CO_2 utilization in organic synthesis

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Carbon dioxide (CO_2) is an important component in the air and well-known as a greenhouse gas that has an important impact on climate change. Meanwhile, it is also an inexpensive, readily available, non-toxic, and renewable carbon-resource. In order to promote resource discovery, environmental protection and sustainable human development, it is of great significance to transfer CO_2 to valuable molecules, such as drugs, materials and fuels. However, due to its thermodynamic stability and kinetic inertness, it is highly challenging to achieve efficient transformations of CO_2 under mild conditions. Our group has been focusing on CO_2 utilization in organic synthesis since 2015 (**Figure 1**). In this talk I will introduce the direct use of CO_2 as the combination of CO and oxidant ("CO_2 = CO + [O]") to realize the redox-neutral lactamization and lactonization of C─H bonds.[2] In addition, I will also talk about radical-type organic transformations with CO_2, highly enantioselective transformations of alkenes with CO_2, as well as the photocatalytic carboxylations of bulk chemicals to generate a variety of substituted diacids, amino acids, hydroxyl acids and other monomers for polymerization. We hope these efforts will provide new methods for efficient CO_2 utilization in organic synthesis.

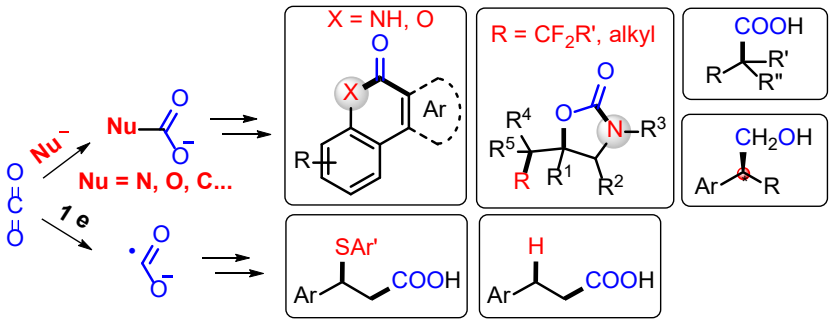

Figure 1: CO_2 utilization in organic synthesis.

Selected References :

[1] For our reviews, see: a) *Coord. Chem. Rev.* **2018**, *374*, 439. b) *Chem. Commun*. **2020**, *56*, 8355. c) *Sci. China Chem*. **2020**, *63*, 1336. d) *Acc. Chem. Res.* **2021**, *54*, 2518.

[2] For selected examples, see: a) *Angew. Chem. Int. Ed.* **2016**, *55*, 7068. b) *Angew. Chem. Int. Ed.* **2016**, *55*, 10022. c) *Angew. Chem. Int. Ed.* **2017**, *56*, 15416. d) *J. Am. Chem. Soc*. **2017**, *139*, 17011. e) *Angew. Chem. Int. Ed.* **2018**, *57*, 13897. f) *J. Am. Chem. Soc*. **2018**, *140*, 17338. g) *Nat. Commun.* **2019**, *10*, 3592. h) *J. Am. Chem. Soc*. **2019**, *141*, 18825. i) *Nat. Commun*. **2020**, *11*, 3263. j) *CCS Chem.* **2020**, *2*, 1746. k) *Angew. Chem. Int. Ed.* **2020**, *59*, 21121. l) *Nat. Catal.* **2021**, *4*, 304. m) *J. Am. Chem. Soc.* **2021**, *143*, 2812; n) *Angew. Chem. Int. Ed.* **2021**, *60*, 14068; o) *Nat. Commun*. **2021**, *12*, 3306; p) *Chem* **2021**, *7*, 3099.