

Preface

The book on “Polyelectrolytes: Thermodynamics and Rheology” summarizes many of the recent research accomplishments in the area of polyelectrolytes such as state-of-art polyoxymethylene, structure and thermodynamics of polyelectrolyte complexes, polyelectrolytes: science and application, study on biological polyelectrolytes, polyelectrolyte hydrogels: thermodynamics of polyelectrolyte hydrogels rheologys, complexes formation between proteins and polyelectrolytes and its application in the downstream processes of enzyme purification, polyelectrolyte complexes: bridging the ensemble average—single-molecule strategies, stratified interpolyelectrolyte complexes: fabrication, structure, properties, and applications, Monte Carlo studies in polyelectrolyte solutions: structure and thermodynamics. As the title indicates, the book emphasizes on the various aspects of polyelectrolyte and their thermodynamics studies and rheological studies to scientific community. This book is intended to serve as a “one-stop” reference resource for important research accomplishments in this area. This book will be a very valuable reference source for university and college faculties, professionals, postdoctoral research fellows, senior graduate students, researchers from R&D laboratories working in the area of “Polyelectrolyte: Thermodynamics and Rheology.” The various chapters in this book are contributed by prominent researchers from industry, academia, and government/private research laboratories across the globe. It covers an up-to-date record on the major findings and observations in the field of “Polyelectrolyte: Thermodynamics and Rheology.”

The Chapter on “[Polyelectrolyte: Thermodynamics and Rheology](#)” give an overview of the area of state of art, new challenges and opportunities of polyelectrolyte-based studies and research. The following chapter provides an overview of structure and thermodynamics of polyelectrolyte complexes. This chapter explained with many subtopics, such as weak and strong electrostatic coupling, thermodynamics of polyelectrolytes and polyelectrolyte complexes, Flory-Huggins solution theory applied to polyelectrolyte solutions, enthalpy in polyelectrolyte solutions, polyelectrolyte gels, computer simulations and structure, Monte Carlo simulations and other simulation methods, molecular dynamics simulations, experimental characterization, polyelectrolyte complexes and gels, etc.

“[Structure and Thermodynamics of Polyelectrolyte Complexes](#)” is mainly concentrated on polyelectrolyte: science and application. The authors of this chapter discussed with recent research on polyelectrolyte, applications of polyelectrolyte, scaling theory, dynamic light scattering, neutron scattering, biopolymers and ionomers. In this section, authors are discussed with very nice subtopics, such as biopolymers, polynucleotides, polypeptides, ionomers, etc. Survey on applications of biological polyelectrolytes done in the “[Biological Polyelectrolytes: Solutions, Gels, Intermolecular Complexes and Nanoparticles](#)”, the authors explained with many subtitles, such as introduction to biological polyelectrolytes, classification of biological polyelectrolytes, biological polyelectrolytes in solutions, intermolecular complexation and coacervation, biological nanoparticles, encapsulation, and drug release, also they explained about other topics, such as carbohydrate, protein, nucleic acids, protein-protein, protein-carbohydrates, protein-DNA, chitosan, gelatin, and pectin. “[Polyelectrolyte Hydrogels: Thermodynamics](#)” discussed about the polyelectrolyte hydrogels: Thermodynamics, this chapter discussed about many interesting topics, such as classification of polyelectrolyte hydrogels, synthesis of polyelectrolyte hydrogels, polyelectrolyte hydrogels: thermodynamics, characterization of polyelectrolyte hydrogels, biomedical applications of polyelectrolyte hydrogels.

“[Thermodynamic and Rheological Properties of Polyelectrolyte Systems](#)” deals with the thermodynamic and rheological properties of polyelectrolyte systems. This chapter explained many properties, such as interactions, rheological properties, flow properties, etc. Authors of this chapter explained with different subjects such as interaction of polyelectrolytes with organic molecules, release of drugs from polyelectrolyte-drug dispersions, rheological properties of polyelectrolyte dispersions, flow properties of representative sodium salts of acid polyelectrolytes, flow properties of acid PE-drug dispersions, properties of carbomer-drug hydrogels, effect of the addition of other species on carbomer-drug dispersions, remarks on thermodynamic and rheological properties of polyelectrolytes, finally field of projections based on the properties of PE-drug complexes are also discussed. “[Complexes Formation Between Proteins and Polyelectrolytes and Their Application in the Downstream Processes of Enzyme Purification](#)” discussed about the complexes formation between proteins and polyelectrolytes and their application, from this chapter, we can see many different kinds of applications and use of polyelectrolyte and authors explained with many other topics including uses and applications of polyelectrolytes, aqueous solutions of polyelectrolytes, the formation of complexes between polyelectrolytes and proteins, the downstream processes of proteins and their scaling up process by PE-P formation, application of PE-P in downstream processes. Bridging the ensemble average-single-molecule strategies of polyelectrolyte complexes are discussed in “[Polyelectrolyte Complexes](#)”, this chapter also explained about polyelectrolytes in biology, polyelectrolyte complexes in biology, man-made polyelectrolyte complexes, polyelectrolyte complex formation, nonideal thermodynamics, structure of the polyelectrolyte complexes, experimental observations at the individual complex level, correspondence to observations at the ensemble level and cooperative

effects in DNA condensation. The coming chapter on stratified interpolyelectrolyte complexes explained with fabrication, structure and properties and with several topics, such as fabrication of stratified interpolyelectrolyte complexes, controlling the fabrication of polyelectrolyte multilayers: effect of different physicochemical variables, structure: stratified and nonstratified systems, water content and hydration, rheological properties, permeability and porosity, response to osmotic stress, applications.

“[Monte Carlo Studies in Polyelectrolyte Solutions: Structure and Thermodynamics](#)” on Monte Carlo studies in polyelectrolyte solutions: structure and thermodynamics, this chapter discussing about, Monte Carlo studies of polyelectrolytes, theoretical approach of Monte Carlo studies, application level of Monte Carlo in polyelectrolyte, authors of this chapter are also trying to discuss more with many topics, such as coarse-grain model for polyelectrolyte and small ions, ideal gas and excess contribution to the partition function of the system, metropolis Monte Carlo method, Monte Carlo trial moves, conformational and persistence length of a single polyelectrolyte chain, counterions condensation and end-chain effects and morphology of polyelectrolyte complex.

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Polyelectrolytes

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