Supporting Information for

Effective hydrogenation of carbonates to produce methanol over ternary Cu/Zn/Al catalyst

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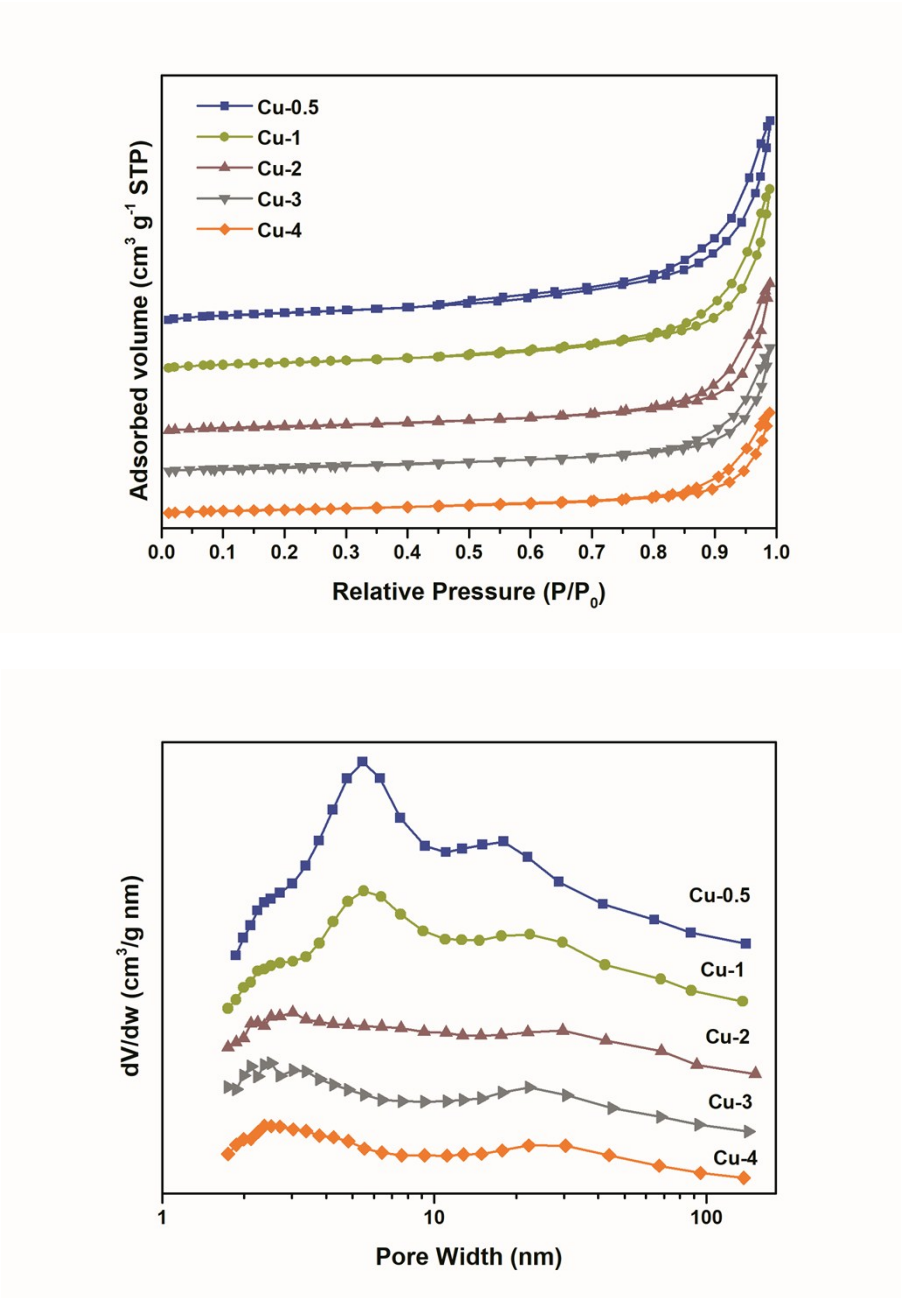


Figure S1. (a) N_2 adsorption-desorption isotherms. (b) Pore size distribution curves from the adsorption branches of catalysts.

