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BOOK REVIEW

B. D. Gupta and Anil J. Elias (Authors): Basic Organometallic Chemistry: Concepts, Syntheses and Applications of Transition Metals (CRC)

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Falling as it does in the space between traditional organic and inorganic subdisciplines, organometallic chemistry can be a tough fit in the crowded undergraduate chemistry curriculum. Frequently treated as a 'special topic' within a course geared toward one of the more foundational areas, there is likely to be increased interest in exposing undergraduate chemists to organometallic chemistry as a result of the three Nobel prizes awarded this past decade for breakthroughs in organometallic catalysis. The text *Basic Organometallic Chemistry*: *Concepts, Syntheses and Applications of Transition Metals* by Gupta and Elias moves into this space, covering a broad range of topics within molecular organotransition metal chemistry. Both in tone and content, the text is well-suited to an upper-level undergraduate audience.

At roughly 500 pages and a total of twenty chapters, the book falls neatly into two equal parts. The first ten chapters cover background and basics. Following an introductory chapter that provides historical perspective on the major milestones in the development of organometallic chemistry, the text begins in earnest with a discussion of electron counting and bonding formalisms (Chapter 2). The approach is primarily expository, providing the basic vocabulary and concepts used to describe organometallic compounds. As a result, the text does not assume an in-depth knowledge of molecular orbital theory and should be highly accessible to undergraduate students. However, the simplicity of this approach leads at times to some awkward moments. A bulleted list is presented in lieu of a more complete explanation of why certain complexes deviate from the 18 electron rule. This ultimately requires recourse to a whole host of concepts (e.g. strong σ-donors, dπ orbitals, etc.) that had not been previously introduced. Moreover, there is very little discussion of global electronic structure (indeed, the first and only depiction of an orbital splitting diagram is found in chapter 18 on page 346!). Consequently, common concepts with broad explanatory power that find their way into other comparable texts (crystal field theory, ligand field theory, hard-soft acid base theory, etc.) are omitted here, and an instructor would likely need to supplement course content in order to provide students with additional perspective on structure.

The text next leads students through a survey of common ligands in organometallic chemistry (Chapters 3–6). Specifically, the bonding, properties, preparation and reactivity of metal-bound carbonyls, phosphines, carbenes, olefins, alkyls, aryls and polyenes are presented. Individual metal–ligand bonds are treated in an ad hoc fashion, but this is generally sufficient to explain observed trends in common ground state properties (e.g. bond lengths, stretching frequencies, etc.). An introduction to elementary reactions of organometallic compounds follows in Chapters 8 and 9. In general, the treatment here is rather brief. For example, the entire breadth of chemistry from oxidative addition and reductive elimination, to migratory insertion and deinsertion is treated in just 17 pages!

The second half of the book delves into the varied modern applications of organometallic chemistry, with specific attention to catalysis. Many of the familiar landmarks in homogeneous catalysis are represented: hydrogenation, hydroformylation, cross coupling, olefin metathesis and polymerization each receive their own chapters, while other industrially important chemistries (hydrocyanation, Wacker oxidation, Monsanto process)

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also receive mention. The authors do a good job of providing a historical perspective on these developments, while making sure to address relatively modern advances. The text is rounded out by the inclusion of chapters on organometallic polymers and bioorganometallic complexes, a unique contribution that helps emphasize the interdisciplinary aspects of organometallic chemistry.

A number of features are likely to be particularly attractive to the student reader. Each chapter includes roughly a dozen problems and exercises to reinforce understanding; answers are included in Appendix 1. Additionally, Appendix 2 contains a selection of quick review questions of the true/false and fill-in-the-blank type that would be particularly useful to students reviewing for final examinations. Throughout, the text is peppered with dialogue boxes containing interesting anecdotes and insights that help bring life to the content in the main body of the text. And, though not meant to be comprehensive, there are adequate references to the primary literature included at the end of every chapter to provide the interested reader with opportunities for supplementary reading.

One opportunity for improvement in subsequent editions of this text would be in the visual presentation. In particular, the chemical drawings are not presented with uniform bond lengths, angles, or even font sizes. At the very least, this is an unnecessary nuisance; but at worst there are instances when the structures are ambiguous and may lead to misunderstandings in situations where geometry is important.

In short, *Basic Organometallic Chemistry*: *Concepts, Syntheses and Applications of Transition Metals* by Gupta and Elias is likely to be useful teaching text at the upper-undergraduate level when supplemented by additional lecture material.