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Magneticfield–promoted cleaner production of small alcohols and hydrocarbons from CO2 over Cu-ZnO/ZrO2and Fe/MCM-41 catalysts

Metta Chareonpanich1,2,*,Waleeporn Donphai 1,2, Sirapassorn Kiatphuengporn3, Jumras Limtrakul2,4

1KU-Green Catalysts Group, Department of Chemical Engineering, Faculty of Engineering,
Kasetsart University, Bangkok 10900, Thailand
2NANOTEC Center for Nanoscale Materials Design for Green Nanotechnology, and Center for Advanced Studies in Nanotechnology and its Applications in Chemical, Food and Agricultural Industries, Kasetsart University, Bangkok 10900, Thailand
3Nanomaterials for the Energy and Catalysis Lab, National Nanotechnology Center, National Science and Technology Development Agency, Pathumthani12120, Thailand
4 Department of Materials Science and Engineering, School of Molecular Science and Engineering, Vidyasirimedhi Institute of Science and Technology, Rayong 21210, Thailand
*Corresponding author: +66 25792083, fengmtc@ku.ac.th

ABSTRACT

Based on green and sustainable applicationfor the enhancement of catalystperformance and energy conservation, an external magneticfield has been applied in CO2 hydrogenationreaction to improve the catalytic activity and reduce the energy consumption. In this research, theperformances of Cu-ZnO/ZrO2and xFe/MCM-41 catalystswith ferro/ferrimagnetic property under magneticfield with different magneticflux intensities (0-27.7 mT) and orientations (north-south and south-north) were investigated. It was found that bothCu-ZnO/ZrO2and xFe/MCM-41 catalysts operated under magneticfield gave higher CO2conversions, compared to that of without magneticfield at all reaction temperatures. The highest CO2conversions under magneticfield condition were 1.8–3.0 times,and 1.5–1.8 timeshigher than that of without magnetic field for Cu-ZnO/ZrO2and xFe/MCM-41, respectively. These outstanding catalytic activities could be attributed to the fact that magnetic field help facilitate the reactant adsorption and surface reaction over magnetized catalysts, leading to the decrease of apparent activation energy, and the increase of selectivities to hydrocarbons and CH3OH.Moreover, this challenge in applicationof magneticfield in CO2 hydrogenation process help reduce CO2 emission into the atmosphere comparedto the convention reactor, and therefore led to the carbon-neutral CO2 conversion process.

Author: Dr CHAREONPANICH, Metta (Kasetsart University)

Presenter: Dr CHAREONPANICH, Metta (Kasetsart University)

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