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This laboratory aims at establishment of new synthetic methodologies and new functional materials by designing well-defined catalysts based on transition metal chemistry. New concepts and ideas of molecular-based catalysts are accumulated by mechanistic investigations using kinetic techniques on the reaction intermediates and elementary processes. The research subjects include: (1) development of novel ligand systems for catalysis, (2) creation of functional metal complexes based on synergistic effects, (3) construction of $\pi$-conjugation system including transition-metals, and (4) development of functional molecules including redox-active transition-metal clusters.

**Scope of Research**

**Publications**


**Presentations**


**Grants**

Syntheses and Characteristics of All-cis Poly(arylene vinylene)s Containing Thiylene Groups in Main Chains

All-cis poly(arylene vinylene) (PAV) containing thiophene derivatives have been prepared in a highly stereo-controlled manner based on Suzuki-Miyaura coupling according to a procedure we previously developed. It has been found that thin films of all-cis PAVs are insolubilized and well immobilized under UV-irradiation, along with cis-to-trans one-way photoisomerization. This phenomenon has been successfully applied to construction of novel carrier transfer materials showing great enhancement of carrier mobility upon photo-induced insolubilization.

Cationic Iridium(III) Complexes Bearing Phosphaalkenes and 2-Phenylpyridine Ligands

We have synthesized a new series of cationic iridium(III) complexes bearing phosphaalkene and 2-pyridylphenyl ligands and examined their electrochemical and photophysical properties. It has been confirmed that the metal $t_{2g}$ levels can be tuned by chemical modification of the phosphaalkene ligands. The DPCB-CF$_3$ ligand in 1 serves as a particularly effective $\pi$-acceptor to cause bluish-green luminescence at 492 nm.

Synthesis and Property of Phosphine Ligands Possessing Redox-Active [4Fe–4C] Core Substituents

Treatment of [Cp$^'$$_4$Fe$_4$(HCCH)$_2$] (1, Cp$^'$ = $\eta^5$-C$_5$H$_4$Me) with 2 equiv. NBS resulted in the exclusive formation of [Cp$^'$$_4$Fe$_4$(HCCH)(HCC–Br)]$^+$ ([2]$^+$). The generated bromoacetylene part on the tetrairon core is highly electrophilic and reacted with HPPPh$_2$ in the presence of NEt$_3$ to give [Cp$^'$$_4$Fe$_4$(HCCH)(HCC–PPh$_2$)]$^+$ ([3]$^+$). Reaction of [3]$^+$ with [Cp$_2$Co] afforded the neutral form 3. To estimate the $s$ character of the lone pair of 3, the NMR coupling constant $\lambda(P$–$Se)$ of the phosphine selenide 4 was measured. The $\lambda(P$–$Se)$ value of 4 (693 Hz) is significantly smaller than those in Se=PR$_3$ [R = Ph (755 Hz), $t$-Bu (708 Hz), Cy (706 Hz)], indicating the exceptionally electron-releasing character of 3. Complexation of 3 with Pd(II) and Pt(II) metals have been achieved under the mild conditions.

Scheme 1. Synthesis of all-cis PAV containing thiophene in main chain.

Scheme 2. Synthesis of Ir(III) complexes bearing phosphaalkene and 2-pyridylphenyl ligands.


Takita R, Development of Catalytic Reactions Using Low Coordinate Phosphine Ligands, Grant-in-Aid for Young Scientists (Start-up), 1 August 2007–31 March 2009.