ICCDU XVI
27-30 August, 2018
Rio de Janeiro, Brazil

16th INTERNATIONAL CONFERENCE ON CARBON DIOXIDE UTILIZATION

Overview of CO_2 Utilization Research and Development in KACST: Two research examples will be presented

Saeed Al-Shihri,[1,*] Abdulaziz A. Bagabas,[1] Hamid Al-Megren,[1] Sultan Al-Shmimri,[1] Fahad Albaqi,[1] Majed Alharbi,[1] Ibrahim Albinali,[1] Abdulmajeed Alqalifah[1]

[1]*King Abdulaziz City for Science and Technology (KACST), Riyadh, Saudi Arabia*

**Corresponding author: alshihri@kacst.edu.sa*

Keywords: CO_2 conversion, heterogeneous catalysts, metal-organic framework, methanol

CO_2 emissions into atmosphere is a global concern and a recent theoretical study provides approach for its connection with global warming and climate change [1,2]. Carbon capture and storage from power stations and blast furnaces is advanced as an essential component of any plans to avoid potentially catastrophic impacts of anthropogenically induced climate change. However, there will be inevitable energy input in the necessary cooling and separation of CO_2, and other exhaust gases, for ultimate carbon capture and storage. The direct utilization or conversion of CO_2 at such sources ideally under their ambient operating conditions and without any capture and separation, would be highly desirable. CO_2 streams are diverse by nature, and they are by-products of industrial processes. To enable the transformation of these streams, catalytic systems must be robust and able to convert these CO_2 streams despite the varying conditions, purity levels, water levels, and CO_2 concentrations. In this presentation, I will present two examples of the recent research that have been conducted at KACST. The first example is a cooperative work between KACST and UC Berkeley on synthesizing innovative nanomaterials such as Metal-organic frameworks (MOFs), for CO_2 utilization. Metal-organic frameworks (MOFs), with their porosity and highly functionalizable nature, are hugely promising for such applications since these materials can be designed with the desired pore environment and size to perform heterogeneous catalysis. In a recent publication, it was shown that the hydrogenation of CO_2 to methanol can be promoted by combining Cu nanoparticles with Zr-based metal organic framework (UiO-66), which has the dual advantage of the MOF protecting the chemically sensitive Cu nanoparticles, and a synergistically enhanced activity. Using this catalyst, an eightfold increase over the benchmark catalyst ($Cu/ZnO/Al_2O_3$) and up to 100% selectivity for methanol over CO was recorded (Figure 1) [3].

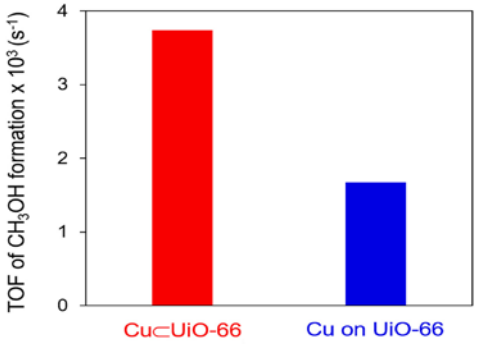

Figure 1. Initial TOFs of methanol formation over Cu-UiO-66 and Cu on UiO-66.

In another work, designing multifunctional catalysts for selective conversion of CO_2 to higher alcohol under energy efficient conditions has been investigated. A conversion of 35% with moderate selectivity toward mainly to methanol has been achieved.

Acknowledgments

We acknowledge the financial support from King Abdulaziz City for Science and Technology.

References

[1] G.W.G. Anthony J McHugh, William E. SchiesserAn Introductory Global CO2 Model World Scientific Publishing Co (2015).

[2] E.Alper and O.Yuksel, CO2 utilization: Developments in conversion processes, Petroleum 3 (2017) 109-126.

[3] B. Rungtaweevoranit, J. Baek, J. R. Araujo, B. S. Archanjo, K. M. Choi, O. M. Yaghi, G. A. Somorjai, Nano Lett., 2016, 16, 7645.