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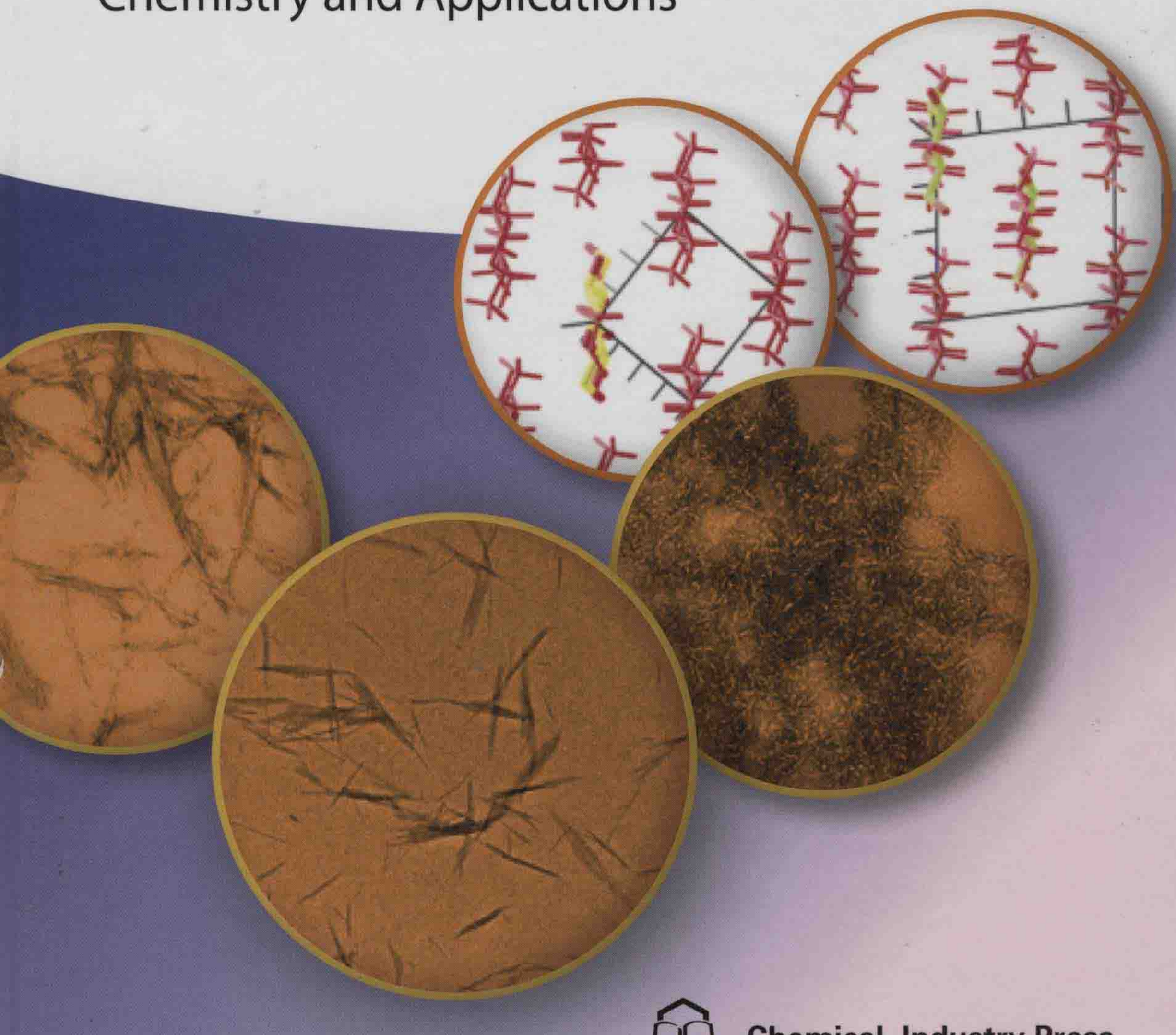
Edited by Jin Huang, Peter R. Chang, Ning Lin, and Alain Dufresne

Polysaccharide-Based Nanocrystals

Chemistry and Applications



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Foreword

Since the beginning of the new century, the development of advanced biobased nanomaterials has been of significant interest in both academia and industry. Polysaccharide nanocrystals, mainly including rod-like cellulose nanocrystals, chitin nanowhiskers, and platelet-like starch nanocrystals, are highly crystalline rigid nanoparticles extracted from biosourced polymers that possess numerous advantages over inorganic nanoparticles. It has been reported that the diverse materials derived from polysaccharide nanocrystals will cover a broad range of properties that are useful in a wide range of applications, for example, in composites, electronics (flexible circuits), energy (flexible batteries, such as Li-ion and solar panels), packaging, coatings, detergents, adhesives, construction, pulp and paper, inks and printing, filtration, medicine and life science (scaffolds in tissue engineering, artificial skin and cartilage, wound healing, and vessel substitutes), optical devices (including reflective properties for security papers and UV or IR reflective barriers), rheological modifiers, and cosmetics. Since the first study on the use of cellulose nanocrystals as a reinforcing filler in nanocomposites about 20 years ago, a huge amount of literature has been devoted to research on polysaccharide nanocrystals in more than 1000 scientific publications.

As a relatively new research area, it is imperative to systematically assemble state-of-the-art technical accomplishments on polysaccharide nanocrystals, particularly with respect to physics, chemistry, materials science, processing, and engineering. This book covers extraction, structure, properties, and surface modification pertaining to polysaccharide nanocrystals. It provides an in-depth description of plastics and composites containing this unique biosourced nanoingredient in terms of structures, properties, manufacturing, and product performance. This book also describes the concept of functional nanomaterials based on polysaccharide nanocrystals and their potential applications. All chapters are contributed by leading experts who have both academic and professional credentials.

It is interesting to note that commercialization/utilization of polysaccharide nanocrystals (especially for cellulose nanocrystals) is finally catching on and is being pursued vigorously by industrial groups, notably in the United States, Canada, and Europe.

Upcoming R&D and relentless pursuit represent well-justified challenges and opportunities for bringing the next generation of polysaccharide nanocrystal-based materials into reality.

Preface

Biobased Polysaccharide Nanocrystals: Chemistry and Applications is the first book that systematically describes the chemistry, properties, processing, and applications of polysaccharide nanocrystals and the nanocomposites/nanomaterials thereby derived.

Development of biobased materials has experienced fast growth in the past two decades thanks to public concern over the environment, climate change, and the depletion of fossil fuels. Over the last 10 years or so, this team of authors has worked collectively and separately with these interesting and yet little known renewable and biodegradable polysaccharide nanocrystals in the cutting edge field of functional nanomaterials and nanocomposites. As such, we are eager to share our knowledge and experience with readers and stakeholders, particularly researchers from academia and industry, policy makers, and the business sector, to foster rapid exploitation and commercialization of these fascinating bioingredients and their derived products, including but not limited to nanocomposites/nanomaterials.

This book is intended to give the reader a comprehensive overview of the present knowledge relating to extraction, structure, properties, surface modification, and the newly derived material of polysaccharide nanocrystals. In addition, it provides an in-depth description of plastics, composites, and nanomaterials specifically procured from cellulose nanocrystals, chitin nanowhiskers, and starch nanocrystals. This is an excellent book for scientists, engineers, graduate students, and industrial researchers in the field of polymeric materials. This book also covers the most recent progress with respect to: (i) the development of a conceptual framework of polysaccharide nanocrystals; (ii) numerous applications in the design and manufacture of nanocomposites and functional nanomaterials; and (iii) the relationship between structure and properties.

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