Book Reviews

Reduction: Techniques and Applications in Organic Synthesis. Edited by ROBERT L. AUGUSTINE, Department of Chemistry, Seton Hall University, South Orange, N. J. Marcel Dekker, Inc., 95 Madison Ave., New York, N. Y. 1968. ix + 242 pp. 16 × 23.5 cm. $12.75.

This volume on "Reduction" is the second to be issued in this relatively new series on techniques and applications in organic synthesis. The editor and the contributing authors have prepared an excellent medium-sized book, the purpose of which is to provide chemists with concise and critical evaluations of as many reduction reactions of synthetic importance as possible The book is divided into three sections which cover reduction by mixed hydrides, reduction by metals, and deoxygenation of carbonyl compounds. Hydrogenation was covered in the first volume of the series.

The first third of the book, by Mark Rerick, deals with mixed hydrides such as lithium aluminum hydride modified by the addition of aluminum chloride, or pyridine, or an alcohol. All essential points are covered: safety, contrasts with unmodified lithium aluminum hydride, and many comparisons of the relative usefulness of the various reagents. Brief experimental directions are included. The chapter is organized in a systematic way: following a discussion of the chemistry involved and the recommended techniques and apparatus, there is a detailed discussion of what happens with olefins, halides, aldehydes, etc., each functional group being considered in turn. Stereochemistry is emphasized. There are many surprises in store for the general synthetic organic chemist who has not made a special effort to keep up with this field. Thus, we learn that the asymmetric reduction of unsymmetrical ketones can be accomplished using lithium aluminum hydride modified with certain glucofuranose ethers. The carbinols are often obtained with optical purities of 20 to 35%, and either the *R* or *S* configuration may be obtained depending on whether or not ethanol is also present as a modifying reagent.

The second third, by Michael Smith, covers reductions carried out by metals. The chapter first considers metals in liquid ammonia with and without a protic source such as alcohol. We learn that lithium is not better than sodium as a reducing agent as long thought, but is utilized more effectively if iron is present and therefore appears to be superior. The various types of bond fission, such as C–N, C–O, C–S, etc., are considered in detail. The chapter would be very helpful to chemists wondering whether one of the metal reduction systems should be considered for their own work. Many selective reductions of terminal *vs.* nonterminal olefins and acetylenes, and of various conjugated polyenes, can be achieved by using the right metal–ammonia–proton donor system. The Birch reduction is given a thorough coverage. Following the liquid ammonia systems, the alkylamine systems are covered and we learn that these metal–amine systems are more powerful reducing agents than are the metals in liquid ammonia. This is a mixed blessing, for selective reductions are more difficult. A final section is devoted to sodium dispersions, and other metals such as iron, tin, and zinc.

The third section, by William Reusch, starts with a thorough coverage of what has been done with the Wolff–Kishner reaction since the development of the Huang-Minlon modification. Then comes a rather short and standard review of the Clemmensen reduction. The third method covered for the deoxygenation of carbonyl compounds involves the formation of thioacetals or ketals followed by desulfurization under neutral conditions. Finally, there is an excellent summary of the best ways to deoxygenate, including a discussion of the above methods and also other methods such as catalytic hydrogenation and the classical hydrogen iodide plus phosphorus procedure.

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