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Preface

Catalytic oxidation for the synthesis of specialty and fine chemicals

The contributions to this issue cover a broad range of oxidation reactions over solid catalysts, and involve also homogeneous and immobilized homogeneous catalysts. The processes discussed in the papers are diverse, but they share the common aim, the development of new catalytic technologies for the production of complex and valuable molecules. Due to the political and social pressure in the past decades, replacement of conventional stoichiometric oxidations by environment-friendly catalytic processes is a widely accepted strategy in fine chemicals industry. However, a technological shift in this direction is frequently obstructed by the limited availability of efficient (heterogeneous) catalysts which can utilize the clean oxidants molecular oxygen, hydrogen peroxide or alkyl hydroperoxides. Another problem is the too narrow application range of available heterogeneous catalysts. The strong substrate specificity of sophisticated solid catalysts typical for bulk chemicals production is a considerable disadvantage in this field as the development of new, "green" catalytic technologies for each production cycle is time consuming and usually too expensive for the highly diversified fine and specialty chemicals industry.

The area of elaborating new catalytic technologies for the selective oxidation of complex and thermally sensitive molecules is advancing rapidly. The target of this volume is to analyze the status of this development by internationally recognized experts. It is hoped that this collection of review papers will stimulate the research in this field and attract attention of colleagues working in both academic and industrial research and development laboratories.

The review papers have been divided into four sections. The first general topic includes an excellent overview on the role of basic solids in synthetic organic chemistry written by Fraile, Garcia and Mayoral. The next two papers describe the recent progress in developing environment-friendly catalytic processes. Choudary and coworkers provide a broad overview on oxidation reactions — a useful starting point for those interested in various catalytic oxidative transformations relevant in fine chemicals industry. The highlight of the paper by Rafelt and Clark is the substitution of stoichiometric oxidations by heterogeneous catalytic processes reflecting the expertise of the authors in developing advanced immobilized reagents and catalysts.

The selective oxidative functionalization of less reactive but cheap alkanes and alkylaromatic compounds over solid catalysts is a big challenge for catalytic chemists. Sorokin and Tuel present some highly successful applications of immobilized transition metal phthalocyanines for the partial oxidation of aromatic compounds. Martin and Lücke review the recent developments on the vapor phase production of aromatic and heteroaromatic aldehydes and nitriles, including synthetic and mechanistic aspects of this important class of catalytic reactions. Electrocatalysis has a great potential in the synthesis of specialty chemicals. Otsuka and Yamanaka provide an exciting overview on the oxygenation of alkanes and aromatics during hydrogen–oxygen cell reactions — maybe the favored clean technology for the next century?

The next chapter deals with the oxidation of olefins. Currently, epoxidation is the most studied solid-catalyzed oxidation reaction in the liquid phase and a wealth of reviews and books are available on the topic. Here, the focus of the first two contributions is immobilization of known homogeneous cata-

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lysts. Sherrington discusses the recent developments in supporting transition metal epoxidation catalysts on polymers with emphasis on the excellent results in asymmetric epoxidations. The highlights of the paper by De Vos and Jacobs are the techniques for heterogenization of Fe and Mn complexes on inorganic supports and the influence of immobilization on the catalytic performance. Another important but far less investigated transformation of olefins is allylic oxidation. It is shown by Murphy et al. that in the oxofunctionalization of cyclic olefins, heterogeneous catalysts cannot compete yet with the best homogeneous transition metal complexes.

The last section in this issue, the oxidation of alcohols to carbonyl compounds and carboxylic acids is a vital reaction in synthetic organic chemistry. Besides, this transformation is one of the most studied solid-catalyzed oxidations in the liquid phase affording excellent selectivities under mild conditions. The paper by Besson and Gallezot provides a detailed insight into the application range and mechanism of aerobic oxidations over metal and bimetallic catalysts. Important engineering aspects of this industrially relevant reaction are summarized by Kluytmans et al., introducing the reader to the role of reaction kinetics and mass transport in catalyst deactivation and reactor design. Sheldon, Arends and Dijksman present the recent developments in alcohol oxidation considering both homogeneous and heterogeneous catalysis. The focus of this collection is on the use of molecular oxygen and hydrogen peroxide, oxidants which from an economic and environmental point of view, are the most attractive for the production of fine chemicals.

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