Development of Environmentally Benign Organometallic Catalysis for Drug Discovery and its Application

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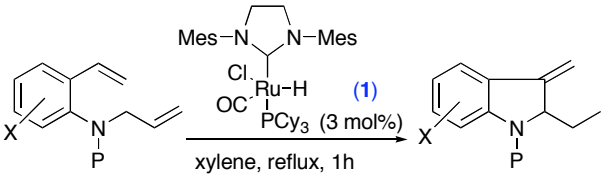
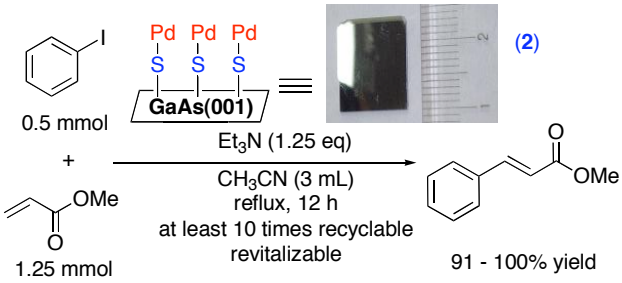
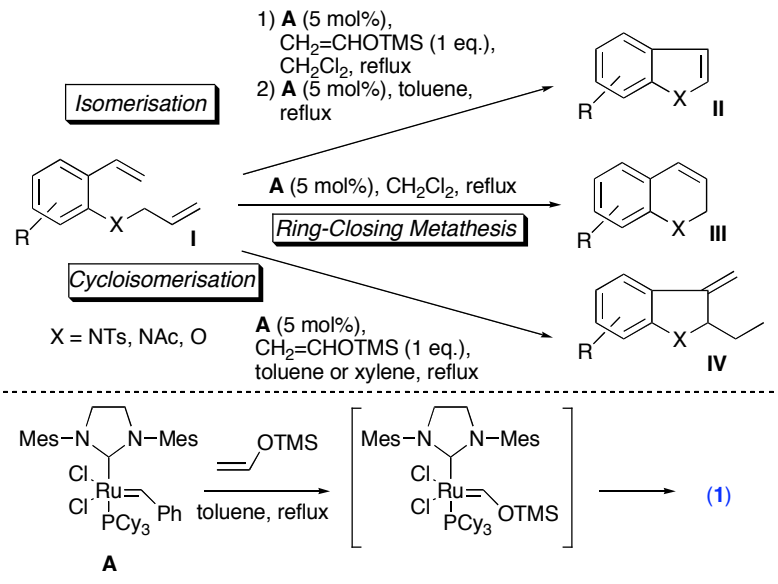
Organometallic catalyzed carbon-carbon bond formations are now essential in organic chemistry and has been widely applied to medicinal chemistry, process chemistry, etc. We developed a novel organometallic catalysis and their application to drug discovery and found two new catalysts, ruthenium hydride with a nitrogen-containing heterocyclic carbene (**1**) and an organopalladium catalyst supported on a sulfur-terminated semi-conductor, gallium arsenide (001) (**2**). Both catalysts are environmentally benign, because **1** can yield indole derivatives with good atom economy, and **2** can catalyze the Mizoroki-Heck reaction more than 10 times with only trace amounts of leached palladium (ppb level). In this awarded lecture, we present the development of these catalysts and their application to the synthesis of a bioactive natural product.





Catalyst **1**: The utility of **1** is demonstrated by its activity: not only isomerization, which can be followed by reactions with other ruthenium hydrides, but also cycloisomerization to give indole derivatives. Using **1** and a second generation Grubbs catalyst (**A**), medicinally valuable nitrogen-containing heterocycles, such as indole (**II**), quinoline (**III**), and indoline (**IV**) are successively prepared from a common precursor (**I**).



Catalyst **2**: One advantage of **2** is its ease of handling. **2** is easily transferred using a pair of tweezers. The valence of the immobilized Pd was zero as determined by XPS spectrometry.