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Book Review

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Multiphase Homogeneous Catalysis

Wiley-VCH, 2005, 906 pp., 2 volumes; price £230.00
ISBN 3-527-30721-4 (hardcover)

The two-volume edited by seven foremost experts in their own fields of catalysis aims to 'summarise all realistic possibilities of multiphase homogeneous catalysis'. In the field of heterogeneous catalytic processes there is a large number of reviews, monographs and textbooks. However, this is the first comprehensive assembly of many aspects of homogeneous multiphase processes in a single work. The book reviews aqueous, organic–organic and fluorous systems in Volume 1, and non-aqueous ionic liquids, supercritical CO_2 and soluble polymer systems in Volume 2.

The focus on multiphase catalysis is warranted by the recent spectacular pace of development in the areas of catalysis in ionic liquids, including the rapid adoption of ionic liquids as a mainstream reaction media in biocatalysis, use of scCO_2 as an extractant or as reaction media, and development of the more exotic concept of 'smart' solvents, with temperature-induced variation in solvation behaviour. These developments present new opportunities for cleaner and more efficient reactions, as well as for developing new products and opening opportunities for otherwise impossible reactions, but they also require a very different approach towards R&D, when chemistry and engineering must be developed simultaneously. The editors attempted to recognize this by including not only the overviews of different types of reactions that can be run in a particular solvent or multiphase system, but also by explicitly including kinetics, phase behaviour, process schemes and aspects of reaction engineering.

Since the book is devised as a snapshot of development of the majority of multiphase approaches in homogeneous catalysis at the end of 2004, each individual component is not described comprehensively. Many individual subsections do not stand out on their own as reviews, but serve to show the multiplicity of approaches. As such, the book can be considered as an introduction to different aspects of homogeneous catalysis in multiphase systems.

The chapter on aqueous catalysis is by far the most extended in the whole work, consuming 80% of Volume 1. It provides detailed information on the commercial hydroformylation oxo process, as well as a fairly comprehensive overview of the different reactions that have been reported to be effective in aqueous media. In comparison, the description of another large-scale multiphase process, SHOP, in Chapter 3 is considerably more concise. There is a considerable amount of avoidable repetition in Chapter 2.

The chapter on non-aqueous ionic liquids gives a good introduction into this rapidly developing field. It covers not only different reactions, but also aspects of large-scale synthesis of ionic liquids, the problems of separation of ILs from products, and their toxicity. The chapter on sc-CO_2 provides an excellent introduction to catalytic reactions, but also surveys other applications of the technology that are more mature.

The book is not the easiest to navigate. This is partly due to the multi-contribution approach to the edited volume and in part due to the organization of the book by the type of phase involved. Thus, the reaction of telomerization appears in several subsections in Chapter 2 as well as in Chapter 3 and under two different reaction names. The organization of the book by phases does not favour the more generic topics. A subsection on membranes in Chapter 2, for example, covers more than aqueous systems and necessarily also covers the heterogenized catalysts. Similarly, it would have been perhaps better to consider all aspects of biocatalysis in one place, and also provide a more substantial section on aqueous biocatalysis.

Unfortunately, Wiley cannot be complemented on the production quality. The book contains very large numbers of repetitions, spelling and grammatical mistakes, and some errors with placing illustrations.

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