max-Planck-Institut für Polymerforschung in Mainz under the sponsorship of the European Physical Society.

The meeting focused on applications of scattering methods to the dynamics of polymer dense systems and covered Rayleigh–Brillouin scattering and photon correlation spectroscopy, quasi-elastic neutron scattering, holographic methods, real time X-ray and neutron scattering techniques as well as the treatment of theoretical models and computer simulations of polymer dynamics. The present issue contains concise papers presented at the meeting after they have been reviewed.

The meeting was attended by over 100 participants from 16 countries. The scenery of the Agia Pelagia peninsula not far from the Minoan Palace, provided a pleasant setting for stimulating, fruitful discussions besides recreation.

We wish to thank: The members of the scientific committee for advice in the preparation of the program, the sponsors (FORTH, Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V., Ministry of Science and Technology and the companies A.G. Petzetakis, Plastica Kritis, AMCO) as well as the participants, the authors and the referees of the submitted papers.

B. Ewen  
E. W. Fischer  
G. Fytas

# Contents

Preface . . . . .	V
Bahar I, Erman B, Kremer F, Fischer EW: Dynamic rotational isomeric state approach for segmental motions of <i>cis</i> -polyisoprene in the bulk state . . . . .	1
Binder K, Paul W, Wittmann H-P, Baschnagel J, Kremer K, Heermann DW: Computer simulation of the glass transition of polymer melts . . . . .	5
Breterton MG: The dynamics of polymer blends: interdiffusion and the glass transition . . . . .	8
Darinski A, Gotlib Yu, Lukyanov M, Lyulin A, Neelov I: Computer simulation of the molecular motion in LC and oriented polymers . . . . .	13
Erman B, Bahar I: Local dynamics of freely rotating polymer chains in dense systems . . . . .	16
Alvarez F, Colmenero J, Wang CH, Fytas G: Relaxation behaviour in bulk PIMA and PIMA-PMMA copolymer near $T_g$ . . . . .	20
Arbe A, Alegria A, Alvarez F, Colmenero J, Frick B: Dynamics of the $\alpha$ -relaxation in glass-forming polymeric systems. Study by neutron scattering and relaxation techniques . . . . .	24
Floudas G, Higgins JS, Burgess A: Incoherent quasielastic neutron scattering study of a glass-forming liquid. A mode coupling interpretation. . . . .	28
Lohfink M, Sillescu H: Tracer diffusion in polymer and organic liquids close to the glass transition studied by forced Rayleigh scattering. . . . .	31
Patkowski A, Fischer EW, Gläser H, Meier G, Nilgens H, Steffen W: Light scattering studies of a glass forming liquid near $T_g$ . . . . .	35
Schönhals A, Kremer F, Schlosser E: The scaling of the $\alpha$ -relaxation in polymers and low-molecular glass-forming liquids – a comparison . . . . .	39
Sidebottom DL, Bergman R, Börjesson L, Torell LM: Scaling behaviour in poly(propylene glycol) in the glass transition range . . . . .	43
Torell LM, Jacobsson P, Sidebottom D, Börjesson L: Structural relaxation characteristics of glass-forming polymeric liquids subject to transient cross-links . . . . .	46
Chu B, Li Y: Synchrotron SAXY studies of segmented polyurethanes . . . . .	51
Fleischer G: Investigations of self- and tracer diffusion in poly(ethylene oxides) and in blends of poly(dimethyl/ethylmethyl siloxanes) with the pulsed field gradient NMR. . . . .	55
Gerharz B, Vogt S, Fischer EW, Fytas G: Segmental relaxation in a symmetric poly(styrene- <i>b</i> -methylphenylsiloxane) copolymer in the disordered phase . . . . .	58
Hoffmann A, Koch T, Schuler M, Stickel F, Stühn B: Static and dynamic scattering at the microphase separation transition in block copolymers. . . . .	61
Meier G, Momper B, Fischer EW: Mode coupling corrections to the Onsager coefficient as determined by light scattering of critical concentration fluctuations from polymer mixtures . . . . .	66
Mortensen K: PEO-PPO-PEO block polymer in aqueous solution: Micelle formation and crystallization . . . . .	69
Rizos AK, Fytas G, Roovers JEL, Ngai KL: Dynamic light scattering study of a 1,4-isoprene- <i>b</i> -styrene copolymer	72
Roland CM, Ngai KL: Concentration fluctuations and segmental relaxation in miscible polymer blends . . . . .	75
Schwahn D, Janßen S, Springer T: Exponential and non-exponential relaxation and early state of spinodal decomposition in polymer blends by SANS . . . . .	80
Toprakcioglu C, Dai L, Ansarifard MA, Stamm M, Motschmann H: Equilibrium and dynamic aspects of end-attached diblock and triblock copolymer chains. . . . .	83
Anastasiadis SH, Menelle A, Russell TP, Satija SK, Majkrzak CF: Very thin films of symmetric diblock copolymers	88
Reiter G, Steiner U: Short-time dynamics of polymer diffusion across an interface . . . . .	93
Russell TP, Menelle A, Anastasiadis SH, Satija SK, Majkrzak CF: The ordering of thin films of symmetric diblock copolymers . . . . .	97
Stamm M, Götzelmann A, Gießler KH, Rauch F: Organized structures in diblock copolymer films of polystyrene and poly- <i>para</i> -methylstyrene . . . . .	101
Bastide J, Boué F, Mendes E, Zielinski F, Buzier M, Lartigue C, Oeser R, Lindner P: Is the distribution of entanglements homogeneous in polymer melts? . . . . .	105

