

Investigations of dioxygen activation mechanisms by dimetal complexes

メタデータ	言語: jpn 出版者: 公開日: 2021-10-22 キーワード (Ja): キーワード (En): 作成者: Suzuki, Masatatsu メールアドレス: 所属:
URL	https://doi.org/10.24517/00060747

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2003 Fiscal Year Final Research Report Summary

Investigations of dioxygen activation mechanisms by dimetal complexes

Research Project

Project/Area Number

11228202

Research Category

Grant-in-Aid for Scientific Research on Priority Areas

Allocation Type

Single-year Grants

Review Section

Science and Engineering

Research Institution

Kanazawa University

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Project Period (FY)

1999 - 2002

Keywords

Dioxygen active species / Oxidation reaction / Dioxygen activation / Nickel complexes / Iron complexes / Copper complexes / High valent metal complexes / Crystal structures

Research Abstract

<Reversible four electron redox conversion of dioxygen by copper complexes > A series of copper(I) complexes ($[\text{Cu}(\text{L})]^+$) having tripodal tetradentate ligands (L) was synthesized and reactivity of their complexes with O_2 was investigated. Reaction of copper(I) complexes ($[\text{Cu}(\text{L})]^+$) generated bis(μ -oxo)dicopper(III) complexes, which showed reversible conversion to copper(I) complexes by bubbling of N_2 . Furthermore, it was also found that bis(μ -oxo)dicopper(III) complexes have monooxygenase activity for the supporting ligands. Reactivity can be modulated by stereochemical electronic effect of the supporting ligands

<Reaction intermediates of nickel complexes having a variety of dioxygen active species formed by the reaction with H_2O_2 > Reaction of a bis(μ -hydroxo)Ni(II)₂ having a series of tetradentate tripodal ligands having methyl substituents with H_2O_2 at low temperature resulted in a successive formation a bis(μ -oxo)Ni(III)₂ a bis(μ -superoxo)Ni(II)₂, and a bis(μ -alkylperoxo)Ni(II)₂ complexes as the intermediates for the conversion of a methyl substituent of ligands to carboxylate and alkoxide ligands

<Reversible O-O bond cleavage and formation of a peroxo group of an iron(III) complex having a peroxycarbonate> A peroxycarbonate iron(III) complex ($[\text{Fe}(\text{qn})_2(\text{O}_2\text{C}(\text{O})\text{O})]^{-(1)}$) was synthesized. The complex is stable at -35°C in acetonitrile, whereas it decomposes at 20°C. Decomposition of an ^{18}O -labeled $[\text{Fe}(\text{qn})_2(^{18}\text{O}-^{18}\text{O}-^{18}\text{O}-^{18}\text{O})]^-$ complex ($1-^{18}\text{O}-^{18}\text{O}$) at 20°C in acetonitrile was investigated by resonance Raman and ESI-MS spectroscopies. They

revealed that the $\mu_3\text{-}\eta^1;\eta^2$ Peroxo Bridge between Two $\text{Co}^{\text{II}}\text{Pb}^{\text{II}}$ Dinuclear Units and Hydrolytic Conversion into a Hydroxo-Bridged $\text{Co}^{\text{III}}\text{Pb}^{\text{II}}$ Complex"Chemistry. Letters. 763-764 (1999)

Research Products (36 results)

All Other

All Publications

[Publications] H.Furutachi, M.Suzuki, et al.: "A Rare $\mu_3\text{-}\eta^1;\eta^2$ Peroxo Bridge between Two $\text{Co}^{\text{II}}\text{Pb}^{\text{II}}$ Dinuclear Units and Hydrolytic Conversion into a Hydroxo-Bridged $\text{Co}^{\text{III}}\text{Pb}^{\text{II}}$ Complex"Chemistry. Letters. 763-764 (1999)

