

M(III) complexes (2). A somewhat analogous structure was proposed by Vaska for the oxygen complex  $\text{Ir}(\text{Ph}_3\text{P})_2\text{CO}(\text{Cl})\text{O}_2$ ,<sup>10</sup> and more recently Parshall and Jones suggested a three-membered,  $\sigma$ -bonded ring structure for the tetrafluoroethylene adduct  $\text{Ir}(\text{Ph}_3\text{P})_2\text{CO}(\text{Cl})\text{C}_2\text{F}_4$ .<sup>11</sup> In this connection, it is interesting to compare  $\nu_{\text{CO}}$  for these two complexes with  $\text{Ir}(\text{Ph}_3\text{P})_2\text{CO}(\text{Cl})\text{TCNE}$ . For  $\text{Ir}(\text{Ph}_3\text{P})_2\text{CO}(\text{Cl})\text{Y}$ ,  $\nu_{\text{CO}}$  values are 2000,<sup>10</sup> 2040,<sup>11</sup> and 2058  $\text{cm}^{-1}$  for  $\text{Y} = \text{oxygen}$ , tetrafluoroethylene, and tetracyanoethylene, respectively,<sup>12</sup> indicating that the transfer of electrons from metal to ligand  $\text{Y}$  increases in the order given. The O-O distance in the oxygen complex has been shown to be intermediate between that in molecular oxygen and peroxide.<sup>13</sup> This fact, considered in conjunction with the rather higher  $\nu_{\text{CO}}$  of the TCNE complex relative to the oxygen complex, probably means that an essentially  $\sigma$ -bonded, three-membered "metallocyclopropane" ring structure exists in these compounds.

The stability of these rhodium and iridium cyanocarbon complexes appears to be greater than analogous hydrocarbon complexes, and equal to or somewhat

(10) L. Vaska, *Science*, **140**, 809 (1963).

(11) G. W. Parshall and F. N. Jones, *J. Am. Chem. Soc.*, **87**, 5356 (1965).

(12) Values quoted are for solid state spectra.

(13) S. J. LaPlaca and J. A. Ibers, *J. Am. Chem. Soc.*, **87**, 2581 (1965).

greater than recently isolated fluorocarbon complexes. Vaska and Rhodes<sup>14</sup> noted that  $\text{Ir}(\text{Ph}_3\text{P})_2\text{CO}(\text{I})$  reacted reversibly with ethylene at 26° and 700 mm in toluene, but due to rapid dissociation the complex was not isolated. In the case of  $\text{Rh}(\text{Ph}_3\text{P})_2\text{CO}(\text{Cl})$ , ethylene absorption was not observed. Tetrafluoroethylene was reported to react with  $\text{Ir}(\text{Ph}_3\text{P})_2\text{CO}(\text{Cl})$  at 25° and 3 atm to give pale yellow  $\text{Ir}(\text{Ph}_3\text{P})_2\text{CO}(\text{Cl})\text{C}_2\text{F}_4$ . Solutions of this complex in benzene evolved tetrafluoroethylene at 25° under vacuum.<sup>15</sup>

In the homogeneous catalytic hydrogenation of ethylene by  $\text{Ir}(\text{Ph}_3\text{P})_2\text{CO}(\text{Cl})$ , an intermediate having a structure similar to that shown in 2 has been postulated.<sup>13</sup> Since the TCNE adduct, unlike the ethylene adduct, may be isolated as a stable, crystalline compound, physical and chemical studies may now be carried out on these model compounds that were not heretofore possible. Such studies, as well as attempts to prepare cyanocarbon complexes of other organometallic substrates, are being pursued.

(14) L. Vaska and R. E. Rhodes, *ibid.*, **87**, 4970 (1965).

(15) R. Cramer and G. W. Parshall, *ibid.*, **87**, 1392 (1965).

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## Book Reviews

**Annual Survey of Organometallic Chemistry. Volume 1. Covering the Year 1964.** By DIETMAR SEYFERTH, Department of Chemistry, Massachusetts Institute of Technology, Cambridge, Mass., and R. BRUCE KING, Mellon Institute, Pittsburgh, Pa. American Elsevier Publishing Co., Inc., 52 Vanderbilt Ave., New York, N. Y. 1965. viii + 330 pp. 17 × 24 cm. \$20.00.

This volume is the first in what is planned as a continuing annual digest of all the original literature on organometallic chemistry, defined as the chemistry of compounds containing at least one metal-carbon bond. It is divided into two parts of about equal length, the first covering the nontransition metals and metalloids, and the second the transition metals. The remarkable growth of research activity in organometallic chemistry is shown by the fact that this first volume, covering somewhat less than a year, lists nearly 1400 references. Merely assimilating the data in so many papers represents a prodigious effort on the part of the authors.

In order to cover all the ground, the authors have adopted a style which will be familiar to all who have used the British Chemical Society's *Annual Reports*. For others, it should be explained that the writing is not just terse, it is bikini-like in its brevity—the essentials are just barely covered. Many articles must be disposed of in single sentences which do no more than indicate their contents. The section on organozinc compounds is typical; twelve original papers are covered in 26 sentences of text. A book of this sort is not intended to be read cover to cover at one time. More than a few pages at a sitting definitely tends to make the head spin.

Within the limitations of the task, the authors have done an admirable job. The organization is very good. Patents are not covered, so the survey is largely restricted to fundamental science rather than technology, but within this framework the coverage is

remarkably complete; the reviewer knows of no significant omissions from the original literature.

Brief critical comments are not uncommon, and, although they necessarily reflect the points of view of the authors, most seem well conceived and pertinent. The literary quality is high, particularly in the first half of the book dealing with the nontransition metals. In the latter half, the density of facts is less, which makes for somewhat easier going on the part of the reader. But in this section nearly every paragraph begins with the names of investigators, and the effect is a bit repetitious.

Interpretation of the text is greatly aided by numerous equations and clear structural drawings. A minor defect is that in the second half of the book, one must often turn the page to find the drawing referred to. This source of frustration could easily be alleviated. Boldface numerals rather than Roman numerals would also simplify things for the user, for the number of drawings rises as high as LXXIV and even XCVIII in some chapters.

For students and others not closely acquainted with the field, well-written reviews of particular subjects, longitudinal in time, are much more helpful than an annual digest. But for the specialist, "Annual Surveys of Organometallic Compounds" can be quite useful as a guide to the literature. Its value will increase with time if the succeeding volumes match the standards set in Volume I. This book is recommended to all good chemical libraries, and to those researchers in organometallic chemistry who wish to have this literature aid available at their fingertips.

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