Self-Assembled Supramolecular Architectures

Surfactants, or amphiphilic molecules, are ubiquitous in society with products ranging from personal care to oil recovery. In most applications the surfactants self-assemble to form spherical micelles in water. When higher concentrations of surfactant are introduced in solvent, the molecules may further self-assemble into ordered nanoassemblies, typically referred to as lyotropic liquid crystals (LLCs). A variety of ordered LLC phases can form including hexagonal, bicontinuous cubic and lamellar in the presence of solvent (generally water). Based on the inherent segregation of polar and non-polar domains, LLCs have been of great interest in the past two decades from both a fundamental perspective and for other applications such as drug delivery and nanomaterials.

The book *Self-Assembled Supramolecular Architectures: Lyotropic Liquid Crystals* examines both fundamental and applied aspects of these fascinating systems. LLCs obtained with lipids and in dispersed phases, i.e. phases that form with excess water, are of primary focus in the book including biocompatible systems for potential in drug delivery. The editors have assembled a mix of chapters that provide general overviews of the state of the field in addition to very specific new research advances in phase understanding and drug delivery.

Excellent overviews of the current state of LLC modeling and characterization are found in chapters 1 and 4, respectively. Modeling of LLC mesophases (chapter 1) is used as pretext to present a basic introduction of LLC phases including the physics and thermodynamics of LLC self-assemblies. The section describing the similarities and differences between LLCs and block copolymers is particularly useful. Chapter 4 then provides a comprehensive outline of the standard and emerging techniques used to characterize LLCs, and serves as a great reference in understanding the nanostructure and nature of these systems. For those more interested in details regarding specific phases, flow modeling of both thermotropic and lyotropic nematic liquid crystals is described in Chapter 2 and the importance of planes in the inverse hexagonal phase is illustrated in Chapter 3. Further details regarding dispersed phases are provided in Chapters 5 and 6 including the impact of different parameters on the self-assembly and basic morphology in lipidic particles (e.g. ISA-somes). In particular, the temperature stabilization of ISA-somes by embedding in temperature-responsive polymeric gels appears promising.

The remaining chapters are primarily focused on using LLCs, especially dispersed phases, for drug delivery. The introduction from Chapter 9 gives an excellent outline regarding the benefits of LLCs, including the utility of emulsions and liposomes in dilute environments as is needed for target delivery systems. Chapter 8 discusses the use of biocompatible lipid LLCs for triggered drug delivery, particularly in the transport of biomacromolecules (proteins, DNA) through transitions from a lamellar mesophase to a non-lamellar phase in response to temperature and pH stimuli. An overview of stimuli-responsive systems for "on demand" drug delivery based on lipid LLCs is given (Chapter 9) as well as an overview of the interaction of LLCs with surfaces and interfaces (Chapter 10). This subject is of particular importance considering the potential impact of LLC drug delivery on biomedical devices and tissue. Chapter 11 extends the discussion started in Chapters 5 and 6, now using these dispersed LLC phase systems for peptide delivery to cell targets with brain receptors.

Unfortunately, very little of the book is devoted to the exciting work using LLC phases as templates for the development of nanostructured hard and soft materials. Some details regarding inorganic nanoparticle synthesis are given in Chapter 7. However, important advances regarding templating of both inorganic and organic systems are largely ignored. One of the most important advances for industrial applications of LLCs is the development of mesoporous silica such as MCM-41, which is not discussed. Additional advances in nanoporous inorganic and inorganic hybrids discovered by Brinker and his group are missing. A rich body of literature and applications of LLCs from O'Brien, Antonietti, Gin, and others demonstrating the use of LLC phases to template organic polymer systems are also regrettably omitted.

In summary, the book provides an overview of LLC systems with particular focus on dispersed LLC phases and drug delivery. Many recent advances are discussed in significant detail, while others particularly regarding LLC templating are not. While *Self-Assembled Supramolecular Architectures: Lyotropic Liquid Crystals* is far from being a comprehensive review of LLC systems, several chapters are recommended as an excellent reference for anyone interested in the field, and other chapters illustrate fundamental principles and applications of dispersed LLC phases.

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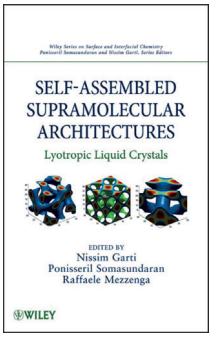

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