[Publications] H.Furutachi, M.Suzuki, et al.: "Oxygenation of Heterodinuclear Di(μ -phenoxo) $\text{Co}^{\text{II}}\text{M}^{\text{II}}$ (M = Mn, Fe or Co) Complexes having "Co(salen)" Entity in a Macrocyclic Framework"Journal of Chemical Society, Dalton transaction. 2197-2203 (1999)

[Publications] M.Kodera, M.Suzuki, et al.: "Crystal Structure and Reversible O_2 Binding of a Room Temperature Stable $\mu\text{-}\eta^2:\eta^2$ Peroxidocopper(II) Complex of a Sterically Hindered Hexapyridine Dinucleating Ligand"Journal of the American Chemical Society. 121. 11006-11007 (1999)

[Publications] K.Siren, M.Suzuki, et al.: "Synthesis, Structures, and Properties of Bis(μ -oxo)nickel(III) and Bis(μ -superoxo)nickel(II) Complexes : An Unusual Conversion of a $\text{Ni}(\text{III})_2(\mu\text{-O})_2$ Core into a $\text{Ni}(\text{II})_2(\mu\text{-OO})_2$ Core by H_2O_2 and Oxygenation of Ligand"Journal of the American Chemical Society. 122. 254-262 (2000)

[Publications] M.Suzuki, H.Okawa, et al.: "Bimetallic Dioxxygen Complexes Derived from 'End-off' Compartmental Ligands"Coordination Chemistry Review. 200-202. 105-129 (2000)

[Publications] H.Hayashi, M.Suzuki, et al.: "A Bis(μ -oxo)dicopper(III) Complex with Aromatic Nitrogen Donors : Structural Characterization and Reversible Conversion between Copper(I) and Bis(μ -oxo)dicopper(III) Species"Journal of the American Chemical Society. 122. 2124-2125 (2000)

[Publications] H.Furutachi, M.Suzuki, et al.: "Dinuclear $\text{Co}^{\text{II}}\text{M}^{\text{II}}$ (M = Pb, Co) Complexes Having a 'Co(salen)' Entity in a Macrocyclic Framework : Ligand Modulation Effect and Neighboring M^{II} Effect upon Oxygenation at the 'Co(salen)' Center."Journal of Chemical Society, Dalton transaction. 2761-2769 (2000)

[Publications] H.Furutachi, M.Suzuki, et al.: "Bis(μ -oxo)(μ -hydroxo)triiron(III) and (μ -oxo)(μ -hydroxo)diiron(III) Core Complexes with Tripodal Ligands Having a Terminal Carboxylate Group."Chemistry Letters. 1132-1133 (2000)

[Publications] M.Shinoura, M.Suzuki, et al.: "A Heterodinuclear $\text{Co}^{\text{II}}\text{Cu}^{\text{I}}$ Complex with Co(salen) in a Macrocyclic Framework. Oxygenation Studies in Comparison with Analogous $\text{Cu}^{\text{II}}\text{Cu}^{\text{I}}$ and $\text{Co}^{\text{II}}\text{Pb}^{\text{II}}$ Complexes."Inorganic Chemistry. 39. 4520-4526 (2000)

[Publications] K.Yamaguchi, M.Suzuki, et al.: "Hydrolysis of Phosphodiester with Hydroxo- or Carboxylate-bridged Dinuclear Ni(II) and Cu(II) Complexes"Journal of Chemical Society, Chemical Communication. 375-376 (2001)

[Publications] K.Shiren, M.Suzuki, et al.: "Synthesis, Structures, and Magnetic Properties of Heterodimetal Bis(μ -hydroxo)Chromium(III)Nickel(II) Complexes with Tpa Derivatives Having Sterically Bulky Substituents"Inorganic Chemistry. 41. 1598-1605 (2002)

[Publications] K.Hashimoto, M.Suzuki, et al.: "A New Mononuclear Iron(III) Complex Containing Peroxocarbonate Ligand"Angewandte Chemie International Edition. 41. 1202-1205 (2002)

