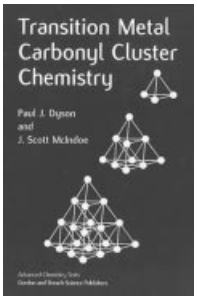
Transition Metal Carbonyl Cluster Chemistry. By *Paul J. Dyson* and *J. Scott McIndoe.* Gordon & Breach Publishers, Amsterdam 2000. 166 pp., hardcover £ 26.00.—ISBN 90-5699-289-9

The field of transition metal carbonyl clusters is the most mature subdomain of the vast field of cluster research and a well established part of molecular inorganic chemistry. It possesses a highly developed conceptual framework, whereby the diverse structural patterns found for carbonyl clusters can be explained by a few relatively straightforward electron counting rules. This relationship between the apparent complexity of the objects of study and the simplicity of the underlying principles gives the field a certain esthetic appeal, and makes it an attractive subject in advanced undergraduate and graduate courses. Ten years ago there were but a few monographs on the subject, written for scientists working in the field. More recently, this situation has changed dramatically with the publication of a whole range of monographs dealing with one aspect or another of cluster chemistry. However, with the exception of Catherine Housecroft's Oxford primer *Metal–Metal Bonded Carbonyl Dimers and Clusters*, there is no textbook available which students who are beginners in the area may use alongside their course work. Thus there is a real need for such a book, and it is this gap which Paul Dyson and Scott McIndoe aim to fill.



In the first three chapters of the book the authors introduce the rules of electron counting in carbonyl clusters, as well as the fundamental structural principles. The discussion of the theoretical framework is backed up by some worked examples illustrating the application of electron counting to polynuclear metal–metal bonded compounds. The EAN rule and the polyhedral skeletal electron pair theory are treated in turn. However, I feel that their conceptual relationship and differences, although briefly indicated at the end of Section 2.3, would have merited a more detailed discussion. For many students the failure of the EAN approach and the transition to the more delocalized bonding picture of the Wade–Mingos rules presents a difficult intellectual challenge.

These introductory chapters are followed by a section on the principal types of ligands, including interstitial ligands. An important point is the discussion of the variety of carbonyl coordination modes, some of which are unique to polynuclear complexes. I found that this chapter was particularly well written, covering all relevant aspects for an introductory lecture course. However, I was surprised to find the old claim of hydrido ligands in tetrahedral interstitial sites re-emerging here, despite the absence up to now of any direct proof for such a structural motif in any of the known molecular clusters (with several claims still unsubstantiated). The chapter on the main methods for characterizing clusters gives a good overview of the experimental techniques and their capabilities and limitations. The ligand polyhedral model which was developed to explain polytopal ligand rearrangements in clusters, and which is particularly useful in the classroom teaching of this subject, is aptly introduced at this stage, but might have deserved a more extensive treatment.

In Chapter 6, which is dedicated to cluster synthesis, the methods used for building clusters are reviewed. Whereas the cluster chemistry of the heavy Group 8 metals is dominated by the various thermolytic and pyrolytic techniques (both types accurately defined in this book!), for their neighbors to the right in the Periodic Table clusters are more easily synthesized using redox chemical approaches. The fundamental aspects of cluster synthesis are followed up by a discussion of the main patterns of reactivity. This discussion of cluster reactivity sets the scene for a review of several reactions with organic ligands in Chapter 8. The variety of π-coordination modes to cluster vertices, edges, and faces is a particularly instructive example of the structural peculiarities of these molecular species, which are not found in the same way in the more conventional mononuclear organometallic complexes. The section on heteronuclear clusters (Ch. 9) gives an overview of the various strategies, some rational and others less obviously so, for the synthesis of these types of high nuclearity clusters. A main objective of fundamental research in cluster chemistry remains the development of new organometallic reagents and catalytically active complexes. Some highlights of this more applied aspect of the field are discussed in the final chapter, which is centered around organic transformations induced and catalyzed by polynuclear metal carbonyl compounds. For a first edition there are remarkably few errors in the text or in the schemes and figures (rare examples are the legend of Fig. 2.4 and Scheme 6.8).

The teaching of cluster chemistry places much emphasis on the application of the basic conceptual principles to a variety of systems. This is done by setting exercises, and it is through these that the student absorbs the peculiar way of thinking which underlies the whole scheme of electron counting, and which is so extremely useful to cluster chemists. It is a pity that the authors have not added a problem section at the end of each chapter or included more worked problems in the main text. Moreover, a book of this type will be a starting point for further studies for the dedicated student as well as the nonspecialist lecturer. The absence of references in the individual chapters, which would allow direct access to the literature, is a weak point of this book, since it is clearly not aimed at first and second year undergraduates (if it were, the lack of references to the primary and secondary literature might be justified). The one-page "further reading" section at the end is inadequate, and it is hoped that it will be substantially extended in future editions.

These final points of criticism aside, Paul Dyson and Scott McIndoe have succeeded in writing a textbook on carbonyl cluster chemistry that is well suited to the needs of university chemistry teaching. I shall recommend it to my students.

Lutz H. Gade
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