

Conversion of CO₂ into cyclic carbonates: benchmarking of the synthetic routes

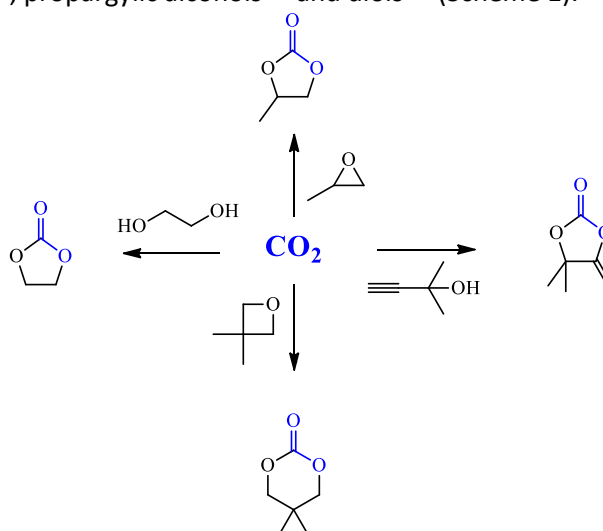
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In view of green chemistry and atom economy, the use of carbon dioxide both as a substitute to harmful and/or volatile organic solvents and as an inexhaustible cheap and ecofriendly C1 chemical reactant has been the subject of a particular attention in the last years.^[1] Many reactions involving CO₂ utilization as a raw material have been described, especially for the synthesis of cyclic carbonates via the coupling of CO₂ with different substrates such as epoxides^[2], oxetanes^[3], propargylic alcohols^[4] and diols^[5] (Scheme 1).

Today, cyclic carbonates find many applications as intermediates for fine chemical synthesis, as electrolytes in Li-ion batteries, and as polar aprotic solvents, and also serve for the synthesis of important polymers such as polycarbonates^[6] and polyurethanes.^[6b, 7] In view of their broad scope and strong economic potential, there is a strong need to improve their synthesis and decrease their production costs. However, CO₂ is a thermodynamically stable molecule, and the use of catalysts is therefore mandatory for activating and facilitating the CO₂/substrate coupling reaction in a selective manner and under mild conditions. In the last five years, organocatalysts have attracted more and more interest in this field and some organocatalysts are now very competitive, cheap,



Scheme 1: Conversion of CO₂ into cyclic carbonates

and readily available. In this context, the aim of this presentation is to review the recent advances in the development of new organocatalytic platforms for the coupling of CO₂ with various substrates for the synthesis of cyclic carbonates. For some representative examples, we will show how in situ kinetic studies correlated to DFT calculations provide insight into the underlying reasons for the observed kinetics, yields and selectivities. Such in-depth fundamental mechanistic studies should pave the way for the design of novel, highly active and selective catalysts for the valorization of CO₂ as a chemical feedstock.

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