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Polymer Chemistry 2019: Triazole-based MOF for the efficient solvent-free CO2 fixation reaction via cyclic carbonates synthesis-Pourya Zarshenas- Shahid Beheshti University

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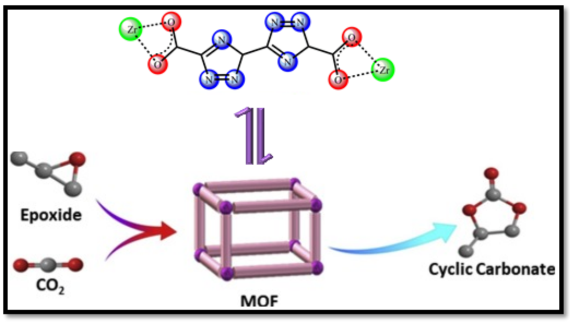
The increase of greenhouse gases such as carbon dioxide (CO2) in the atmosphere causes serious climate problems. The release of CO2 by anthropogenic activity may lead to a rise in global temperature over the past several hundred years. Hence, effective methods to capture CO2 and mitigate CO2 emissions are urgently demanded. Several strategies have been attempted to reduce CO2, including physical adsorption, and chemical sequestration of CO2. In situ conversion of the captured CO2 into useful product could be the most effective method for CO2 treatment. The CO2 cycloaddition reaction is an important reaction for producing cyclic carbonate, which has a wide range of applications in many fields. Various heterogeneous catalysts have been developed for CO2 cycloaddition reactions, including metal oxides, zeolites, metal-organic frameworks (MOFs) and supported catalyst. Among these catalysts, MOFs have attracted increasing interest due to their excellent properties such as many reactive sites, large surface area, high absorption capacity and well tunable pore structures. It has been reported that MOF-5, Co-MOF-74, Mg-MOF-74, MIL-125-NH2, UiO-66-NH2, Fe-MIL-101, Cr-MIL-101, PCN-224, PCN-700, Hf-Nu-1000, MMCF-2 and MMPF-18 as catalysts can well accelerate the CO2 coupling with epoxide. In this seminar, a highly new porous and stable metal-organic framework containing both metal sites (Zr clusters as Lewis acid sites) and nitrogen rich triazole group (as Lewis base sites) was successfully synthesized via solvothermal reaction. Triazole containing MOF exhibit superior catalytic activities in solvent free CO2 cycloaddition with epoxides. It was demonstrated that the highly performance of triazole containing catalyst is due to the presence of nitrogen groups of triazole moiety which can act as Lewis base. In addition the MOF catalyst showed excellent stability and easy recyclability in comparison with homogenous catalysts. Metal organic frameworks (MOFs) are hybrid crystalline materials, exhibiting high specific surface areas, controllable pore sizes and surface chemistry. These properties have made MOFs attractive for a wide range of applications including gas separation, gas storage, sensing, drug delivery and catalysis. This review focuses on recent progress in the application of MOF materials as catalysts for CO2 conversion through chemical fixation, photocatalysis and electrocatalysis. In particular, this review discusses the co-relationship between the physicochemical properties of MOF materials including their catalytic performance as well as their stability and recyclability under different reaction conditions, relevant to CO2 conversion. Current modification techniques for improving MOF performance are highlighted along with the recent understanding of their electronic properties. The limitations of MOF based catalysts are also discussed and potential routes for improvement are suggested.



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