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Statistical, Gradient, Block and Graft Copolymers by Controlled/Living Radical Polymerizations

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Springer

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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.

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Foreword

The design and the realisation of well-defined polymer architectures has become an important goal in macromolecular science. The prerequisite for achieving this goal is the availability of controlled polymerisation reactions. Living anionic polymerisation was the first reaction fulfilling these requirements. Cationic polymerisation only came into play when it was realised that it was possible to create an equilibrium between active and dormant species with the fraction of the dormant species being far superior to that of active ones.

A corresponding principle applies to controlled radical polymerisation performed in quite a number of modes such as nitroxide-mediated polymerisation (NMP), atom transfer radical polymerisation (ATRP), reversible addition fragmentation chain transfer (RAFT) or catalytic chain transfer (CCT) reactions. All of these variants of controlled radical polymerisation lead to well-defined architectures with the particular advantage that a much larger number of monomers are suitable and the reaction conditions are much less demanding than those of living ionic polymerisation reactions.

Although in controlled radical polymerisation, termination reactions cannot be excluded completely, they are limited in their extent and consequently the molecular weight is controlled, the polydispersity index is small and functionalities can be attached to the macromolecules. These features are indicative of the realisation of well-defined polymer architectures such as block copolymers, star-shaped and comb-shaped copolymers.

The present volume is particularly concerned with the use of the different modes of controlled radical polymerisation for the preparation of copolymers such as random copolymers, linear block copolymers, as well as graft copolymers and star-shaped copolymers. It also presents the combination of controlled radical polymerisation with non-controlled radical copolymerisation, cationic and anionic polymerisation, both of vinyl monomers and cyclic monomers, and ring-opening metathesis polymerisation.

The power of controlled radical polymerisation is demonstrated convincingly and the limitations of the synthetic approaches clearly indicated.

Last but not least the volume presents some potential applications for copolymers obtained by controlled radical polymerisation. It is expected that the first commercial products will appear on the market this year, giving convincing evidence for the importance of controlled radical polymerisation methods.

Aachen, March 2002 Hartwig Höcker

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