

## MASTER'S THESIS

# Synthesis, characterization and properties of luminescent rigid-rod organometallic acetylide materials

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*Date of Award:*  
2001

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**Synthesis, Characterization and  
Properties of Luminescent Rigid-Rod  
Organometallic Acetylide Materials**

CHOI Ka Ho

A thesis submitted in partial fulfillment of the requirements

for the degree of

Master of Philosophy

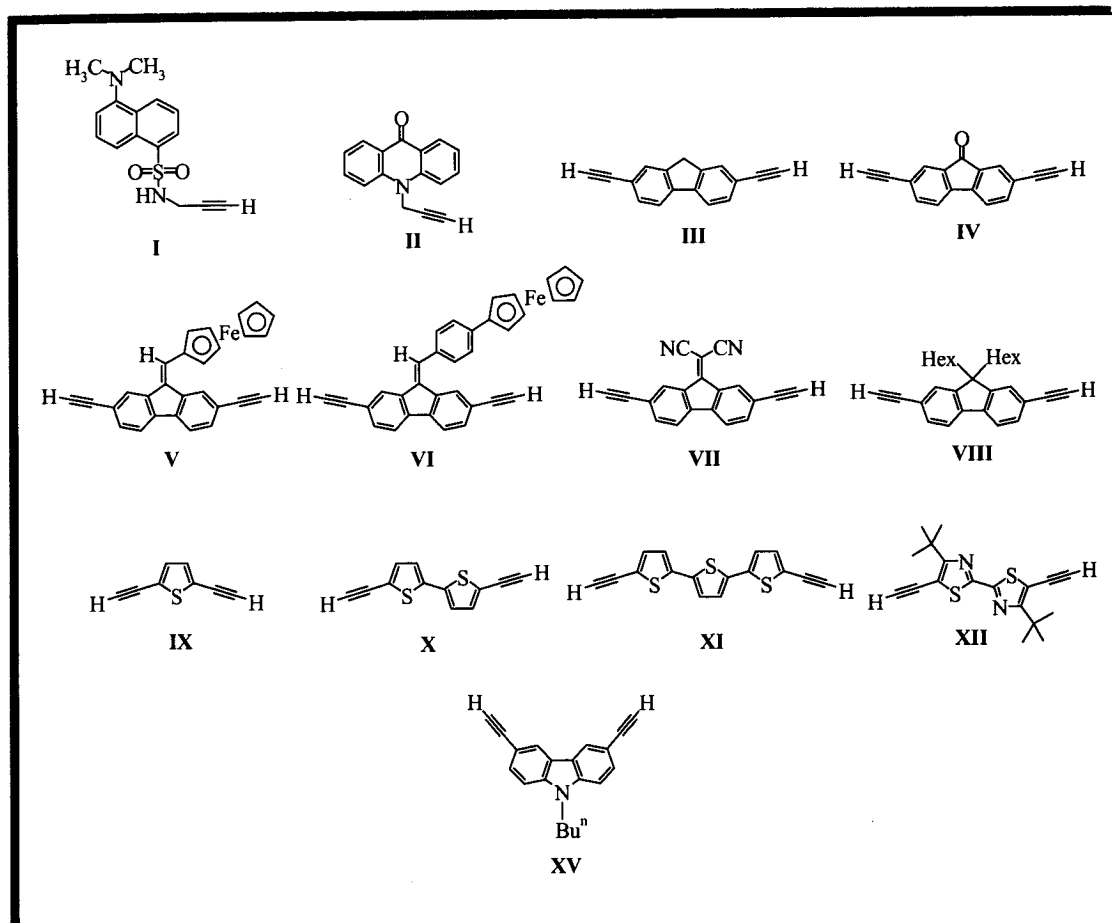
October 2001

Hong Kong Baptist University

## Abstract

Reaction of *trans*-[PtCl<sub>2</sub>(PBU<sub>3</sub>)<sub>2</sub>] with the terminal alkyne ligands **I** and **II** in diisopropylamine in the presence of catalytic amount of CuI afforded mono-platinum(II) diacetylide complexes **1** and **2**. Reaction of [Co<sub>2</sub>(CO)<sub>8</sub>] with **I** and **II** in *n*-hexane at 0°C yielded two new cobalt complexes **3** and **4**. Treatment of [(Et<sub>3</sub>NH)(μ-CO)(μ-S<sup>t</sup>Bu)Fe<sub>2</sub>(CO)<sub>6</sub>] with **I** and **II** in refluxing THF gave the diiron complexes **5** and **6** in moderate yield. Triruthenium and triosmium carbonyl clusters ([M<sub>3</sub>(CO)<sub>10</sub>(NCMe)<sub>2</sub>], M = Ru, Os) react with **I** and **II** in CH<sub>2</sub>Cl<sub>2</sub> at room temperature to produce the alkyne-coordinated triruthenium and triosmium cluster complexes **7–10**. Reactions of the diterminal alkyne ligands **III–XII** and **XV** with triphenylphosphinegold(I) chloride [(Ph<sub>3</sub>P)AuCl], anthracenyldiphenylphosphinegold(I) chloride [AnPh<sub>2</sub>PAuCl], trimethylphosphinegold(I) chloride [(Me<sub>3</sub>P)AuCl], methylmercury(II) chloride [MeHgCl] and phenylmercury(II) chloride [PhHgCl] in a basic medium at room temperature afforded the dimeric complexes **11–20**, **21–30**, **31**, **32–40** and **41–44** in high yields, respectively. Treatment of selected diyne ligands with *trans*-[Pt(PEt<sub>3</sub>)<sub>2</sub>(Ph)(Cl)] and *trans*-[PtCl<sub>2</sub>(PBU<sup>n</sup>)<sub>2</sub>] in diisopropylamine in the presence of CuI, at room temperature over 15 hours yielded the dimeric metal acetylide complexes **45–49** and polymeric materials **50–54**. All these compounds have been characterized by various spectroscopic (infrared, <sup>1</sup>H NMR, <sup>31</sup>P NMR and mass spectrometry) methods. Moreover, these new compounds were subjected to electronic absorption (UV/Vis) and emission (photoluminescence) spectroscopy in order to investigate their electronic properties. The structures of selected complexes have been determined by X-ray crystallography. The first example of solid state structure of dimercury(II) diacetylide complex was reported. Some selected electroactive metal acetylide complexes were investigated in CH<sub>2</sub>Cl<sub>2</sub> using cyclic voltammetry in order to study their electrochemical behaviour. The new platinum(II) acetylide polymeric

materials were found to be thermally stable and photoconducting. The monoacetylide ligands **I** and **II** and diacetylide ligands **III–XV** were shown below:



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