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# An innovative application of magnetic field for CO2 hydrogenation reaction on Fe and Cu supported MCM-41 catalyst

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The external magnetic field was applied in a packed-bed reactor based on the concepts of green and sustainable production of alternative fuels through CO2 hydrogenation reaction. Accordingly, the roles of magnetic flux density and magnetic field direction on the performance of Fe-Cu/MCM-41 catalyst with intrinsic magnetic property were investigated and compared to that of without magnetic field. It was found that magnetic field strongly affected the activity of catalyst, both CO2 conversion and product selectivity. Over 10Cu–10Fe/MCM-41 catalyst, magnetic field remarkably promoted CO2 conversion, especially in the north-to-south (N-S) direction (1.8 times higher than that of without magnetic field at 260oC). With increasing magnetic flux density, CO2 conversion was increased followed the order of 27.7 mT > 20.8 mT > 0 mT in each magnetic field direction. Moreover, under the magnetic field conditions which gave the highest CO2 conversion, it was more favorable for CH3OH formation. CH3OH space time yield with magnetic field was 1.5 times higher than that of without magnetic field. The improvement of catalytic activity by the magnetic field application was described by mean of the reduction of apparent activation energy (Ea). With magnetic field, the apparent activation energy was decreased for approximately 1.18 times compared to that of without magnetic field. This outstanding performance was attributed to the fact that magnetic field could facilitate the adsorption ability of reactant gases on magnetized catalyst surfaces, leading to the increase of catalytic CO2 hydrogenation and selective conversion to CH3OH, and lowering of the activation energy.

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