

Book Reviews

Ylides and Imines of Phosphorus. By A.W. Johnson with special contributions by W.C. Kaska, K.A. Ostoja Starzewski and D.A. Dixon. Wiley: New York; 1993, 587 pp., hardback. £ 74. ISBN 0-471-52217-1

An updated version of the standard work on "Ylide Chemistry" by A.W. Johnson has now appeared 27 years after its first publication.

The impressive development in ylide chemistry since 1966 and the flood of publications in this area have made the author concentrate on the chemistry of ylides and imine analogs of phosphorus in the present monograph and postpone the chemistry of ylides of other heteroatoms for a later work. In spite of these limitations, the author still had to sort through and research 3150 references compared to 840 literature citations in the first monograph. The author has succeeded in a convincing way.

The successful arrangement of the first edition has been more or less retained. At the beginning of the work, divided into 14 chapters, the author introduces his far-reaching definition of ylides, which includes, besides the well known phosphonium ylides, the carbanions of phosphine oxides, phosphonates and other P(V) derivatives. It concludes with an historical survey on the

development of the chemistry of ylides and imines of phosphorus and other heteroatoms.

Chapter 2, written by D.A. Dixon, deals with the theory of the bonding in ylides, especially the phosphonium ylides. Chapters 3-9 are exclusively devoted to these compounds. The physical properties (structural parameters, optical activity, rotation around the ylide bond, isomerism of β -carbonyl ylides, spectroscopic data and basicity) of these compounds are introduced in detail in Chapter 3 and the influence of their structure discussed. The so-called "unusual" phosphonium ylides are also covered in the same chapter. The author has collected under this term species like allylidenephosphoranes, phosphacumulenes, bisylides, cyclic ylides and ylides with "unusual" substituents on phosphorus or the anionic carbon atom. Even if all these compounds show certain special properties as compared to the "usual" phosphonium ylides, their discussion is not justified here from a systematic and didactic view, because then part of the synthesis and reactions from Chapters 5-8 are dealt with prematurely. It would have been more plausible to include here an account of the "unusual ylides" (as far as this concept is sensible) after the "normal" types, especially for readers not familiar with ylide chemistry. The chapter on phosphacumulenes could have been more extensive because of the manifold reactivity of this class of compounds. In Chapter 4, different methods for the preparation of phosphonium ylides, especially the important salt method, are described (comment on pp 105-106: sodium methoxide is not necessarily needed as base for the preparation of stable methoxycarbonylmethyltriphenylphosphorane, the reaction also takes place successfully with sodium hydroxide). The synthesis of complex ylides from simple representatives are discussed later in Chapter 6 and 7 in connection with the reaction of ylides with electrophiles. The reaction behaviour of ylides is discussed in Chapters 5-9. Chapter 5 describes the different ways of splitting the ylide group, whereby, among others, the oxidative and hydrolytic cleavage of the ylide to phosphorus free products are important. Chapter 6 describes the reaction of phosphonium ylides with a variety of electrophiles, especially organohalogen compounds, by which relatively simple ylides can be transformed into a great variety of complex representatives. In accordance with their importance in preparative chemistry, the alkylation and acylation of the ylides and the resulting preparative possibilities are specially treated. Chapter 7 deals with the

addition of phosphonium ylides to double-bond systems, 1,3-dipolar reagents and 3-membered rings. The great variety of reactions is impressively demonstrated. The Wittig reaction is described separately appropriate to its importance. The influence of structure and reaction parameters on the course of the Wittig reaction, especially with regards to stereochemistry, as well as modifications, problems and limitations of this reaction, are discussed in considerable detail in Chapter 8. Selected examples from different fields impressively show the possibilities for the application of this important reaction to synthesis. Chapter 9 is reserved for the mechanism of the Wittig reaction which is still actively researched and controversially debated and its clarification is still a fascinating puzzle. The author introduces different models, discusses them and gives a critically balanced comment. No other review exists for those readers interested in obtaining a complete overview of the current state of the debate on the mechanism and stereochemistry of the Wittig reaction. Chapters 10-12 deal with phosphonate, phosphinoxy and other phosphorus carbanions, which are similar in their reaction behaviour to phosphonium ylides. The carbonyl olefination reaction with phosphonates (Wadsworth-Emmons reaction) and phosphine oxides (Horner reaction) are critically compared to the Wittig reaction and have been given special treatment. The author should be commended for providing useful information on the general confusion in the literature about these name reactions and for his plea for the use of correct nomenclature. Iminophosphoranes, which are similar to phosphonium ylides in their structure and reactivity, are described in Chapter 13. Finally in Chapter 14, W.C. Kaska and K.A. Ostojka Starzewski describe the reaction of ylides with transition metal compounds and show the immense structural variation in organometal ylide chemistry, a very current research field, which is far from complete.

The aim of the author to present the current information on ylide and imine chemistry of phosphorus has been successful. The book, which is intended for researchers in the field of ylides as well for anyone who requires a quick overview of this subject, is useful and should stimulate all groups and should not be missing from any library.

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