[Publications] H.Hayashi, M.Suzuki, et al.: "Modulation of the Copper-Dioxygen Reactivity by Stereochemical Effect of Tetradentate Tripodal Ligands"Chemistry Letters. 416-417 (2002)

[Publications] Furutachi, H., Suzuki, M.et al.: "Regioselective Hydroxylation of Xylyl Linker in a Diiron(III) Complex having a Carboxylate-Rich Ligand with H_2O_2 "Journal of Chemical Society, Chemical Communication. 1900-1901 (2002)

[Publications] M.Mizuno, M.Suzuki, et al.: "Ligand Effect on Reversible Conversion between Copper and Bis(μ -oxo)Dicopper(III) Complex with a Sterically Hindered Tetradentate Tripodal Ligand and Monooxygenase Activity of Bis(μ -oxo)Dicopper(III) Complex"Inorganic Chemistry. 42. 8534-8544 (2003)

[Publications] Kodera, M, Suzuki, M. et al.: "Synthesis, Structure and Greatly Improved Reversible O_2 Binding in a Structurally Modulated $\mu\text{-}\eta^2:\eta^2$ -Peroxidocopper(II) Complex with Room-Temperature Stability"Angewandte Chemie International Edition. 43. 334-337 (2004)

[Publications] Komiyama, K, Suzuki, M. et al.: "Dioxygen Reactivity of Copper(I) Complexes with Tetradentate Tripodal Ligands Having Aliphatic Nitrogen Donors : Synthesis Structures, and Properties of Peroxo and Superoxo Complexes"Bulletin Chemical Society of Japan. 77. 59-72 (2004)

[Publications] Chow, J., Suzuki, M.et al.: "Formation and Characterization of a Bis(μ -allylperoxo)dinickel(II) Complex as a Reaction Intermediate for Oxidation of Methyl Getup of $\text{Me}_2\text{-tpa}$ Ligand to Carboxyl ate and Alkoxide Ligands"Angewandte Chemie International Edition. (in press). (2004)

[Publications] H.Furutachi, M.Suzuki: "A Rare $\mu_3\text{-}\eta^1 ; \eta^2$ Peroxo Bridge between Two $\text{Co}^{\text{II}}\text{Pb}^{\text{II}}$ Dinuclear Units and Hydrolytic Conversion into a Hydroxo-Bridged $\text{Co}^{\text{III}}\text{Pb}^{\text{II}}$ Complex"Chemistry. Letters. 763-764 (1999)

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- [Publications] K.Siren, M.Suzuki: "Synthesis, Structures, and Properties of Bis(μ -oxo)nickel(III) and Bis(μ -superoxo)nickel(II) Complexes : An Unusual Conversion of a Ni(III)₂(μ -O)₂ Core into a Ni(II)₂(μ -OO)₂ Core by H₂O₂ and Oxygenation of Ligand"Journal of the American Chemical Society. 122. 254-262 (2000) ▼
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- [Publications] H.Furutachi, M.Suzuki: "Bis(μ -oxo)(μ -hydroxo)triiron(III) and (μ -oxo)(μ -hydroxo)diiron(III) Core Complexes with Tripodal Ligands Having a Terminal Carboxylate Group"Chemistry Letters. 1132-1133 (2000) ▼
- [Publications] M.Shinoura, M.Suzuki: "A Heterodinuclear Co^{<II>}Cu^I Complex with Co(salen) in a Macrocyclic Framework. Oxygenation Studies in Comparison with Analogous Cu^{<II>}Cu^I and Co^{<II>}Pb^{<II>} Complexes"Inorganic Chemistry. 39. 4520-4526 (2000) ▼
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- [Publications] Cho, J., Suzuki, M.: "Formation and Characterization of a Bis(μ -alkylperoxy)dinickel(II) Complex as a Reaction Intermediate for Oxidation of Methyl Group of Me₂-tpa Ligand to Carboxylate and Alkoxide Ligands"Angewandte Chemie International Edition. ▼

URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-11228202/112282022003kenkyu_seika_hokoku

Published: 2005-04-18