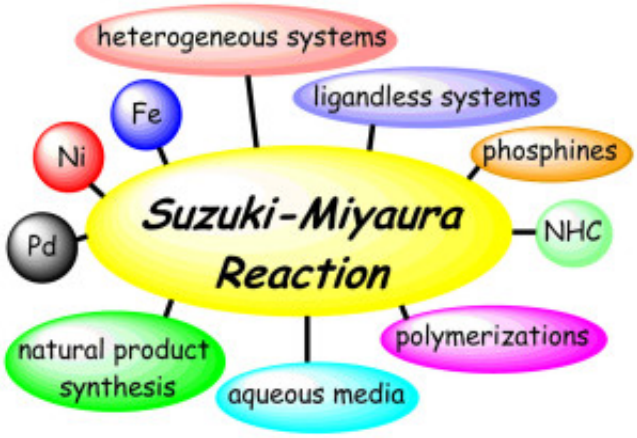
Catalytic carbon-carbon bond formation

A chemical reaction is the transformation of one or more reagents into one or more products that takes place at a characteristic rate depending on the energy needed to activate the process. A catalyst is a substance that is added to the reaction in very small quantities and is capable of speeding up this transformation by finding an alternative pathway with a lower energy barrier.



The Suzuki-Miyaura reaction (SMR), first reported in 1979, has become one of the most utilized tools for the catalytic construction of carbon-carbon bonds. This reaction involves the coupling between an organic halide (containing a halogen bound to a carbon atom) and an organoboron reagent mediated by a metal-based catalyst (most usually containing palladium or nickel) and a base. Some of the more remarkable advantages among other types of couplings are the mild reaction conditions (e.g. low temperature), the availability of organoboron reagents (most of them stable even in the presence of water and oxygen) and the low toxicity of both starting materials and products. All this has allowed researchers to use it in a wide variety of applications making possible the synthesis of natural products, drugs or polymeric materials. Due to its outstanding impact in a variety of fields, Akira Suzuki was awarded in 2010 the Nobel Prize in Chemistry together with Richard F. Heck and Ei-Ichi Negishi, who discovered the reactions that bear their names.

This review intends to be a general account of the available catalysts and protocols, new coupling partners and applications of the SMR, presenting a selection of the most significant developments between 2010 and 2014. The catalytic systems reviewed were classified as homogeneous (all the components in the reaction are in the same phase, usually liquid) or heterogeneous (with more than one phase in the reaction). Because of the growing interest in cheaper, safer and environmental friendly reactions, a dedicated part of this review refers to the use of water as a solvent in SMR reactions. A specific section on actual medicinal targets, natural products and polymers that have been prepared using this reaction in any step of their synthesis concludes this review.

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