

# Development of Dinuclear and Multinuclear Transition Metal Complexes with Novel Properties

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# 1991 Fiscal Year Final Research Report Summary

## Development of Dinuclear and Multinuclear Transition Metal Complexes with Novel Properties

Research Project

### Project/Area Number

02640471

### Research Category

Grant-in-Aid for General Scientific Research (C)

### Allocation Type

Single-year Grants

### Research Field

無機・錯塩・放射化学

### Research Institution

Faculty of Science, Kanazawa University

### Principal Investigator

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### Project Period (FY)

1990 - 1991

### Keywords

Dinuclear Cobalt Complexes / Dinuclear Iron Complexes / Dinuclear Manganese Complexes / Tetranuclear Manganese Complexes / Molecular Oxygen Complexes / Solid-phase Syntheses / Magnetic Interaction

### Research Abstract

(1) Design and Preparation of Tetranuclear Manganese Complexes for the Models of Manganese Clusters Involved in Oxygen Evolving Center (OEC) in Photosystem II : Novel tetranuclear manganese complexes with 1, 3-Bis[bis (2-pyridyl-methyl) amino]-2-propanol (Htpdp) and 1, 5-Bis[bis (2-pyridylmethyl) amino]-3-pentanol (Htmdp) were newly prepared and their structures were clarified. The complexes are characteristic of having two di ( $\mu$ -oxo) Mn<sub>2</sub> (III, IV) units. Especially, the latter tmdp complex contains two water molecules in close proximity to the di ( $\mu$ -oxo) Mn<sub>2</sub> (III, IV) units. Therefore, the complex is worth noting as an effective model for the tetranuclear manganese clusters involved in OEC.

(2) Preparation of Dinuclear Cobalt and Iron Complexes Which Reversibly React with Molecular Oxygen : The dinuclear cobalt (II, II) complex [Co<sub>2</sub> (tpdp or

tmdp) (CH<sub>3</sub>COO)]<sup>2+</sup> was newly prepared. The complex was found to react with molecular oxygen to form μ-peroxo complex. In addition, the dinuclear iron (II, II) complex containing N, N, N', N'-Tetrakis[2-(6-methylpyridyl) methyl]-1, 3-diamino-propane-2-ol (6Me-Htpdp) was newly prepared. The complex is very interesting in that it reversibly reacts with molecular oxygen at -20°C. We are trying to prepare the oxygen complex which can be isolated even under ambient conditions.

(3) Thermal Reactions of Solid Metal Complexes : For the construction of novel multinuclear metal complexes, a new solid-phase synthetic method must be developed in addition to usual liquid-phase method. To do this, the solid-phase thermal reactions of various metal complexes should be fully understood. The structural changes (especially isomerization) of a variety of nickel (II), cobalt(III), and chromium (III) complexes were investigated. The results obtained in the present study will give fundamental data for the development of a new synthetic method.

## Research Products (22 results)

All Other

All Publications (22 results)

[Publications] M.Suzuki, T.Sugisawa, and A.Uehara: "Dinuclear Cobalt(II) Complexes Containing 1,3-(or 1,5-)-Bis [bis(2-pyridylmethyl)amino] -2-propanolato (or-3-pentanolato): Preparation and Reaction with Molecular Oxygen" Bull.Chem.Soc.Jpn.63. 1115-1120 (1990) ▼

[Publications] M.Suzuki, H.Senda, M.Suenaga, T.Sugisawa, and A.Uehara: "Synthesis and Characterization of a Novel Linear Tetranuclear Manganese Complexes with Three Different Oxidation State(II,III,IV,II)" Chem.Lett.923-926 (1990) ▼

[Publications] Y.Ihara, Y.Satake, Y.Fujimoto, H.Senda, M.Suzuki, and A.Uegara: "X-ray Crystal Structures of Octahedral Diaquabis(N,N-dialkylethylenediamine)nickel(II) Complexes Possessing Elongated Nickel(II)-Nitrogen Bonds along Axial Direction" Bull.Chem.Soc.Jpn.64. 2349-2352 (1991) ▼

