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Editor
Aziz M. Muzafarov
N.S. Enikolopov Institute of Synthetic Polymer Materials
Russian Academy of Sciences
Profsoyuznaya ul. 70
117393 Moscow
Russia
aziz@ispm.ru

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Volume Editor

Aziz M. Muzafarov

N.S. Enikolopov Institute of Synthetic Polymer Materials
Russian Academy of Sciences
Profsoyuznaya ul. 70
117393 Moscow
Russia
aziz@ispm.ru

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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 including chemistry, physical chemistry, physics and material science. It is addressed to all scientists at universities and in industry who wish to keep abreast of advances in the topics covered.

Review articles for the topical volumes are invited by the volume editors. As a rule, single contributions are also 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.

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Preface

The chemistry of organosilicon polymers is in the uprising stage of its development; the prospects of further growth and improvement opening before it are endless. Almost every review or study devoted to organosilicon polymers contained this phrase for several tens of years to date, and in every case, it reflected the real state of affairs without fail. It is just as true for today when the chemistry of organosilicon polymers enters yet another stage of its development.

Among the main tendencies characterizing this new stage, one can name a higher level of directed control of organosilicon polymers' structure, as well as implementing elements of selectivity and preliminary self-organization. The new synthetic approaches are based on modern experimental techniques and new methods of properties investigation of the created polymers and polymer-based materials. The unique qualities of organosilicon polymers ensure their being in high demand in almost every aspect of human activity and serve as a powerful driving force for further development of their synthesis. Areas of implementation, as well as the specific characteristics of particular materials achieved by previous generations of organosilicon scientists, are in constant need of being perfected. Further expansion and improvement of polymers possessing useful practical properties are the natural need of this science field, providing a steady connection between the science labs and the real world.

One of the separate branches that have reached a qualitatively different stage of their development are sol-gel technologies, which had come a long way from the "black box" method to the understanding of the chemistry of the process and the order of the major part of the stages that happen under various conditions. Even more successful were the scientists who created the so-called liquid silicon – a polysilane polymer that, under the influence of UV, transforms into polycrystalline silicon, which allows a fundamental change in the production of integrated circuits.

The rundown of recent achievements would be inconclusive without the mentioning of the unique process of forming of siloxane bond via the interaction of hydrosilane with alkoxysilane groups with the release of corresponding alkane. It is equally impossible not to take notice of the remarkable progress of the hybrid polymers, created by polymerization of silyl derivatives of ferrocene. It is obvious that even the most superficial recitation of actively developing fields clearly demonstrates the uprise of polymerization approaches which provide the most effective

control of the forming polymers. As for condensation processes, apart from the aforementioned unique reaction of catalytic condensation of hydro- and alkoxysilanes, one must take note of the evident progress in the synthesis of dendrimers and hyperbranched polymers that, due to the specifics of their chemical nature, are the most fast-developing molecular systems in this particular area of polymer chemistry.

This introduction does not include all the spectacular achievements of the last decades, just as not all of the aforementioned fields of study are present in this book. Silicon-containing dendrimers and hyperbranched polymers are well represented in a separate volume which has been taken notice of among polymer as well as organosilicon scientific circles. We have also neglected the thriving area of unsaturated organosilicon polymers in hopes of becoming readers of a separate specialized paper one day. By making – and not making – certain provisos, we acknowledge the fact that the selection of materials for this volume has been subjective, and the volume itself is a caption of a fast moving object that does not quite allow for a complete comprehension of this object, but enables one to feel its movement and the main vectors of development.

The first chapter is devoted to the advances in polysilanes. The recent remarkable progress in this field only serves to emphasize the actuality and inexhaustible nature of silicon chemistry. This chapter may present a perfect illustration of how the traditional and would-be thoroughly explored systems can regain our attention due to the development of new technological methods.

In the second chapter, silicon is used as an element that does not take part in complex conjugated structures built of aromatic subunits. Instead, due to the high reactivity of its functional groups and stability of silicon–carbon bonds, silicon serves as a skeleton holding those laced structures; it becomes the element via which they interact with the surface and themselves.

The third chapter reviews the dynamic of the design of polymer structures created using polymerization methods. The material gathered in this section convinces us yet again that this is but a beginning for this exuberantly developing area of silicon–carbon polymers.

The fourth chapter of this book reminds us that good things come in small packages. It is devoted to probably the most promising method of siloxane polymers synthesis, particularly with regard to unlimited capability of designing macromolecules of complex architecture. This is even more remarkable, because up to date this field lacked high selectivity of the reactions.

The concluding fifth chapter touches upon the issues and advances in constructing of the most thermodynamically stable polysiloxanes built of cage-like subunits. The chemistry of siloxane cages has a long history, but their polymer biography is in the very beginning.

To my regret, it was not possible for this book to include the earlier planned chapters on the progress of the basics of silicon chemistry, namely the methods of production of organosilicon monomers, particularly chloride-free and bioinspired methods of silicon polymers synthesis. I hope, however, that in view of the attention that the Springer publishing house pays to this branch of chemistry, those materials will appear in the journal *Silicon* if not in another collected volume.

I am convinced that this book will be of interest not only to those working with silicones, but also to the whole polymer community and material science specialists, as it contains a lot of new and fascinating data. I would be particularly pleased with the attention of young researchers who are bound to find the spirit of constant renewal in this old but highly dynamic area of chemistry contagious.

In conclusion, I would like to thank all the authors who accepted the invitation to participate in this volume and Springer publishing house for providing an opportunity to work on this book, as well as for their patience and cooperation.

Moscow, Russia *Aziz M. Muzafarov*

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