Preface

Encapsulation technologies are widely used in medicine and pharmaceutics, agriculture and cosmetic industries for the development of a wide range of controlled-release delivery systems. Thin films, and particulates such as liposomes, emulsions and capsules, are used for the sustained release of drugs, pesticides, fragrances and other substances. Advanced variants of these systems have also been used to perform various confined nano-/microreactions to mimic cellular processes. The impetus for this stems from the fact that many biological processes are compartmentalized within cells through the localization of proteins and other molecules, and such confinement controls the complex processes. Although the synthetic counterparts are still far from the complexity of living systems, they hold promise for advancing studies into the synthesis, encapsulation (confinement), reactions and delivery of (bio)molecules.

This volume provides an overview of a number of extensively used techniques to encapsulate a host of different materials, ranging from confined polymerization to self-assembly. The encapsulation vehicles formed include thin multi-strata films, emulsions, polymersomes, nanoparticle-based hollow spheres and polymer capsules. The potential applications of these systems for encapsulation and their use as microreactors to perform a host of complex reactions are discussed, and examples showing the diversity of properties that can be controlled in these systems are given.

In Chapter 1, Landfester and Weiss outline details of miniemulsion polymerization for the encapsulation of a range of materials such as dyes, pigments, fragrances, photo-initiators, drugs, nanoparticles and biomolecules (DNA) in polymeric nanoparticles. The preparation of nanoparticles with new properties is also presented.

Chapter 2, by Ariga, Ji and Hill, presents recent developments on the application of the layer-by-layer technique for encapsulating enzymes. Encapsulation strategies are demonstrated for enzymes in both thin film and particle formats to generate complex enzyme architectures for microreactions. The integration of such systems into advanced biodevices such as microchannels, field effect transistors and flow injection amperometric sensors is also presented.

In Chapter 3, Kini, Biswal and Wong discuss recent developments in synthetic routes and properties of hollow spheres formed from nanoparticles. It is shown that arranging nanoparticles into hollow spheres through self-assembly produces particle

systems with new properties that can be exploited for encapsulation, storage and controlled release, making them potentially useful in medical therapy, catalysis and encapsulation applications.

In Chapter 4, Massignani, Lomas and Battaglia review the fabrication processes used to form polymersomes, membrane-enclosed structures that are formed through self-assembly of amphiphilic copolymers. The resulting molecular properties, methods to control their size, loading strategies and applications of polymersomes are also detailed.

Chapter 5, by Price, Johnston, Such and Caruso, focuses on recent progress in the design of layer-by-layer capsule reactors. Fundamentals that underpin the assembly of such capsules are presented, followed by the assembly parameters that affect the retention of components within the resultant capsules. Prominent examples of layer-by-layer assembled microreactors and potential applications of such systems in biomedicine and micro-encapsulated catalysis are also discussed.

The collection of chapters in this volume will be of interest to a multidisciplinary audience working at the interface of chemistry, biology, physics, materials science and engineering. This volume is also aimed at encouraging scientists and engineers who wish to diversify their research in encapsulation and nano-/microreactor systems.

Finally, I would like to thank all of the contributors for taking valuable time from their busy schedules to write stimulating and informative chapters, and to the Springer team for assistance in publishing this volume in their leading book series "Advances in Polymer Science."

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