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Advances in Polymer Science

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The series 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.

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Preface

In this special volume on polymer particles, recent trends and developments in the synthesis of nano- to micron-sized polymer particles by radical polymerization of vinyl monomers in environmentally friendly heterogeneous aqueous and supercritical carbon dioxide fluid media are reviewed by prominent worldwide researchers. Polymer particles are prepared extensively as synthetic emulsions and latexes, which are applied as binders in the industrial fields of paint, paper and inks, and films such as adhesives and coating materials. Considerable attention has recently been directed towards aqueous dispersed systems due to the increased awareness of environmental issues. Moreover, such polymer particles have already been applied to more advanced fields such as bio-, information, and electronic technologies. In addition to the obvious commercial importance of these techniques, it is of fundamental scientific interest to completely elucidate the mechanistic details of macromolecule synthesis in the “microreactors” that the polymer particles in these heterogeneous systems constitute.

In the first chapter, Professor Nomura et al. review features of emulsion polymerization, which is applied for the synthesis of submicron-sized polymer particles, with particular emphasis on particle nucleation and growth and polymer structure development. In the second chapter, Professor Schork describes the basic features of miniemulsion polymerization, which is deeply related to emulsion polymerization, but offers advantages for the synthesis of hybrid particles in which hydrophobic substances are included. This chapter also covers controlled/living radical polymerization, which has been developed over the past 10 years. It is of great importance both from an academic and industrial perspective to make controlled/living radical polymerization compatible with heterogeneous systems. In the third chapter, Professor Gan and coworkers review microemulsion polymerization and its applications for the synthesis of polymer nanoparticles and nanocomposites of polymeric/inorganic substances. In the fourth chapter, Professors Kawaguchi and Ito review various features of dispersion polymerization, which is a useful technique for the synthesis of micron-sized monodisperse polymer particles, focusing on the preparation of novel functional particles and the control of particle size. In the final chapter, heterogeneous polymerization of fluoroolefins in supercritical carbon dioxide fluids is reviewed. One of the authors,

Professor DeSimone, is the pioneer of heterogeneous polymerizations in supercritical carbon dioxide.

As the editor of this Special Volume on “Polymer Particles”, I would like to thank all of the authors who made valuable contributions in spite of their undoubtedly busy schedules. I believe this work will be of great use for scientists in both academia and industry.

Kobe, November 2004

Masayoshi Okubo

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