

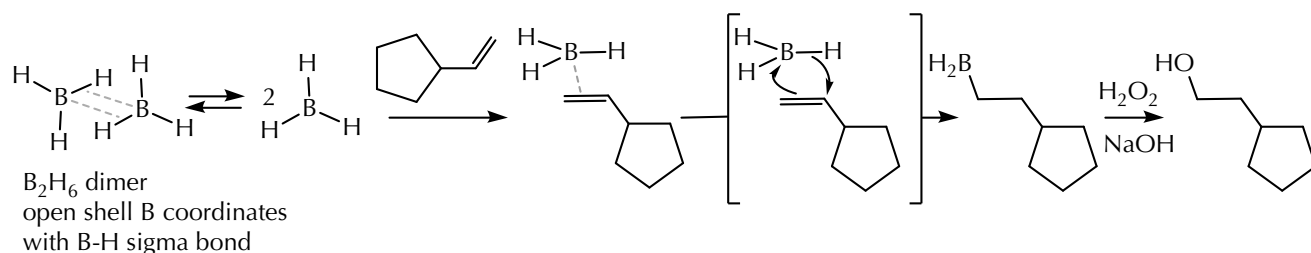
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these reactions are usually open shell (12- to 16-electron compounds), which gives the pi bond a Lewis acidic site to complex as a starting point for the reaction. Unlike metals, the complex with boron is not stable at all, and the Lewis acid-base interaction with boron is simply seen as being along the pathway towards the transition state for the hydroboration reaction (see Figure 0838 for a complete illustration).

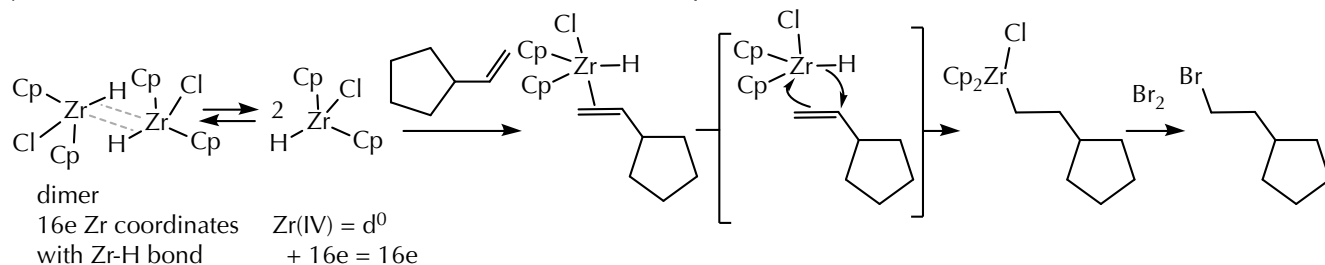
Figure 1950 shows some examples of hydrometallation and carbometallation addition reactions, along with a reminder about some features of the familiar hydroboration reaction including a synthetic outcome after the addition reactions are performed.

Figure 1950**Addition: hydrometallation and carbometallation reactions.**

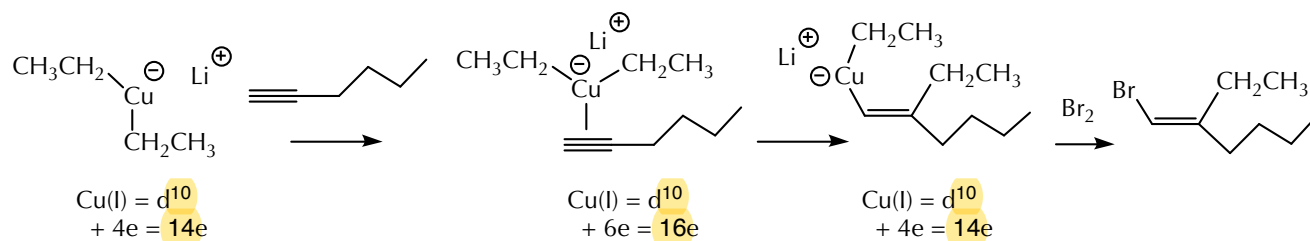
hydroboration and the transformation of the addition product



hydrometallation reaction and the transformation of the addition product



carbometallation reaction and the transformation of the addition product



The hydrozirconation reaction, as illustrated, is quite analogous to hydroboration. Both of the pure starting materials are open shell compounds and exist as dimers in which the open shell atom coordinates with a sigma bond. The equilibrium dissociation of the dimer creates the reactive, Lewis acidic monomer, which associates (in the case of boron) or fully coordinates (in the case of zirconium) with the pi bond of an alkene. The addition reactions create C-B and C-Zr bonds that can be replaced by other atoms in subsequent reactions.

Lithium dialkylcuprates, which you have previously seen in the conjugate addition reactions of conjugated carbonyl compounds, are formally 12-electron compounds that can readily coordinate with alkenes and alkynes. The transfer of one of the alkyl groups from the copper to the alkyne results in a regioselective, syn addition, and as in the other examples, the carbon-metal bond can be transformed into a variety of different outcomes (although only one example is shown in Figure 1950 for the purpose of illustration).