---

Benmouna M, Fischer EW, Benoit H, Benmansour Z, Vilgis TA: Dynamic scattering from ternary mixtures of polymers in solution. . . . .	109
Brown W: Dynamics in concentrated polymer solutions studied using dynamic light scattering . . . . .	113
Duval M, Haida H, Lingelser JP, Gallot Y: Dynamics of PS-PMMA diblock copolymers in toluene . . . . .	117
Ewen B, Richter D, Farago B, Maschke U: The effect of microscopic spatial restrictions on the segmental diffusion of dense polymer systems: Their observation and analysis by neutron spin echo spectroscopy . . . . .	121
Floudas G, Steffen W, Giebel L, Fytas G: Polymer and solvent dynamics in a polystyrene/di-2-ethylhexyl phthalate solution . . . . .	124
Helmstedt M: Dynamic light scattering investigations on semidilute solutions of branched polyethylene. . . . .	127
Richter D, Ewen B, Fetters LJ, Huang JS, Farago B: On the dynamic of dense polymer systems . . . . .	130
Rizos AK, Ngai KL, Fytas G: Solvent reorientation dynamics in Aroclor/polymer solutions . . . . .	135
Wang CH: Dynamic light scattering and viscoelasticity in polymer solutions . . . . .	138
Chu B, Yu J, Wang Z: Dynamics of polymer chains from expanded coils to the collapsed state . . . . .	142
Hellmann GP, Hellmann EH, Rennie AR: Chain fragmentation and fragment diffusion at the glass transition . .	146
Joosten JGH: Dynamic light scattering by non-ergodic media. . . . .	149
Langley KH, Teraoka I, Karasz FE: Diffusion of flexible and semirigid polymers confined to the pore spaces in porous glass . . . . .	153
Ricka J, Meewes M, Queller Ch, Binkert Th: Coils, globules and solubilization of a thermosensitive polymer . .	156
Schlosser E, Schönhals A: Relation between main- and normal-mode relaxation. A dielectric study on poly(propyleneoxide) . . . . .	158
Stieber F, Floudas G, Alig I, Fytas G: Structural relaxation in a low molecular weight poly(methylphenyl siloxane)	162
Tracy MA, Pecora R: Diffusion in rod/sphere composite liquids . . . . .	165
<b>Author Index</b> . . . . .	<b>171</b>
<b>Subject Index</b> . . . . .	<b>172</b>