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# Book reviews

*The Chemistry of Transition Metal Carbides and Nitrides*, S.T. Okama (ed.), Chapman & Hall, London, 1996, 536 + xxv pages, £125, ISBN 0 7514 0365 2

Many organometallic chemists have now been lured into the wide-ranging world of materials chemistry, both because of its undoubted fascination and applicability and because it often offers an increased likelihood of funding. These chemists then require extended insight into the structures, properties and actual or potential applications of the materials they seek to produce, and this provides the justification for reviewing the present volume in a journal devoted to organometallic chemistry.

This book cannot be fairly described as a comprehensive overview of its subject area; indeed the amount of published work is such that no single volume could achieve this. It is better considered as a set of vignettes which highlight particular aspects of current research in the area, and derives from a symposium which formed part of the Congress of Pacific Rim Chemical Societies, held in Honolulu in December 1995. Topics include studies of the crystal and electronic structures of these compounds, their physical and chemical properties, improved preparative methods, calculations concerned with bonding modes, Fermi levels and superconductivity, their uses as catalysts, cutting tools and magnetic materials, and even their possible use in nuclear rocket motors for space travel. One feature which emerges is that although an immense amount of detailed and precise information about these materials has been uncovered, there is still uncertainty regarding some of the most fundamental physical and mechanical properties, probably because of the difficulty of obtaining really pure bulk materials. Thus the melting point of TiC is variously quoted in Chapters 1 and 2 as 2903 and 3370 K, its microhardness as 3200 and 3000 $kg\,mm^{-2}$, and its Young's modulus as 370 and 451 GPa.

The chapter of most direct interest to organometallic chemists is that dealing with single-substance precursors for the chemical vapour deposition (CVD) of films of TiN, TiC, VN and VC and contributed by well-known practitioners from the Toulouse and Perpignan groups. These compounds are not only refractory ceramics, useful as protective coatings, but also have applications in microelectronics: thus thin films of TiN are important as a barrier layer to prevent mutual and harmful diffusion between silicon substrates and attached metal conductors. A critical examination of the behaviour of 28 volatile organometallic precursors under low-or atmospheric-pressure CVD conditions, together with detailed analysis of the solid and gaseous products, provides important insights into the requirements for useful precursor design. Compounds such as $(\eta^5\text{-}C_5H_5)_2TiCl$ and $[\eta^5\text{-}C_5H_3(SiMe_3)_2]TiCl_3$ (for TiC) or $(\eta^5\text{-}C_5H_4Bu^t)_2V$ (for VC) seem particularly promising. Single-compound precursors for nitrides are more elusive, and often lead to unwanted carbon and/or halogen incorporation (e.g. $(\eta^5\text{-}C_5H_5)TiCl_2[N(SiMe_3)_2]$ and $Cl_3VNBu^t$).

This well-produced and up-to-date book makes extensive reference to the primary literature, although patents on industrial applications are sparse. It represents a useful resource for chemists wishing to expand their horizons.

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*Gmelin Handbook of Inorganic and Organometallic Chemistry, 8th edn., Organolead Compounds Part 4: $R_3PbR'$ compounds*, edited by W. Petz, Springer-Verlag, Berlin, 1995, 409 pp. + xiv, DM 2,350.00, ISBN 3-540-93727-7

Parts 1–3 of this series on organolead compounds dealt with compounds of the type $PbR_4$. This new edition, written by F. Huber, is concerned with compounds of the type $R_3PR'$, which provide most of the known unsymmetrical compounds with more than one type of organic group attached to lead. Many of the compounds $R_3PbR'$ were prepared for studies of their possible application as anti-knock additives to

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petroleum, but some for use as reagents in organic synthesis.

