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Introductory Chapter: Concepts in Textbook and a Study on Schiff Base Metal Complexes

Takashiro Akitsu

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1. Introduction

The reason to propose the concept of this book is that some graduate students could not think their own researches in laboratory with related things learned in undergraduate textbooks. In order to overcome this issue, chapters in this book mention basic things of inorganic chemistry as well as frontier research topics on purpose.

In a conference [1], for example, we have recently reported the results of Z-scan NLO measurements for the analogous achiral organic ligands and metal complexes shown in **Figure 1**. As a promising renewable energy, a dye-sensitized solar cell (DSSC) is developing to improve performance of each materials and systems. From the view point of dye of metal complexes (or extended organic compounds), we have reported chiral Schiff base (salen-type) metal complexes. Induced CD from chiral Schiff base metal complexes containing azo-group has been also investigated for Au or TiO₂ nanoparticles using their optical interaction so far.

Probably, the disagreement between researches and textbook may come from deviation (explained in brackets) from typical cases of definition (description) of terms (bold fonts). In this case, related things in basic inorganic chemistry are as follows:

Four-coordinated complexes (coordination numbers): A complex of four-coordinated coordination structure adopts two structures, tetrahedral type and square planar type. In tetrahedral type, metal atoms are steric repulsion such as large ligand is larger than electron factor (The complex in **Figure 1** is a square planar one having chelate ligand.)

Multidentate (chelate) ligands: Ligands in which two or more atoms can simultaneously form two electrons (lone-pair) donor bonding to the same metal ion are called “multidentate” ligands in contrast to monodentate ligand. These ligands are also called as “chelate” ligands

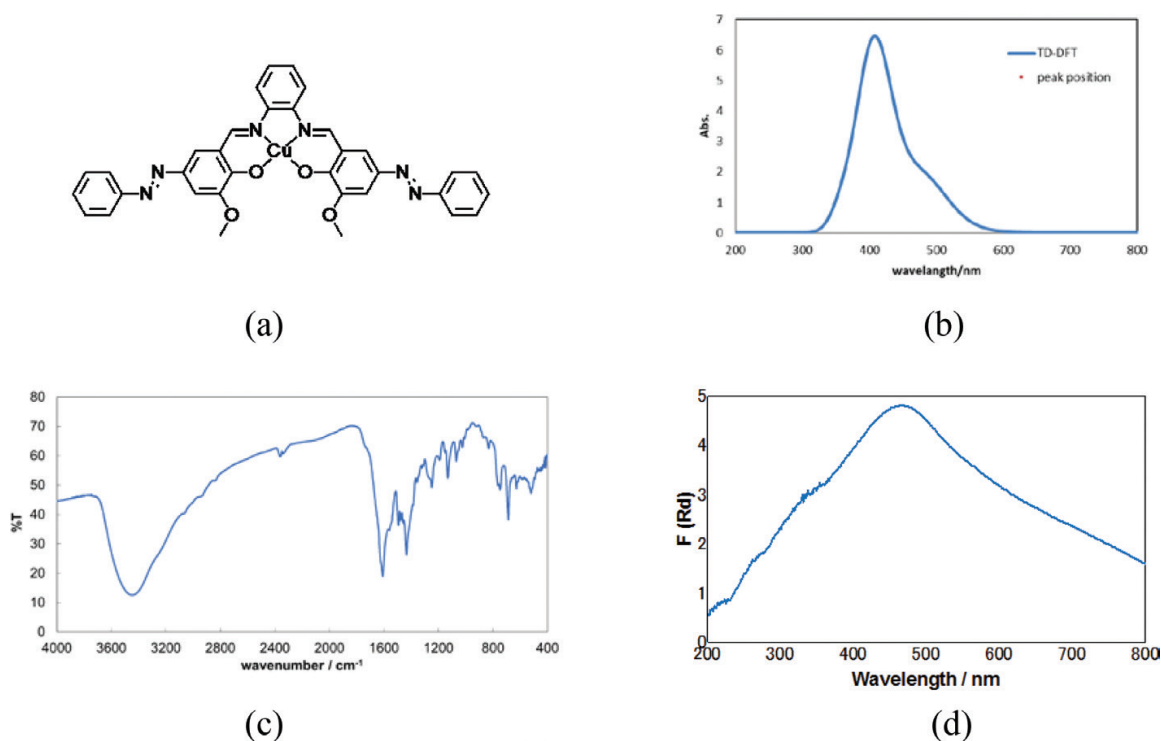


Figure 1. (a) Molecular structure, (b) simulated UV-vis spectrum (DFT), (c) IR spectrum, and (d) diffuse reflectance UV-vis spectrum of a Schiff base Cu(II) complex.

and include bidentate, tridentate, tetradentate, etc. and various coordination sites. For example, ethylenediamine has (N,N) coordination atoms (The complex in **Figure 1** has a tetradentate (N,N,O,O) Schiff base ligand.)

Electronic spectra (d-d transition): In order for the electronic state of a molecule to cause optical transition between d orbitals, the following “selection rule” exists. The d-d transitions occurring according to the selection rule are called allowed transitions, and the rest ones are called forbidden transitions. However, even for forbidden transitions, transitions may occur due to perturbation by vibration modes within the molecule. In **Figure 1**, UV-vis and IR spectra are exhibited. However, the intense bands in UV-vis spectrum are $\pi\text{-}\pi^*$ band due to organic ligands.

In this way, it is a wish of the editor to master basic concepts [2] in advanced researches [3–5] mainly for graduate students.

Author details

Takashi Akitsu

Address all correspondence to: akitsu@rs.kagu.tus.ac.jp

Department of Chemistry, Faculty of Science, Tokyo University of Science, Tokyo, Japan

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