

**Organometallic Conjugation: Structures, Reactions and Functions of  $d-d$  and  $d-\pi$  Conjugated Systems.** Edited by Akira Nakamura, Norikazu Ueyama, and Kizashi Yamaguchi (Osaka University). From the Series: Chemical Physics, Volume 73. Kodansha, Ltd: Tokyo. Springer-Verlag: Berlin, Heidelberg, New York. 2002. xvi + 352 pp. \$129.00. Kodansha ISBN 4-06-209654-4. Springer-Verlag ISBN 3-540-00088-7.

This monograph contains a series of chapters authored by a collection of scientists working in the broad areas of structure, bonding, and synthesis of metal-organic and organometallic complexes and materials. The objective was to present summary reports and reviews based on a project entitled "Organometallic Conjugation. Its Construction and Research Prospects in the Physicochemical Field" carried out during 1994-1997 by a number of groups sponsored by the Ministry of Education, Science, and Culture of Japan. This research program combined the efforts of scientists in the area of chemical physics who have an interest in applying theoretical methods to examine the properties of structure and bonding in metal-organic systems with the efforts of synthetic chemists working to develop new structures having interesting optical properties, useful chemical reactivity, and/or catalytic properties.

Chapter 1 provides an overview of the research program and gives some background on the topics that are discussed in more detail in the remainder of the book. The chapter gives examples of the types of chemical systems of interest, with a focus on metal-organic and organometallic structures with some type of delocalized bonding systems. The concept of organometallic conjugation developed here is broad; it essentially comprises any metal-containing system in which orbitals are delocalized over three or more atoms. The next chapter is a description of work carried out using *ab initio* methods to understand structure and bonding in metal-containing systems with delocalized electronic systems. Here, some emphasis is placed on theoretical descriptions of metal-organic and organometallic electronic systems that have magnetic properties. The following chapter also features theoretical work, except in this case the emphasis is on applying perturbation theory to describe nonlinear optical properties of metal-containing delocalized bonding systems. A number of issues are probed here, with some emphasis placed on multiple bond systems of metal-carbons (e.g.,  $M=CH_2$  and  $M\equiv C-H$ ).

A theoretical study of magnetic properties in Mn-oxide systems is discussed in Chapter 4. This chapter is quite specific

and will be of interest mainly to specialists working in this narrow field. Chapter 5 provides a survey of structures that may be of interest to those who are involved in the area of  $\pi$ -type conjugation in metal-organic and organometallic systems. The chapter is brief, but it lists examples of prototypical structures drawn from the literature of the past 20 years. Here, the survey is rather broad and nonspecific, with the objective mainly being to classify the different types of bonding encountered in metal-containing delocalized electronic systems.

The discussion turns to the topic of nanoporous solids fabricated by crystallization of metal-carboxylates in the succeeding chapter. It contains a survey of a number of different systems, mainly comprising Cu, Mo, and Ru carboxylates. Some data concerning gas adsorption are provided. Quite honestly, this chapter does not fit very well within the overall theme of the monograph, but it may be of interest to specialists working in the area of inorganic-based nanoporous solids.

Chapter 7 continues the theme of surveying solid-state metal-containing systems. Here, studies using solid-state NMR are used to probe the structure of inorganic solids, and some discussion is also provided concerning the magnetic properties of layered copper oxide systems. The next two chapters return to the general topic of conjugation. The first of them is a discussion of  $d\pi-p\pi$  interactions in early transition metal complex systems that are of interest as catalysts for olefin polymerization. The second is a review of orbital and bonding interactions in metalloenzymes. Chapter 10 is a discussion of a specific class of organometallic-based materials where hydrogen bonding plays a role in the structure. Of interest here is some unique work focused on the structure and properties of organometallic-based polypeptides. The final chapter provides a wrap-up, where the authors look to the future of this broadly defined field.

Overall, this book provides some interesting information in the broad area of organometallic chemistry. Specific chapters will be useful to specialists in the areas listed above. The book should find a place in many research libraries and on the shelves of practicing scientists and students in the area of organometallic chemistry.

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