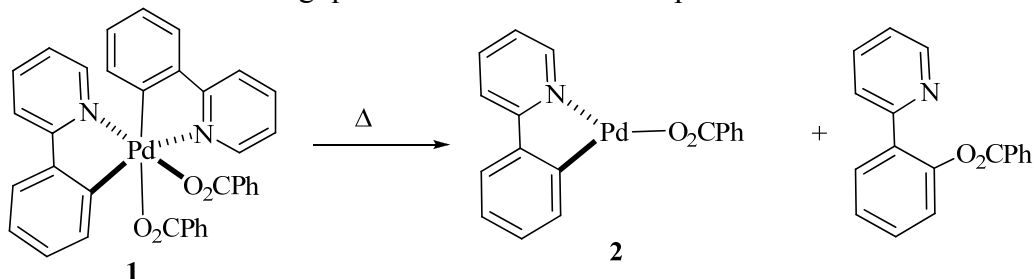


**Organometallic Chemistry**Name: Sarah Palin**Problem Set #2**

Due: Sept. 23, 2008

1. Answer the following questions about the Pd complexes shown in the reaction below.



a) What is the oxidation state of Pd in complex **1** and **2**? (1 pt.) **1, Pd<sup>+4</sup>; 2, Pd<sup>+2</sup>**  
(Reaction taken from M. Sanford et al. *JACS* **2005**, *127*, 12790.)

b) What type of transition metal reaction is occurring to Pd? (1 pt.) **reductive elimination**

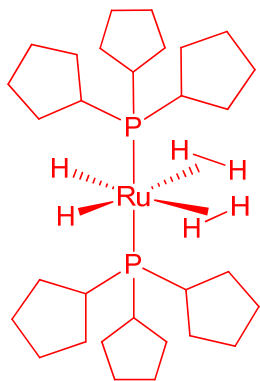
c) What about Pd complex **1** makes this reaction favorable? (2 pts.)

**Pd, a highly electronegative late transition metal is in a high oxidation state making reduction favorable. In addition, the complex is coordinatively saturated, so elimination of ligands reduces the steric congestion.**

d) One of the most common reactions for alkyl-metal complexes is beta-elimination. Why does the aryl Pd complex **1** not undergo a beta-elimination? (2 pts.)

**Complex 1 is coordinatively saturated making beta-H elimination impossible unless a ligand were to dissociate. Additionally, both aryl ligands on complex 1 have sp<sup>2</sup> C's in the beta-position. These carbons make the proper alignment of d<sub>π</sub> electrons with the C-H σ\* orbital difficult.**

2. Draw the most stable structure for the metal-hydride complex RuH<sub>2</sub>(η<sup>2</sup>-H<sub>2</sub>)<sub>2</sub>(PCyp<sub>3</sub>)<sub>2</sub>, (Cyp=cyclopentyl). List the total electron count, oxidation state, dn configuration and coordination number of this complex. (4 pts.)

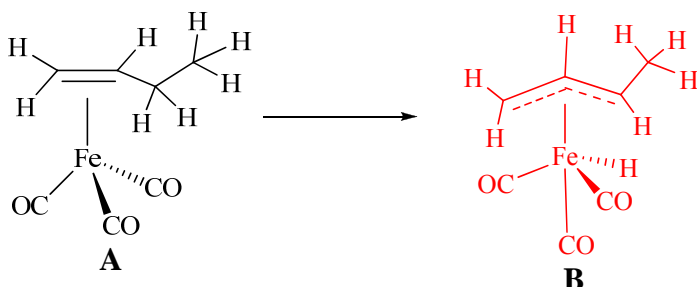


**18e<sup>-</sup>s, Ru<sup>+2</sup>, d<sup>6</sup>, CN=6**

**Complex reported in *Organometallics* Sept. 13, 2008, ASAP. (10.1021/om8005118)**

3. The iron complex **A** below undergoes a reaction with the attached alkene ligand to become an iron-hydride complex **B** with a  $\eta^3$ -allyl ligand. The hydride comes from the allylic position of the alkene ligand on **A**.

a) Draw the structure of this iron-hydride product. (2 pts.)



C. B. Harris et al.  
*Organometallics* **2008**,  
27(17), 4370-4379.

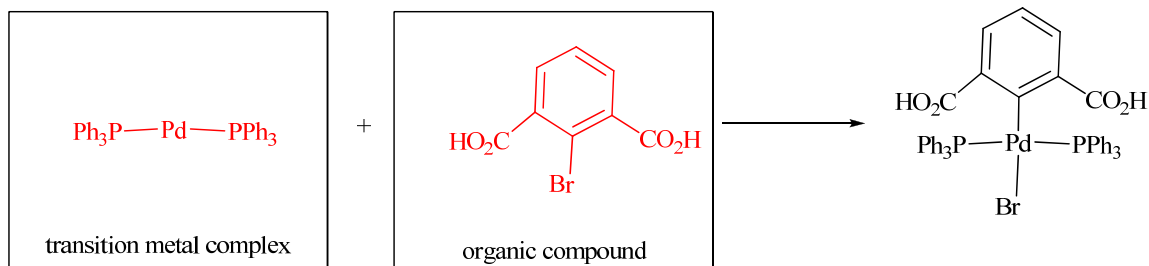
b) Determine the total electron count, oxidation state,  $d^n$  configurations and coordination number (CN) of both structures **A** and **B**. (2 pts.)

A: 16 e<sup>-</sup>'s, Fe(0),  $d^8$ , CN=4  
B: 18e<sup>-</sup>'s, Fe(II),  $d^6$ , CN=6

c) Based on your answers to part b, what changes to the iron complex make this a favorable process? (1 pt.)

The iron complex total electron count in **B** rises to 18, a full valence for iron.

4. Suggest an organic compound and a transition metal reagent that could be combined to make the palladium-aryl complex shown below. What type of reaction have you shown? (5 pts.)



This is an oxidative addition reaction.

Yasuhiro Uozumi et al. *Organometallics*, ASAP Article, 10.1021/om800666x