About 40% of the book (i.e. 156 pages) is devoted to the compounds $Me_3PbR'$, including $Me_3PbEt$ which takes up 50 pages; remarkably, only 4 pages are required to deal with the chemical reactions of the latter compound, the studies of it having been largely focused on its physical properties, toxicity, environmental effects and uses. Much the same distribution of space applies in the case of the compounds $Et_3PbR'$, which take up 55 pages, and $Ph_3PbR'$, which takes up 124 pages. A great amount of information is clearly and concisely made available, much of it in tables. Coverage of the literature is complete up to the end of 1994, and extends to the more readily available journals up to mid-1995. There is a useful formula index.

Anyone engaged in research on organolead compounds should have access to this excellent series, either to the printed volumes or on-line.

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*Multiply Bonded Main Group Metals and Metalloids*, R. West and F.G.A. Stone (eds.), Academic Press, San Diego, 1996, 408 pp. + xi, $65.00, ISBN 0–12–744740–7

This book, timely and of high quality, is a paperback edition of *Advances in Organometallic Chemistry*, Volume 39. Concerned with a field of chemistry in which there is much current activity, it presents an excellent set of authoritative reviews of several of the main topics by authors who are among the leaders in the areas covered.

The reviews are as follows: multiple bonding involving the heavier Main Group 3 elements Al, Ga, In and Tl (69 pages, 152 refs.) by P.J. Brothers and P.P. Power; the chemistry of silenes (88 pages, 223 refs.) by A.G. Brook and M.A. Brook; iminosilanes and related compounds – synthesis and reactions (33 pages, 55 refs.) by I. Hemme and U. Klingebiel; silicon–phosphorus and silicon–arsenic multiple bonds (36 pages, 46 refs.); chemistry of stable disilenes (43 pages, 105 refs.) by R. Okazaki and R. West; stable doubly bonded compounds of germanium and tin (49 pages, 115 refs.) by K.M. Baines and W.G. Stibbs; diheteroferrocenes and related derivatives of the Group V elements arsenic, antimony and bismuth (28 pages, 57 refs.) by A.J. Ashe III and S. Al-Ahmad; boron–carbon multiple bonds (36 pages, 113 refs.) by J.J. Eisch.

Most of the reviews are concerned with 'unsaturated' species that would conventionally be shown as having double bonds to the Main Group elements, e.g. $R_2Si{=}CR'_2$, $R_2Si{=}SiR_2$, $R_2Si{=}NR'$, $R_2Ge{=}PR'_2$, or in the case of the diheteroferrocene derivatives of Group 15 elements, aromatic rings incorporating the Main Group element. However the first review, a well-organized survey by P.J. Brother and P.P. Power, largely deals with the question of what would commonly be thought of as partial double bonding in formally saturated species such as $R_2MER'_2$, where M is a Group 3 element and E a Group 5 or Group 6 element (e.g. $R_2GaPR'_2$, $R_2AlOR'$), but also with anions such as $[R_2AlAlR_2]^-$; for many readers the section dealing with possible $\pi$-bonding in compounds having a Main Group element bonded to a transition metal will be of special interest. Likewise, much of the well-informed and interesting survey of boron–carbon multiple bonds is concerned with partial double bond character that in valence-bond terms can be represented in terms of resonance between canonical forms such as (in the simplest case) $R_2C{=}CR{-}BR'_2$ and $R_2C^+{-}CR{=}B^-R'_2$, but classically unsaturated species, such as Paetzold's stable $(Me_3Si)_2C{=}BBu^t$, and anions of the type $[RC{=}BR']^-$ are also discussed.

The presentation is good, with high quality print and clear diagrams, and there is a satisfactory subject index. The editors and authors are to be congratulated on this book, which represents very good value by today's standards. But its content is, of course, already available in libraries that subscribe to the excellent *Advances in Organometallic Chemistry* series.

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*Metal-Containing Polymeric Materials*, C.U. Pittman Jr., C.E. Carraher Jr., M. Zeldin, J.E. Sheats and B.M. Culbertson (eds.), Plenum Press, New York, 1996, 518 + x pages, US$125.00, ISBN 0–306–45295–2.

This is the fifth in a series based on lectures given at successive symposia of the American Chemical Society