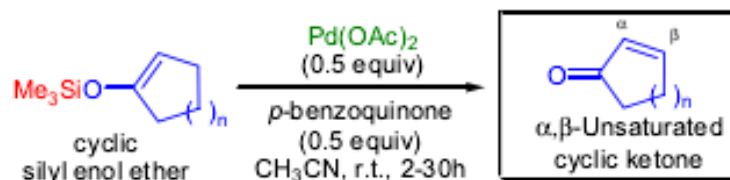
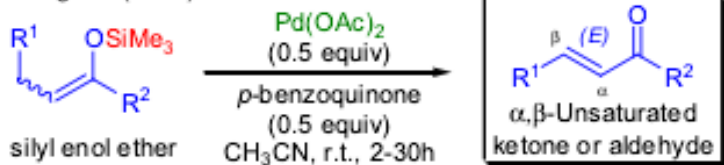


SAEGUSA OXIDATION

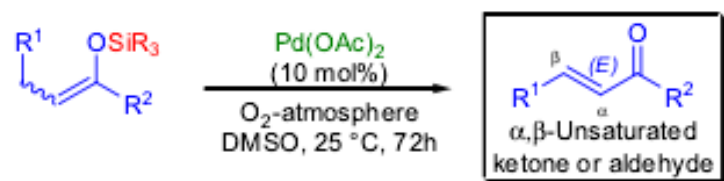
Liangleiming
20170509

Discovery:

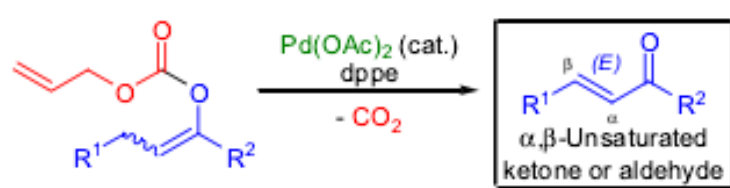
Saegusa (1978):



Catalytic process (*Larock modification*, 1995):



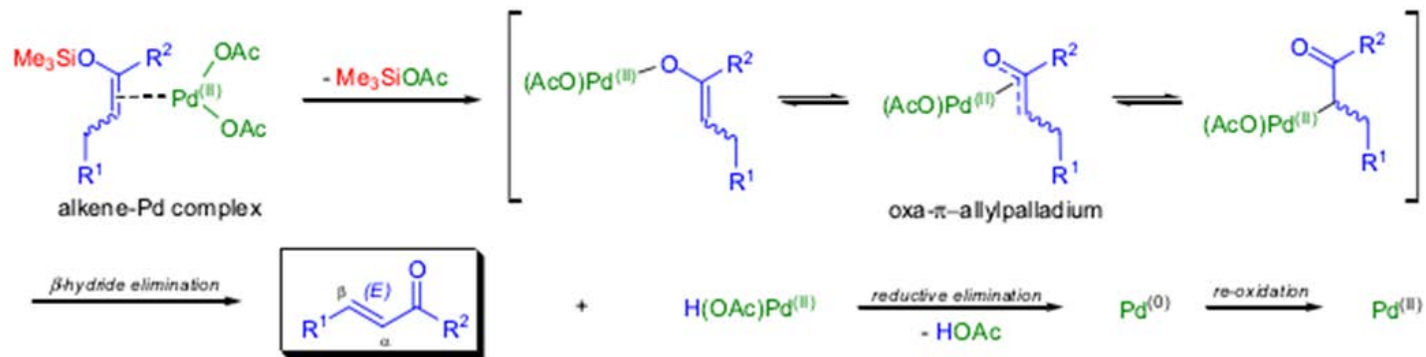
Allyl enol carbonate modification:



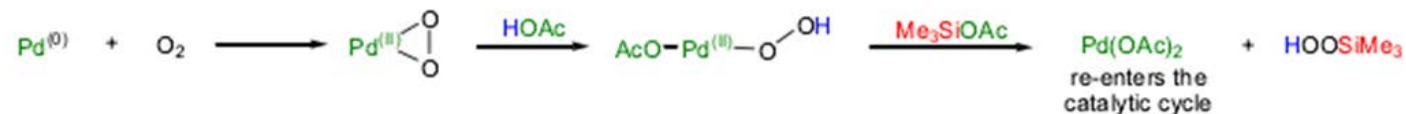
$\text{R}^{1-2} = \text{H, alkyl, aryl}; \text{SiR}_3 = \text{TMS, TBDMS}; n = 1-7$

Mechanism:

When substoichiometric/stoichiometric amounts of Pd(OAc)_2 is used:



When the oxidation takes place under an oxygen atmosphere with catalytic amounts of Pd(OAc)_2 :



- 1) the reaction is usually carried out using 0.5 equivalents of Pd(OAc)₂ and 0.5 equivalents of p-benzoquinone (co-oxidant) at room temperature;
- 2) when stoichiometric amounts of Pd(OAc)₂ are used, no co-oxidant is needed. However, less than 0.25 equivalents of Pd(OAc)₂ results in a substantial decrease in the reaction rate as well as isolated yield of the product;
- 3) the starting silyl enol ethers are easily obtained by trapping metal enolates with TMSCl (the metal enolates are either obtained by the regioselective deprotonation of ketones and aldehydes with LiHMDS or LDA or by the conjugate addition of carbon nucleophiles to α,β -unsaturated carbonyl compounds);
- 4) both acyclic and cyclic silyl enol ethers undergo the transformation;

5) the oxidation proceeds with high stereoselectivity, because in acyclic systems the stereochemistry of the newly formed double bond is predominantly (E) even if the starting silyl enol ether was a mixture of (E) and (Z) stereoisomers;

6) cyclic silyl enol ethers ($n=1-7$) are efficiently oxidized, and when the ring size allows, the newly introduced double bond will have the (E) stereochemistry. The main drawback of the Saegusa oxidation is the high cost of the palladium acetate.

modifications: 1) an environmentally friendly catalytic version using only 10 mol% of $\text{Pd}(\text{OAc})_2$ and oxygen atmosphere in DMSO (Larock modification); 2) instead of silyl enol ethers, enol acetates can also be used when they are heated with allyl methyl carbonate, catalytic amounts of $\text{Pd}(\text{OAc})_2$ and MeOSnBu_3 ; 3) allyl enol carbonates also undergo oxidation with catalytic amounts of $\text{Pd}(\text{OAc})_2/\text{dppe}$.^{8,7} Alternatively, silyl enol ethers can be efficiently oxidized by IBX and IBX-N-oxides to the corresponding enones (Nicolaou oxidation).

Synthetic Applications:

