DOI: 10.1595/147106708X364922

"Catalysis for Renewables: From Feedstock to Energy Production"

EDITED BY GABRIELE CENTI (University of Messina, Italy) and RUTGER A. VAN SANTEN (Eindhoven University of Technology, The Netherlands), Wiley-VCH, Weinheim, Germany, 2007, 448 pages, ISBN 978-3-527-31788-2, £105.00, €141.80, U.S.$200.00

Reviewed by John Birtill

15 Portman Rise, Guisborough, Cleveland TS14 7LW, U.K.; E-mail: john.birtill@ntlworld.com

The drive for renewable feedstocks and fuels is a hot topic for scientists and governments, and catalysis is a key enabling technology for the development of new and improved processes. Hence, the appearance of this book is well timed. I am not sure about the publisher's claim that "this will be a white book in the field". The sixteen chapters are mostly reviews, and some of them have overlapping content. As with any type of boom, this research field is prone to exaggerated claims and false trails. Competition between food and biofeedstocks is likely in due course to discourage the use of food crops, but agricultural (lignocellulosic) waste products and targeted crops from marginal land have long-term potential.

The content originated in a workshop, "Catalysis for Renewables", held in the Netherlands in 2006, and organised within the EU sponsored 'IDECAT' (Integrated Design of Catalytic Nanomaterials for a Sustainable Production) framework (1). The editors of the book were members of the Organising Committee. The aim was to define "new directions and opportunities for catalytic research in this field by integrating industrial, governmental and academic points of view". The authors are mostly academic and government scientists from the Netherlands and Italy, with a few more from France and Finland. There are very few industrial scientists. Hence, although the subject matter is of global geopolitical and industrial significance, the content reflects the views of attendees at this regional, academic workshop. However, the reviews cover a wide range of literature, and so the book serves as a useful source of information.

Each chapter clearly stands alone as the work of its authors, suggesting a light editorial touch. Most of the reviews are informative, and a few are excellent. I liked the overall perspective on renewable catalytic technologies in the early chapters and the roadmap in the final chapter. Various controversial points are well described, regarding the magnitude of environmental challenges and the effectiveness of proposed solutions. However, the lists of academic studies of catalytic reactions in chapters on chemical transformations are not very helpful without some critical appraisal of their true potential for application (cost, robustness, effectiveness). The early chapters cover the biomass conversion chain, from the biorefinery to fuels and chemical products. The ordering of later chapters seems more random. Chapter 8, which describes combustion modelling, appears to be in the wrong book. There are further chapters on bioethanol production and upgrading, the conversion of glycerol to diesel components, other chemicals and syngas (carbon monoxide and hydrogen), and the methodology of cascade catalysis. The chapters on hydrogen production and fuel cells, and the techno-commercial and environmental case for hydrogen in transportation are loosely linked to the title theme, but are relevant for strategic reasons. The production of hydrogen by solar photocatalysis is the biggest challenge for the future.

In general, there is little novel catalysis in this book. The production chain from the biorefinery is based on catalytic unit operations familiar to the chemical industry. Hence, processes such as reforming, hydrogenation, oxidation, hydrolysis and etherification appear throughout the book. New catalytic requirements do appear, for example, in the selective deoxygenation of certain intermediates. There is an interesting roadmap in the final chapter for priorities in

catalysis research into renewable raw materials and sources of energy.

Not surprisingly, there are many passing references throughout the book to supported and/or bifunctional platinum group metal catalysts, for example hydrogenation (palladium, platinum, ruthenium, rhodium, iridium), hydrogenolysis (Pd), dehydrogenation (Pd), oxidation (Pt, Pd), homogeneous telomerisation (Pd), homogeneous hydrogenation (Rh), steam reforming (Pt), aqueous reforming (Ru, Pt, Pd) and electrocatalysis (Pt). However, many of these references have not been included in the index. The practical conversion of biofeedstocks is certain to place new demands on the robustness of catalysts, but this aspect is hardly mentioned by the mainly academic authors. A chapter on new challenges for catalyst design might have been useful, but I suppose that no-one talked about this at the IDECAT workshop. Besides the lack of industrial experience of bioprocessing, other notable omissions include the potential use of marine harvests and municipal waste.

In conclusion, this book will be useful to anyone who wants an academic, strategic perspective on the potential contributions from various catalytic technologies to this field of research. The lack of industrial perspective is its most serious weakness. The price will limit its purchase mainly to libraries. It will be read by academic and industrial scientists, research students seeking a wider perspective, and those concerned with science policy. For instance, the issues of food competition and poor overall effectiveness attached to use of some food crops as industrial feedstocks are well explained, and it is surprising that these issues have only recently become politically controversial. Anyone interested in detailed catalytic science will find texts dedicated to the respective catalytic technologies to be more useful; for a general source, see for example Reference (2).

References

1 IDECAT Conference Series, Catalysis for Renewables Conference: http://idecat.unime.it/index.php?pag=CatForRen

2 C. H. Bartholomew and R. J. Farrauto, "Fundamentals of Industrial Catalytic Processes", 2nd Edn., Wiley-Interscience, Weinheim, Germany, 2006

The Reviewer

John Birtill is a consultant in industrial catalytic technology, an Honorary Research Fellow at the University of Glasgow, U.K., and Secretary of the Royal Society of Chemistry Applied Catalysis Group. See his website at: www.catalyst-decay.com for more information.