

Twist in Small Molecule Activation: It's metal free

CO₂ has been continuously used as a carbon source for the sustainable synthesis of fine chemicals and pharmaceuticals due to its abundance, non-toxicity and low-cost. Therefore, fixing of CO₂ onto organic molecules and synthesizing new molecules out of it, is currently considered of paramount importance. The aim of this concept is to use CO₂ as a C1 source for sustainable synthesis of fine chemicals, pharmaceuticals and for the generation of fuel type molecules. Using CO₂ instead of CO or COCl₂ also constitutes an attractive alternative avoiding hazardous and toxic components. Therefore, fixing of CO₂ onto organic molecules and synthesizing new molecules out of it is currently considered of paramount importance. Based on this concept, we have used CO₂ as a catalyst for the transformation of functional groups in organic synthesis. In all of the cases, the selective transformation can be achieved without using transition metal. Additionally, we have strong focus for the synthesis of fuel type molecules in a metal-free way!

Parallel to the activation of CO₂ molecule, we are also involved in visible-light-mediated O₂ molecule activation. Molecular oxygen is a stable molecule which occupies 20% of the air components. However, under photocatalytic conditions, oxygen molecules can be converted to highly reactive species which generally called reactive oxygen species (ROS). Four major ROS have been recognized which are superoxide anion radical ([•]O₂⁻), hydrogen peroxide (H₂O₂), singlet oxygen (¹O₂), and hydroxy radical ([•]OH). These reactive species can be used for the syntheses of various organic molecules. Based on this, we have developed metal-free photocatalytic methodologies to transfer different functional groups.