

Aqueous-Organic Biphase Catalysis

Aqueous-Phase Organometallic Catalysis: Concepts and Applications

EDITED BY BOY CORNILS AND WOLFGANG A. HERRMANN, Wiley-VCH, Weinheim, 1998, 615 pages, ISBN 3-527-29478-3, £140.00

This is the first book devoted entirely to the subject of aqueous-organic biphase catalysis and is both timely and important for this environmentally clean technology. Biphase catalysis involves two immiscible liquid phases, one containing the catalyst and the other the substrate, so that the separation of the catalysts is drastically simplified. Many eminent scientists contribute chapters, including F. Joó and E. G. Kuntz whose papers are seminal. The editors are well-known experts, one from academia and one from industry, and this is reflected in the range of contributions. The book covers other catalysts besides those of the platinum group metals, but since it describes many industrially important catalytic processes, ruthenium, rhodium and palladium frequently feature.

The book contains eight main chapters made up from between one and twenty-five individual contributions. Certain chapters, such as that on environmental and safety aspects of biphase catalysis, are essential reading for a rounded picture of the subject.

The platinum metals feature most prominently in the chapter entitled "Typical Reactions" which is more than 250 pages in length, with contributions from many authors. Hydroformylation is discussed first, with B. Cornils and E. G. Kuntz providing a résumé of the development of a commercial biphase oxo plant employing a water-soluble rhodium catalyst. Hydroformylation of lower and higher olefins, as well as functionalised olefins, is described, and not surprisingly, rhodium catalysts feature prominently. F. Joó and A. Kathó write a section on hydrogenation which is dominated by rhodium and ruthenium catalysts. After this comes a series of shorter sections beginning with carbonylation and carbon-carbon coupling reactions, the emphasis being firmly on palladium-based catalysts. Allylic substitution, hydrodimerisation, asymmetric synthesis, fine chemical syntheses, polymerisation

and olefin metathesis are all reviewed and the rôle of the platinum metals in these reactions is described. In keeping with the underlying theme of clean catalysis, the hydrogenation and hydrogenolysis of organosulfur compounds, and dehalogenations using hydrophilic catalysts, are also covered. These sections are written by notable experts including M. Beller, J. G. E. Krauter, W. A. Herrmann, C.-P. Reisinger, D. Sinou, N. Yoshimura, S. Haber, W. C. Schattenmann, R. H. Grubbs, D. M. Lynn, C. Bianchini, A. Meli, M. Bressan and A. Morvillo.

The penultimate chapter on other biphase concepts includes non-aqueous biphase regimes. The section on fluorous-organic systems by I. T. Horváth covers rhodium and iridium catalysts. Ionic liquid-organic systems are described by H. Olivier who illustrates the use of ruthenium, rhodium, palladium and platinum catalysts. P. C. J. Kamer and P. W. N. M. van Leeuwen describe an amphiphilic approach and M. Beller and J. G. E. Krauter conclude with a section on water-soluble, polymer-bound catalysts. These methodologies are emerging as important – but related – alternatives to the aqueous-organic protocol.

The book is full of factual data presented in tables and graphs and as such is an invaluable source of information when coupled with the extensive bibliographies at the end of each section. There are also a large number of figures and schemes which help to clarify the text.

The editors have succeeded in producing a book of interest to everyone working with platinum metals in homogeneous catalysis and compliments their earlier volume entitled "Applied Homogeneous Catalysis with Organometallic Compounds". It sets out ways in which organometallic catalysts can be made hydrophilic and shows their wide range of uses in biphase catalysis for small-scale synthesis and industrial-scale work.

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