University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

JIN YANG

BSc Honours (St. Francis Xavier University, 2014)

"The Study of Ruthenium(II) Half-sandwich Phosphido Complexes Containing Pentamethylcyclopentadienyl (Cp*) ligand"

Department of Chemistry

Friday, December 16, 2016
10:00 A.M.
MacLaurin Building
Room A326

Supervisory Committee:
Dr. Lisa Rosenberg, Department of Chemistry, University of Victoria (Co-Supervisor)
Dr. Dave Berg, Department of Chemistry, University of Victoria (Co-Supervisor)

External Examiner:
Dr. Larry Lee, Applied Chemistry & Biotechnology, Camosun College Lansdowne

Chair of Oral Examination:
Dr. Linda Shi, School of Business, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Previous work in the Rosenberg group showed that the half-sandwich complexes $Ru(\eta^5\text{-indenyl})Cl(PR_2H)(PPh_3)$ $(\mathbf{2}^i)$, where R = cyclohexyl (Cy), isopropyl (Pr^i), phenyl (Ph), *para*-tolyl (Tol^p), react with the strong, bulky base $KOBu^t$ to give highly reactive complexes $Ru(\eta^5\text{-indenyl})(PR_2)(PPh_3)$ $(\mathbf{6}^i)$ containing a rutheniumphosphorus double bond, Ru=PR2. The reactions of these phosphido complexes $(\mathbf{6}^i)$ with some reagents, such as alkenes, carbon monoxide and dihydrogen, illustrate their rich and varied reactivity. To better understand the mechanisms of these reactions (whether indenyl effect is necessary in these reactions), synthesis of analogous secondary phosphine complexes containing the pentamethylcyclopentadienyl (Cp*) ligand, $Ru(\eta^5\text{-Cp*})Cl(PPh_3)(PR_2H)$ (**2**) were prepared via ligand substitution at $Ru(\eta^5\text{-Cp*})Cl(PPh_3)_2$ (**1**). Cp* phosphido complexes $Ru(\eta^5\text{-Cp*})(PR_2)(PPh_3)$ (**6**) were generated *in situ* and their reactivity was investigated to see if they behaved similarly to the indenyl complexes. Experimental evidence in this thesis suggests that variable hapticity is not necessary in our indenyl system. In addition, these experimental evidence highlight enhanced lability of ligand at the bulky Cp*Ru fragment and higher Bronsted basicity of the phosphido ligand (PR_2^-) in Cp* phosphido **6** relative to indenyl analogues $(\mathbf{6}^i)$.