metal centres are most facile for radicals centred on electronegative atoms: the longest section in the chapter is devoted to alkoxy radicals, whilst alkyl and aryl radicals rate only two pages. Attack by alkylperoxy radicals is important in autoxidation of organometallic compounds, and these autoxidations form an instructive contrast to hydrocarbon autoxidations (a topic also considered in the separate chapter on autoxidation by J.A. Howard). Many of these reactions have been studied kinetically by ESR methods, and structural features affecting reactivity are becoming better understood.

The way in which organometallic radical reactions have become part of the fabric of free radical chemistry is shown by the wide occurrence of organometallic reactions in the discussions in the other chapters of the book. Although only three chapters out of 26 are devoted entirely to radical reactions of organometallic compounds, discussion of structure or reactivity of organometallic radicals, especially those centred on tin or silicon, occurs in no less than 14 of the remaining chapters of the work.

In summary, this work is likely to remain for many years the best and most comprehensive monograph on Free Radical Chemistry available. Although its price may appear to put in the "library purchase" category, the utility of "Free Radicals" will ensure that a large number of individual researchers on free radical chemistry, including the growing number working on organometallic radicals, will wish to have their own copies.

School of Molecular Sciences
University of Sussex
Brighton BN1 9QJ (Great Britain)

R.A. JACKSON

Gmelins Handbuch der anorganischen Chemie. Ergänzungswerk zur 8. Auflage. *Band 10. Zirkonium-organische Verbindungen* (88 pp.). *Band 11. Hafnium-organische Verbindungen* (22 pp.). Gmelin Institut für anorganische Chemie und Grenzgebiete in der Max Planck-Gesellschaft. A. Moulik (reporter); A. Slawisch (senior editor), Verlag Chemie, Weinheim/Bergstrasse, 1973, DM169.

This slim book which contains both of the mentioned volumes continues the Gmelin Institut's coverage of organotransition metal chemistry with an exhaustive review of the C-bonded organic derivatives of zirconium and hafnium. In contrast to the volumes on chromium, vanadium and cobalt [1,2] which are in German, this book is in English. (It would be nice indeed, and it would make practical sense, if all future Gmelin volumes were published in English). Marginal notes in German serve to aid the German user, and the preface which explains the organization of these volumes is given in German as well as in English. The organization is the same as that followed in the previous volumes [1,2] and useful compound and ligand formula indices are provided.

Over 400 compounds of zirconium and hafnium are described. Their types are not numerous, compared with those of other transition metals. Some σ-bonded alkyls, benzyls and aryls are reported, but π-bonded derivatives make up the large majority of the organic derivatives: many π-cyclopentadienyls of types π-$C_5H_5MY_3$ and $(\pi$-$C_5H_5)_2MY_2$, a few π-allyls and the isolated examples of compounds with neutral benzene and cyclooctatetraene ligands. Tables and text give preparative procedures, physical and spectroscopic properties, structural details where known, chemical reactions, applications and catalytic activity as gleaned from original research articles, patents, reviews, books, theses and conference reports with typical Gmelin thoroughness. Formulas and figures are presented where appropriate. The volumes are up-to-date, with coverage complete through 1972, but with some 1973 references as well. We welcome this new and useful contribution to the "handbook literature" of organometallic chemistry.

Department of Chemistry
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139 (U.S.A.)

DIETMAR SEYFERTH

1 J. Organometal. Chem., 34 (1972) C59
2 J. Organometal. Chem., 55 (1973) C95

Metastable Ions; by R.G. Cooks, J.H. Beynon, R.M. Caprioli and G.R. Lester, Elsevier Scientific Publishing, Amsterdam, 1973, x + 296 pages, Dfl. 75.00

This book was written with the belief that an awareness of the significance of metastable ions will extend the range of complex molecules that can be characterized by mass spectrometry. A metastable ion for this purpose is defined as one that is sufficiently stable to leave the ionization chamber but decomposes before reaching the collector. In the normal spectrometer it gives rise to broad peaks, usually spreading over one or more mass unit.

From the point of view of straight chemical analysis the observation of metastable ions is the most direct evidence for particular fragmentation pathways, which lead in turn to structural information. The field offers, in addition, rich pickings for the physical chemist, for by the analysis of peak shapes information is obtained about the conversion of internal energy of the parent ion into kinetic energy of the fragments. The book covers both of these aspects as well as giving a description of the instrumental techniques and the basic theory of the kinetic processes involved.

Examples are given in both the organic and inorganic fields and it is clearly a technique that will have wide applications in organometallic chemistry. I can recommend the book without reservations.

School of Molecular Sciences
University of Sussex
Brighton BN1 9QJ
(Great Britain)

J.N. MURRELL