Heterogeneous catalytic approach to the synthesis of cyclic carbonates and their decarboxylative transformations

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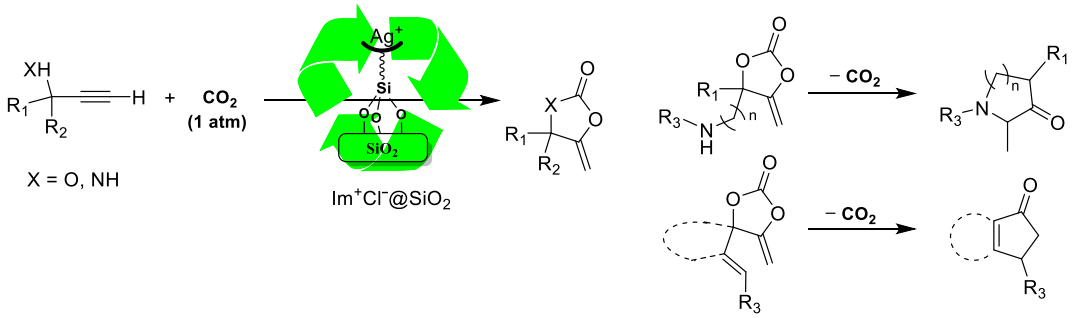
CO_2 has been regarded as a nontoxic, abundant, nonflammable, and renewable one-carbon (C1) feedstock for the synthesis of a variety of value-added chemicals. There have been numerous advances on the metal-catalyzed synthesis of various organic compounds utilizing CO_2 as a C1 source. Among them, the reactions of CO_2 with unsaturated alcohols and amines to afford carbonates and carbamates through carboxylative cyclization process is one of the promising green routes. These compounds have wide range of application in organic synthesis for being important building blocks and potential biological activity. Silver has the potential to activate alkynes and has been extensively studied for chemical transformation of CO_2. Most of the studies have concentrated on homogeneous catalysis using relatively large amounts of Ag based catalysts[1]. Compared to homogeneous systems, heterogeneous system is advantageous for development of green and sustainable society in terms of good activity and reusability.

We recently developed a heterogeneous silver catalyst by the immobilization of silver catalyst on silica support via alkoxysilane linkage ($Im^+Cl^-@SiO_2$)[2]. We carried out the CO_2 transformation reactions with propargyl alcohols and amines using the synthesized silver catalyst $Im^+Cl^-@SiO_2$. The active catalysts were synthesized or generated in situ which performed the reactions with excellent yields of the corresponding carbonates and carbamates under mild condition with good activity and reusability. In addition, the product cyclic carbonates were converted to various value-added products by decarboxylation processes.



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