New Zinc-based Catalysts for the Coupling of Carbon Dioxide and Epoxides

Beom Jin Oh, Min Kim, and Youngjo Kim*
Department of Chemistry and BK21+Program Research Team, Chungbuk National University, Cheongju, Chungbuk 28644, Republic of Korea

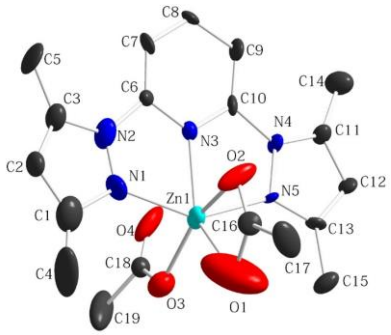
*E-mail: ykim@chungbuk.ac.kr

The chemical transformation of carbon dioxide into valuable chemicals is currently one of significant themes in both academic and industrial fields [1]. Since aliphatic cyclic carbonates, which have broad applications for aprotic solvents, electrolytes for secondary batteries, and intermediates for polycarbonates, were commercialized in 1950s [2], a wide range of catalytic systems including transition metal complexes [3], quaternary ammonium salt [4], ionic liquids [5], and so on have been tested to make cyclic carbonates from carbon dioxide and epoxides. Despite the fact that some excellent initiators have been found among these systems for aliphatic cyclic carbonates, the search for new catalysts with eco-friendly and low toxic properties is still remain of interest. In the aspect of solving environmental and poisonous problem, one of possible candidates would be zinc complexes bearing chelating ligands.

There are many kinds of reported zinc compounds as catalysts for aliphatic cyclic carbonates. Most reports of zinc catalysts for cyclic carbonates have focused on compounds chelated by bidentate or tetradentate ligands; much less attention has been directed towards complexes containing tridentate ligands [6,7].

Tridentate 2,6-bis(pyrazol-1-yl)pyridine (**PyPz$_2$**) ligand [8] and its derivatives have been extensively studied as ligands in coordination chemistry for 25 years [9,10]. A variety of their metal-based inorganic systems have been developed. Unlike other metal complexes, zinc-based complexes with **PyPz$_2$** ligand are not widely studied. Even though the molecular structure of zinc (II) chloride complex containing **PyPz$_2$** ligand was determined [11], to our best knowledge, any zinc compound with 2,6-bis(3,5-dimethylpyrazol-1-yl)pyridine (**Py(Me$_2$Pz)$_2$**) ligand has never been reported in the literature. Good ethylene polymerization behavior for chromium and vanadium-based catalysts containing its related ligand such as 2,6-bis(3,5-dimethylpyrazol-1-ylmethyl)pyridine prompted us to search for new catalysts

In this work we will report the synthesis and their catalysis of the cycloaddition reaction between CO_2 and epoxides using new zinc acetate complexes with **PyPz$_2$** and **Py(Me$_2$Pz)$_2$**.



ACKNOWLEDGMENT: This work was financially supported by NRF of Korea through the Creative Human Resource Training Project for Regional Innovation (grant number 2014H1C1A1066874).

REFERENCES

[1] E. Lichtfouse, J. Schwarzbauer and D. Robert, CO_2 Sequestration: Biofuels and Depollution (2015) Springer: Switzerland.
[2] W.J. Peppel, Ind. Eng. Chem., 50 (1958) 767.
[3] A. Decortes, A.M. Castilla and A.W. Kleij, Angew. Chem. Int. Ed., 49 (2010) 9822.
[4] J.-Q. Wang, K. Dong, W.-G. Cheng, J. Sun and S.-J. Zhang, Catal. Sci. Technol., 2 (2012) 1480.
[5] Q. He, J.W. O'Brian, K.A. Kitselman, L.E. Tompkins, G.C.T. Curtis and F.M. Kerton, Catal. Sci. Technol., 4 (2014) 1513.
[6] H.V. Babu and K. Muralidharan, Dalton Trans., 42 (2013) 1238.
[7] L. Cuesta-Aluja, A. Campos-Carrasco, J. Castilla, M. Reguero, A.M. Masdeu-Bultó and A. Aghmiz, J. CO_2 Util., 14 (2016) 10.
[8] D.L. Jameson and K.A. Goldsby, J. Org. Chem., 55 (1990) 4992.
[9] M.A. Halcrow, New J. Chem., 38 (2014) 1868.
[10] M.A. Halcrow, Coord. Chem. Rev., 249 (2005) 2880.
[11] Z.N. Yang and T.T. Sun, Acta Cryst., E64 (2008) m1374.