

Book Review

Phase-Transfer Catalysis, Mechanism and Syntheses. Edited by Marc E. Halpern. ACS, 1997. 314 pp, hardback. \$ 99.95. ISBN 0-8412-3491-4.

This book is a printed version of a symposium on PTC held in Honolulu, Hawaii, Dec. 17–22, 1995. The authors of the chapters were selected from leading chemists in the field, including founders of PTC, to cover its theoretical as well as practical aspects.

The book is divided into three parts, entitled: “Mechanisms and Research Guidelines” (8 chapters), “Phase-Transfer Catalysis in Organic and Polymer Synthesis” (9 chapters) and “Phase-Transfer Catalysts” (4 chapters) which precedes a chapter by M. E. Halpern on “Recent Trends in Industrial and Academic Phase-Transfer Catalysis”. This introductory article is an interesting evaluation of the “state of art” of PTC and its future in universities and industry.

C. Starks analyses all important parameters of PTC to conclude that interfacial and extraction mechanisms must be considered to occur simultaneously. A short historical background of PTC and some new synthetic (generation of difluorocarbene, β -elimination) and mechanistic (the effect of produced anions on reaction course) results are presented by M. Makosza. Ch. L. Liotta et al. discuss both mechanistic as well as practical aspects of solid-liquid PTC systems, indicating a critical role of water. The importance of interface and formation of cyclic adsorption complexes in PTC reactions is described by S. S. Yufit et al. A combination of PT and micellar activities exhibited by quats with long carbon chains is discussed by F. S. Sirovski. M. J. O'Donnell et al. overviewed in two articles the PTC alkylation of glycine derived Schiff bases. This reaction is a key step in preparation of alkylated amino acids, also in chiral, non-racemic form. The use of chiral quaternary ammonium and phosphonium fluorides for asymmetric PTC reactions is described by T. Shioiri et al. A chapter written by M. E. Halpern can be recommended as a very useful guideline for selection of quats as PT catalysts of enhanced reactivity. E. V. Dehmlow tries to combine the reaction paths with the structure of the catalysts, but we are still far from understanding why they cause reaction branching and from prediction of their peculiar catalytic properties. Non-stoichiometric adducts of tetraalkylammonium fluorides with compounds able to form hydrogen bonds are used for simultaneous application of

fluoride as a nucleophile and a base (Y. Sasson et al.). R. Roy et al. demonstrate the efficiency of liquid-liquid PTC for preparation of anomeric glycosides. Some disadvantages stem from the use of tetra-*n*-butylammonium hydrogen sulfate (the best catalyst) in equimolar amount. Furthermore, a need for the use of a weak base in reactions of glycosyl halides with some nucleophiles (e.g. sodium azide) requires a comment. Regio- and diastereoselectivity of Michael addition of 2-phenylcyclohexanone to chalcone can be controlled by proper choice of reaction conditions (E. Diez-Barra et al.). T. Takido et al. describe a useful PTC method for preparation of sulfides, thiol esters and cyclic polythiaethers which eliminates the use of thiols. Dramatic speeding-up of active methylene compounds alkylation in solid-liquid PTC system by microwave irradiation is reported by Y. Iiang et al. However, this useful observation is described in a very schematic manner. PTC can be used for chemical modification of chlorine atoms containing polymers (T. Nishibuko), and to chemoselective polycondensation leading to aromatic polyesters with pendant reactive groups (S. Nakamura, Ch. Wang). A phenomenon of triphase catalysis is a subject of two articles: physico-chemical investigations of polystyrene-supported onium salts are detailed by N. Ohtani et al. while determination of a rate-limiting step in esterification of phenols by N. N. Dutta et al. T. Balakrishnan and J. P. Jayachandran advocate a new, multisite catalyst. However, it does not reveal advantages in PTC reactions, being also less easily available than typical quats. Postulated hydroxide ion extraction mechanism for phenylacetone alkylation by ethyl iodide seems rather unexpected. The final article is not connected directly with PTC, because it refers to synthesis and sodium-selective complexing properties of 16-crown-5 derivatives (M. Ouchi et al).

Some articles cited above possess an experimental section and the book is equipped with three well arranged, exhaustive indexes: authors, affiliation and subject.

Overall this book would be useful for university and industrial chemists, but rather for those who are already involved in PTC. M. E. Halpern's opinion that “... much progress has yet to be made both in the fundamentals of PTC and its industrial application” should be encouragement for further investigation in the field.

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