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BOOK REVIEW

R. Šebesta (ed.): Enantioselective Homogeneous Supported Catalysis

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A heterogeneous catalyst is one in a different phase from the reactants. Broadly defined in this way, enantioselective heterogeneous catalysis has seen an explosion of research in recent years, so the editor of the volume "Enantioselective Homogeneous Supported Catalysis" has chosen to focus on systems envisioned to react as homogeneous liquid phase catalysts able to be brought into a second phase, enabling recovery. These are intended to be contrasted with 'heterogenized' catalysts that are strongly attached to an insoluble support. This is an intriguingly-worded focus, inviting enquiry into whether, for example, many of the systems described in the literature do indeed behave mechanistically as do the homogeneous analogs, and if not, why.

This volume brings together eight essentially independent, comprehensive reviews covering a relatively recent time frame, partially out of necessity to not overlap with the many current reviews. The chapters most true to the book's theme are those covering catalysts that are easily extracted/precipitated or can operate in biphasic conditions via ionic (Chap. 1), macromolecular (Chaps. 4 and 5), or fluorous (Chap. 6) tags. Chapter 8 describes catalysts supported on insoluble materials, which strays into the domain of 'heterogenized' catalysts, but its inclusion is welcomed, as it is one of the stronger chapters. Chapters 3 and 7 are organized around the solvent or co-solvent (ionic liquids and water, respectively), rather than a particular type of modified catalyst. Chapter 2 is somewhat of a structural outsider, being arranged around a catalyst type (organocatalysts), rather than a supporting method, leading to some unproductive overlap with the other chapters.

This choice of chapter themes would make the volume a good starting point for new researchers entering the field. It summarizes relatively recent literature, but would then need to be supplemented with prior reviews. Most of the chapters appear to be organized with synthetic organic practitioners in mind, since they are arranged around reactions. Unfortunately, many sections lapse into long repeating text blocks of reaction detail, yield, selectivity, performance over recycles. This is helpful when a new catalyst or immobilization technique is sought as a new synthetic tool, but it may not be easy for novice readers to distinguish the particularly important contributions; a more tightly curated selection could have been helpful, also to enable more cross analysis and insight into catalyst structure–function relations, as discussed below.

Chapter 3 is a quite well-written chapter on asymmetric catalysis in ionic liquids contributed by Hardacre and colleagues. It is notable for making mechanistic hypothesis throughout and posing challenges to the reader. These authors also take pains to point out understudied/under-appreciated areas like asymmetric hydroformylations, the role of ionic liquid counteranion, or interesting outstanding questions as in the section on cyanosilylation, even when they appear to be outside of their own research area. Chapter 8 by Fraile et al. is also a very strong chapter and one that is clearly written from the perspective of a catalyst developer. It cites fewer examples than many of the other chapters, yet has an ostensibly broader topic of liquid phases supported on insoluble materials. The chapter goes into more detail on each example, and tends to postulate reasons for changes in activity or selectivity. The authors are also not afraid to give their opinion when an approach may be less viable than others. Critical reviews of this type

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are increasingly important as electronic indexing makes it easy to generate large bibliographies, the value of whose individual entries may not be known. This expert commentary is useful and should encourage critical analysis on the part of the reader.

A catalysis scientist, as opposed to a synthetic chemist, may desire more chapters like the two above, and in general seek more details or cross-analysis. Throughout the volume, potentially interesting topics, (e.g. electrosterics, unusual solvent effects, etc.) are mentioned, but not expanded upon. The reader is certainly left wanting more when unusual changes in reactivity or selectivity are seen as a result of supporting a molecular catalyst, but are not given special emphasis or discussion other than leading the sentence with "Interestingly…" Some of the promise of the volume is not being lived up to. There are also missed opportunities to make more cross-cutting conclusions, although some sections did a good job of collating data from several publications into a single table or discussion. This allowed, for example, a discussion of how fluorous tags alter organocatalyst acidity in Sects. 6.3 and 6.4.

This reviewer was also somewhat surprised that a volume in a 'Green Chemistry' series did not more explicitly address green chemistry principles. The editor notes that academics devote considerable effort to catalyst immobilization and recycling for purported cost savings, but it would have been very valuable to make more clear which problems are being tackled also by industrial researchers. With the notable exception of the chapter by Hardacre and collaborators (Chap. 3), many chapters shy away from discussions of engineering and cost (dis)advantages for a particular catalyst class or reaction. Chapter 3 also makes explicit mention of flow chemistry, something which was found to be surprisingly weak throughout the text in general, considering recent surges of interest related to greening fine chemicals production or discovery.

Overall, each of the individual chapters is a reasonably useful and well-written review of their subfields, and this reviewer frequently found himself highlighting citations to follow up on. However, little editing appears to have been done to tie them together in the service of green chemistry or catalysis science, and it is not clear how much is gained by collecting these reviews into a single volume. Finally, and with notable exceptions, the individual chapters would be better served by being more critical. Part of the role of a book is to provide expert commentary, not simply an annotated bibliography.