This literature discussion is based on a paper (*Dalton Trans.* **2015**, *44*, 2575-2587) from Dick Andersen’s group at Berkley and is part of a birthday tribute by the authors. The paper is rich in detail and as such this LO focus on the Yb catalyzed conversion of buta-1,2-diene to 2-butyne.

1. List the ground state electron configuration for Yb.
2. The most common oxidation state for the lanthanide elements is +3. Yb is unusually stable as both Yb(II) and Yb(III). Use electron configurations to explain why lanthanides are typically +3  and Yb(II) is unusually stable.
3. What is the electron count on (Me5C5)2Yb?
4. The following questions relate to the catalytic reaction in this study.
   1. Write a balanced chemical equation for the stoichiometric reaction of (Me5C5)2Yb and buta-1,2-diene (methyl allene).
   2. Figure 1 shows the time evolution of the 1H NMR of a chemical reaction.
      1. What are the starting materials in the chemical reaction (include the relative mole ratio of the reagents)? Bonus question: Why didn’t the authors use CDCl3 as their NMR solvent?
      2. Describe the chemical change observed in the NMR spectrum.
      3. Why did the authors do this experiment?
5. What is the electron count on (Me5C5)2Yb(𝜂2-MeC≡CMe)?
6. Use the ground state electron configuration of calcium to explain why its third ionization energy is nearly two times more than the third ionization energy of Yb.
7. The authors studied the parallel complex (Me5C5)2Ca to see if it could catalyze the same reaction. Name two reasons why the calcium complex could be expected to behave in a similar manner to the ytterbium complex.
8. What was the result of the study using the (Me5C5)2Ca complex, and how did these results contribute to the authors’ claims?
9. Look at Figure 2 in the paper. Why does (Me5C5)2Yb have zero enthalpy on the diagram?
10. Complex A is 1.7 kcal/mol lower in enthalpy than the starting materials. What is the chemical reason for this change in enthalpy?
11. Why are TSA-I and TSI-P at the top of the curve instead of at a minimum? In other words, what is the difference between TS and I?
12. Why is I so much higher in energy than A? The allene anion might be expected to be a *better* ligand than the neutral allene due to electrostatic attraction between the metal cation and the anionic ligand. Consider the difference in the two rings on the Yb center. Why is one drawn with a circle and the other with 2 double bonds?
13. Explain how Figure 2 is consistent with the authors’ mechanistic conclusions. Consider the information from the last paragraph on page 2579 that continues on 2580. Why are the barriers of 30.9, 31.5 or >50 kcal/mol calculated for three other mechanisms not reasonable?