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Book Review

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Polymeric materials in organic synthesis and catalysis

Wiley–VCH, 2003,
582 pp; price £115
ISBN 3-527-30630-7 (hardcover)

This is a valuable asset for anyone wishing to know about the current state of the art in novel functional polymer systems applied in organic and bio-synthesis and catalysis.

The first chapter sets the scene with a very useful review of the structure of polymers and methods of characterizing both their structure and chemical functionality. The second chapter is devoted to multistep synthesis of potentially therapeutic molecules using solid supported reagents, catalysts and sequestering agents with the aim of high throughput screening. Examples are given in small molecule construction, heterocyclic scaffold decoration and natural product synthesis. Chapter 3 focuses on a classification of the linker element to the polymeric support in terms of linker families and their participation in different types of organic reaction, as well as a comprehensive list with references of the types of molecular system that can be produced by the different types of linker. Chapter 4 is devoted to catalytic applications of both silica and polymer solid supported reagents, in oxidation, Lewis acid, and transition-metal-catalysed reactions in this rapidly growing field, where the recyclable solid-bound catalyst is an important tool within chemical sustainability. Chapter 5 describes the use of soluble supports and can help overcome many of the problems associated with solid supports, such as nonlinear kinetic behaviour, unequal distribution and difficulties in the preparation of some reagents on a solid support. Liquid-phase methodologies using soluble polymers (such as polyethylene glycol, non-cross-linked polystyrene and microgels) are described as supports for catalysts and reagents. Catalysts bound to polymers that are able to form micelles in which the catalysis takes place are elucidated in Chapter 6 and focuses on amphiphilic block copolymers as support materials for homogeneous transition metal complexes. Dendritic polymers, both in soluble (non-cross-linked) and insoluble (cross-linked) hybrid polymers, are discussed in Chapter 7, particularly high loading architectures and their separation from reaction mixtures and their application in synthesis and catalysis. Metathesis-based reactions are among the most important C–C coupling reactions and Chapter 8 describes metathesis-based polymerization reactions, which are among the most powerful techniques for the preparation of functionalized inorganic and organic supports for a large number of reactions. Chapter 9 describes the preparation and applications of self-assembled monolayers of organic molecules on surfaces and surface-initiated polymerization of polymers to form thicker layers of 'polymer brushes'. Biocatalysed reactions on polymeric supports using enzyme-labile linker groups are described in Chapter 10, and Chapter 11 is devoted to a range of polymer-supported olefin metathesis catalysts, including chiral catalysts for asymmetric synthesis. Chapter 12 describes the methodologies for reaction optimization as, unless careful optimization is carried out, compound library synthesis often results in low yields and many impurities. Finally, the integration of reaction and separation using polymeric membranes in a number of processes is given in Chapter 13.

The book is not only comprehensive in coverage, but well written and interesting to read, with each chapter representing a review of the appropriate subject matter. The diagrams are useful, and the references, given at the end of each chapter, are again comprehensive. The work described is very much at the forefront of current technology.

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