[Publications] Y.Ihara, Y.Satake, M.Suzuki, and A.Uehara: "cis-trans Isomerism among the Octahedral Diaqua(N,N- or N,N'-Dialkylethylenediamine)nickel(II) Complexes and Their Thermal Reaction Products" Bull.Chem.Soc.Jpn.64. 3647-3652 (1991) ▼

[Publications] M.Suzuki, Y.Hayashi, K.Munezawa, M.Suenaga, H.Senda, and A.Uehara: "Synthesis and Characterization of a Novel Dimer of Di(μ-oxo)-manganese Dimers with Two Coordinated Water Molecules in (III,IV,III,IV) Oxidation State" Chem.Lett.1929-1932 (1991) ▼

[Publications] Y.Hayashi, M.Suzuki, A.Uehara, Y.Mizutani, and T.Kitagawa: "(μ-Alkoxo)-diiron(II,II) Complexes of N,N,N',N'-Tetrakis [2-(6-methylpyridyl)methyl] -1,3-diaminopropane-2-olate and the Reversible Formation of the O<sub>2</sub>-Adduct" Chem.Lett.91-94 (1992) ▼

[Publications] E.Itoh, K.Yamamoto, M.Funato, M.Suzuki, and A.Uehara: "Preparation of Chromium(III) Complexes with a Series of Tetraazacycloalkanes, [12] aneN<sub>4</sub> to [16] aneN<sub>4</sub>, and Solid-state Thermal Isomerization of cis- [CrCl<sub>2</sub>( [15] - or [16] aneN<sub>4</sub>) ]<sup>+</sup>" Thermochim.Acta. ▼

[Publications] E.Itoh, M.Suzuki, and A.Uehara: "Thermal Isomerization of cis- [CrCl<sub>2</sub>( [15] aneN<sub>4</sub>) ] SCN in the Solid State" Thermochim.Acta. ▼

[Publications] Y.Ihara, S.Naride, and A.Uehara: "Thermal Reactions of Nickel(II) Complexes Containing Optically Active 1,2-Cyclohexanediamine in Solid State.Comparison with Those of the Corresponding Complexes with the Racemate" Thermochim.Acta. ▼

[Publications] S.Yamaguchi, Y.Hayashi, M.Suzuki, and A.Uehara: "Solid-phase Thermal cis-trans Isomerization of the Bis(diamine) and Tetraazacycloalkene Complexes of the Type [(Co or Cr)<sub>2</sub>X<sub>2</sub>- [(diamine)<sub>2</sub> or (mac)]<sup>+</sup>" Thermochim.Acta. ▼

[Publications] Y.Satake, Y.Ihara, H.Senda, M.Suzuki, and A.Uehara: "Study on cis-Folded Macrocyclic Nickel(II) Complex.Molecular Structure and Thermal Reaction of cis-Diaqua(1,4,7,11-tetraaza-cyclotetradecane)nickel(II) Chloride" Inorg.Chem. ▼

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[Publications] E. Itoh, K. Yamamoto, M. Funato, M. Suzuki, and A. Uehara.: "Preparation of Chromium (III) Complexes with a Series of Tetraazacycloalkanes, [12]aneN<sub>4</sub> to [16]aneN<sub>4</sub>, and Solid-state Thermal Isomerization of cis-[CrCl<sub>2</sub>-([15]- or [16]aneN<sub>4</sub>)]<sup>+</sup>." Thermochem. Acta. ▼

[Publications] E. Itoh, M. Suzuki, and A. Uehara.: "Thermal Isomerization of cis-[CrCl<sub>2</sub> ([15]aneN<sub>4</sub>)]SCN in the Solid State." Thermochem. Acta. ▼

[Publications] Y. Ihara, S. Naride, and A. Uehara.: "Thermal Reactions of Nickel (II) Complexes Containing Optically Active 1, 2-Cyclohexanediamine in Solid State. Comparison with Those of the Corresponding Complexes with the Racemate." Thermochem. Acta. ▼

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[Publications] Y. Satake, Y. Ihara, H. Senda, M. Suzuki, and A. Uehara.: "Study on cis- Folded Macrocyclic Nickel (II) Complex. Molecular Structure and Thermal Reaction of cis-Diaqua (1, 4, 7, 11-tetraazacyclotetradecane) nickel (II) Chloride." Inorg. Chem. ▼

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