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M. L. H. GREEN  
*Inorganic Chemistry Laboratory, University of Oxford*

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### **Catalytic Reductive Carbonylation of Organic Nitro Compounds**

S. Cenini and F. Ragaini

Kluwer Academic Publishers, Dordrecht, 1996

339 + xi pages. £115

ISBN 0-7923-4307-7, Hardback

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Research workers in the area of metal-catalysed reactions of organic nitro compounds will be familiar with the work of the Milan group and the article by Professor Cenini and Colleagues.<sup>1</sup> This has now been updated and expanded to produce the current monograph. Experts in this area will be keen to make a comparison with the article by two researchers from Hoechst<sup>2</sup> which appeared only months after the literature deadline for this book, given as March 1996.

The book is divided into six chapters with a useful index. Chapter 1 is introductory: it sets out the most important objectives of the research in the field, and also describes how a nitro group can interact with a metal ion. Chapter 2 is concerned with the carbonylation of nitro compounds to give isocyanates, which are needed for the manufacture of polyurethanes. It is this reaction which has involved so much effort over the years, because a direct synthesis of an isocyanate from a nitro compound and carbon monoxide would eliminate the need for the use of the highly toxic phosgene. Chapter 3 describes the synthesis of carbamates and ureas. Carbamates can provide another route to isocyanates, as they may be thermally decomposed into the isocyanate and alcohol. Unfortunately the catalysts so far developed are not sufficiently active to be commercially attractive. Chapter 4 is devoted to the synthesis of non-cyclic compounds (oximes, amines, nitriles, azo compounds, Schiff bases and other miscellaneous derivatives), whereas Chapter 5 concentrates on heterocyclic compounds. The final chapter is a critical discussion of the mechanisms of the reductive carbonylation of nitro compounds; it is divided according to the catalytic metal, with over 20 pages devoted to palladium. The authors say in the

introduction to this chapter that whereas the first five chapters are essentially a literature survey, in the final chapter they give their interpretation of observations and it should be regarded as an original contribution rather than a review article. In other words, this is reductive carbonylation of organic nitro compounds '*alla Milanese*', and certainly none the worse for that. Some of the suggestions are controversial; for example, on p. 264 the authors suggest an alternative structure for an intermediate which had been deduced from spectroscopic evidence.

This is an extremely specialized book of over 300 pages on a topic which only receives about five pages of coverage in Parshall and Ittel's *Homogeneous Catalysis*.<sup>3</sup> Those working in the field will be extremely grateful to the authors for giving such a comprehensive account together with their specialist insight.

A. W. PARKINS  
*King's College London, UK*

### **REFERENCES**

1. S. Cenini, M. Pizzotti and C. Crotti, *Aspects Homogen. Catal.* **6**, 97 (1988).
2. A. M. Tafesh and J. Weiguny, *Chem. Rev.* **96**, 2035 (1996).
3. G. W. Parshall and S. D. Ittel, *Homogeneous Catalysis – The Applications and Chemistry of Catalysis by Soluble Transition Metal Complexes*, Wiley, New York, 1992.

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### **Chemistry of Tin**, 2nd edn

P. J. Smith (ed)

Blackie Academic & Professional, London, 1997

578 pages. £149 (hardback)

ISBN 0-7514-0385-7

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Tin is one of the world's most valuable metals. Although its annual consumption of around 200 000 tonnes is small

compared with that of many industrial metals, its importance lies in the fact that it is a vital component

in a large number of applications. Nowhere is the versatility of tin more apparent than in its chemical compounds. Chemical uses of tin account for well over 10% of total tin consumption and range from traditional long-established uses to modern high-technology applications. Understanding the mode of action of tin chemicals in these uses requires a detailed knowledge of the properties of the compounds and the mechanisms involved in their reactions. At a time when the applications are becoming ever more specialized and refined, it is fortunate that a new edition of *Chemistry of Tin* has become available.

This second edition has been considerably revised and updated, with six completely new chapters covering  $^{119}\text{mSn}$  Mössbauer studies; solid-state NMR; uses in organic synthesis; environmental analysis; biological properties; and health and safety aspects. The individual chapters are written by authorities in the field drawn from many parts of the world so that coverage is truly international. The editor has many years of experience in tin chemistry from both practical and theoretical standpoints.

In all there are 15 chapters, covering all the major aspects of tin chemistry, with extensive references and data. The opening chapters look at 'Tin — the element' and general trends in tin chemicals, this including a detailed discussion of structure and bonding in tin(II) and tin(IV) compounds, thereby highlighting the wide range of coordination geometries and lattice structures that are exhibited. Chapter 3 deals with the inorganic chemistry of tin, while Chapters 4–6 discuss various aspects of organotin chemistry. Chapter 7 is a detailed treatment of tin–metal bonded compounds and Chapter 8 examines the radical chemistry of tin.

The next four chapters are particularly important from the point of view of applications of tin chemicals. The use of organotin compounds in organic synthesis has become a major field of organometallic chemistry during the past decade and a very comprehensive review of the use of tin reagents in this area is presented in Chapter 9. Chapter 10 reviews recent studies on the mode of biological action of di- and tri-alkyltin compounds, including a section on their antitumour activity. An

interesting conclusion to this chapter suggests that whilst some organotin compounds are gradually being eliminated as environmental contaminants, others are being developed as new medicines.

Tin itself is a non-toxic metal and is reported to be an essential trace element. Indeed, the generally low toxicity of tin chemicals has led to their increasing usage in recent years. However, some health and safety problems have arisen with certain biologically active trialkyltin compounds, which have resulted in restrictions being placed on their use in specific areas. Chapter 11 provides a very useful summary of the toxicology of tin chemicals and, in addition, gives a listing of the world's primary manufacturers of both inorganic tin and organotin compounds.

Chapter 12 gives a concise but comprehensive overview of the many industrial applications of tin chemicals, these being subdivided into the following sections; the plastics industry; glass and ceramics; electroplating; biocidal applications; heterogeneous catalysts; pharmaceuticals; fire prevention; and miscellaneous uses.

The next two chapters deal with two solid-state techniques which have been widely used to investigate structures and bonding in tin compounds; solid-state NMR and  $^{119}\text{mSn}$  Mössbauer spectroscopy. Each chapter provides a brief description of the technique in question, its value with regard to understanding tin chemistry, and a wealth of tabulated data.

The final chapter is concerned with the analysis of organotin compounds from the natural environment and details the modes of entry of tin species into the environment, extraction techniques, and the various chromatographic and spectroscopic methods which have been developed (primarily over the past 20 years or so) to analyse organotin species to sub-ppb levels.

This book, which is addressed to academic researchers and industrial chemists alike, provides an in-depth reference work which will keep its value for many years to come.

P. A. CUSACK

*International Tin Research Institute, Uxbridge, UK*

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### **Structure and Bonding, Vol. 87. Structural and Electronic Paradigms in Cluster Chemistry**

D. M. P. Mingos (ed.)

Springer, Berlin, 1997

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This 87th volume in Springer's excellent 'Structure and Bonding' series was produced to mark the quarter-century that has elapsed since the first papers appeared drawing attention to the way the polyhedral shapes of

cluster compounds reflect their formula types and so, by implication, the numbers of electrons they contain. Relationships between molecular shapes and electron numbers are now so commonplace in chemistry in