

New Dimension of Acid and Base Catalysis

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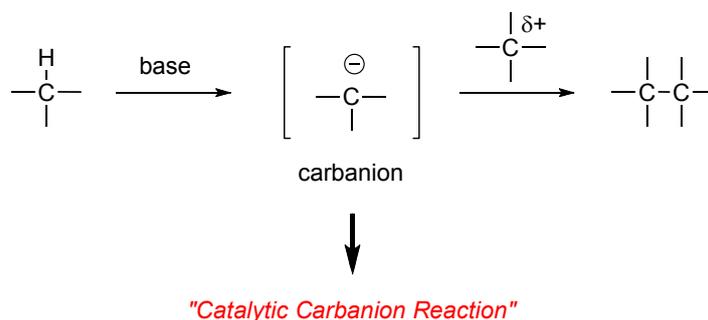
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Carbon-carbon bond forming reactions are among the most important for the construction of the basic skeletons of target molecules. Carbanions are often used to make carbon-carbon bonds; they are prepared from appropriate precursors, and reacted with, for example, carbonyl and related compounds to form new carbon-carbon bonds.

In the relatively long history of carbanion chemistry, carbanions have been used for carbon-carbon bond formation even in classical organic synthesis. Typical examples are classical aldol and Mannich reactions carried out in the presence of bases, assuming formation of carbanions as intermediates. Here the amounts of bases are of peripheral interest, because reactions were not well-controlled and major concerns were low yields and selectivities due to many undesired reactions such as self-condensation, isomerisation, retro-reactions, elimination reactions, etc. To address these issues, strong bases such as lithium diisopropylamide (LDA) were developed with the onset of modern organic synthesis. Many strong bases and organometallic compounds were introduced and high yields, high regio-, diastereo- and sometimes even enantioselectivities were attained in carbon-carbon bond forming reactions. This success could be ascribed to the use of stoichiometric amounts of strong bases under kinetic conditions. The precursors have to convert to the corresponding carbanions completely, since unreacted precursors may react with carbanions formed to afford undesired side products.

In contrast, reduction of the amount of base is one of main goals in recent organic synthesis, related to the development of many “catalytic synthetic reactions.” We now describe and demonstrate here reactions using catalytically formed carbanions (“Catalytic, Carbanion Reaction”), where carbanions are formed using catalytic amounts of bases. This is different from conventional carbanion chemistry, where stoichiometric amounts of bases have been used.



References:

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 [2] Kobayashi, S.; Kiyohara, H.; Yamaguchi, M. *J. Am. Chem. Soc.* **2011**, *133*, 708.