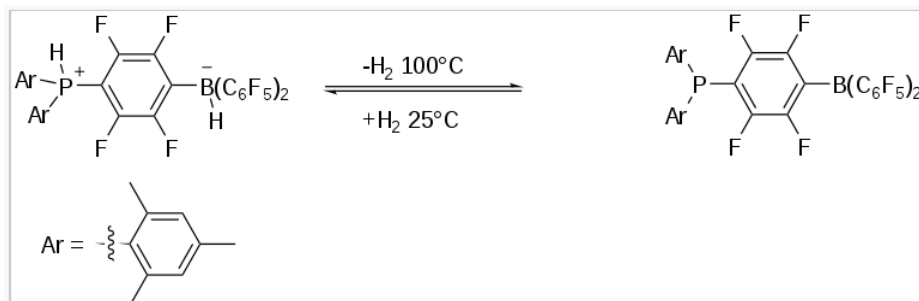


3.5: Frustrated Lewis Pairs

A **frustrated Lewis pair (FLP)** is a compound or mixture that contains a Lewis acid and a Lewis base which, because of steric hindrance, cannot combine to form a classical adduct.^[8] Many kinds of FLPs have been devised, and their reactivity towards other molecules has been broadly developed.^{[9][10]}

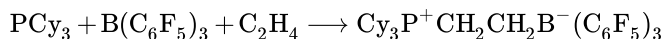
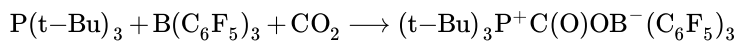
The hydrogen adduct of the original FLP, a phosphonium-borate salt, can be prepared by combining a phenylene bridged phosphinoborane and dihydrogen. The salt, which is colorless, is stable in the presence of air and moisture. It releases molecular H₂ when heated above 100 °C. This reactivity is remarkable considering the strength of the H-H bond, 432 kJ/mol.



Absorption and release of hydrogen from FLP

The discovery that some FLPs can split H₂^[11] triggered the rapid growth of research into FLP's. Because of their "unquenched" reactivity, such systems are reactive toward substrates that can undergo heterolysis. For example, many FLP's split the hydrogen molecule. This reactivity suggested that FLP's can be useful for hydrogenation reactions. A sizable range of homogeneous and heterogeneous catalytic reactions have now been developed using FLP's.

Mixtures of sterically hindered Lewis acids and bases also can act as FLPs. One successful strategy is to mix sterically hindered triarylphosphines with triarylboranes. Small molecules such as CO₂ and ethylene can then form a bridge between the phosphine Lewis base and borane Lewis acid, e.g.,



Because FLPs behave at the same time as both nucleophiles and electrophiles, they can effect the ring-opening of cyclic ethers such as THF, 2,5-dihydrofuran, coumaran, and dioxane.^[12]

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