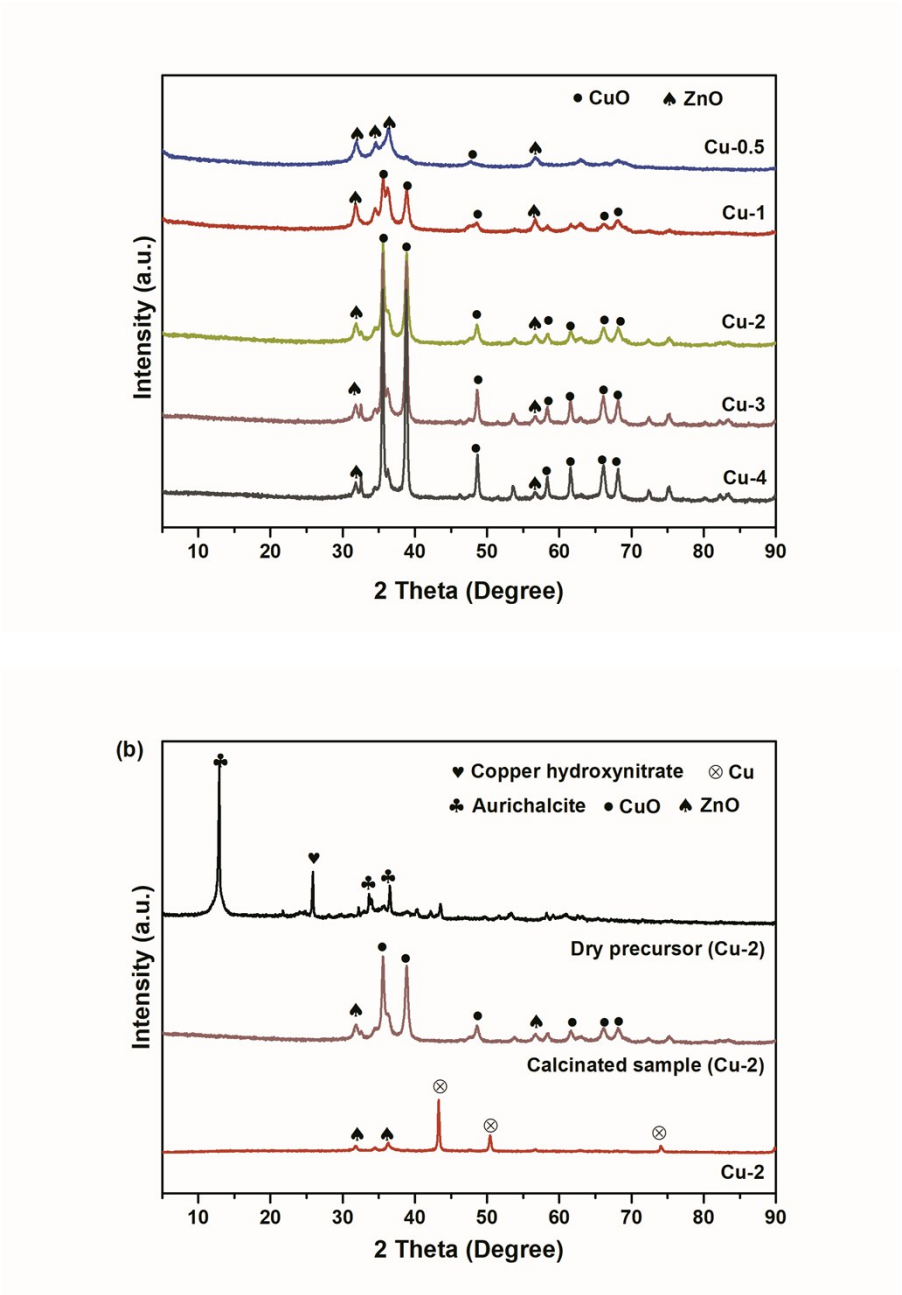


Figure S2. XRD patterns of Cu/Zn/Al-C (a), Cu-2 samples at different preparation stage (b).

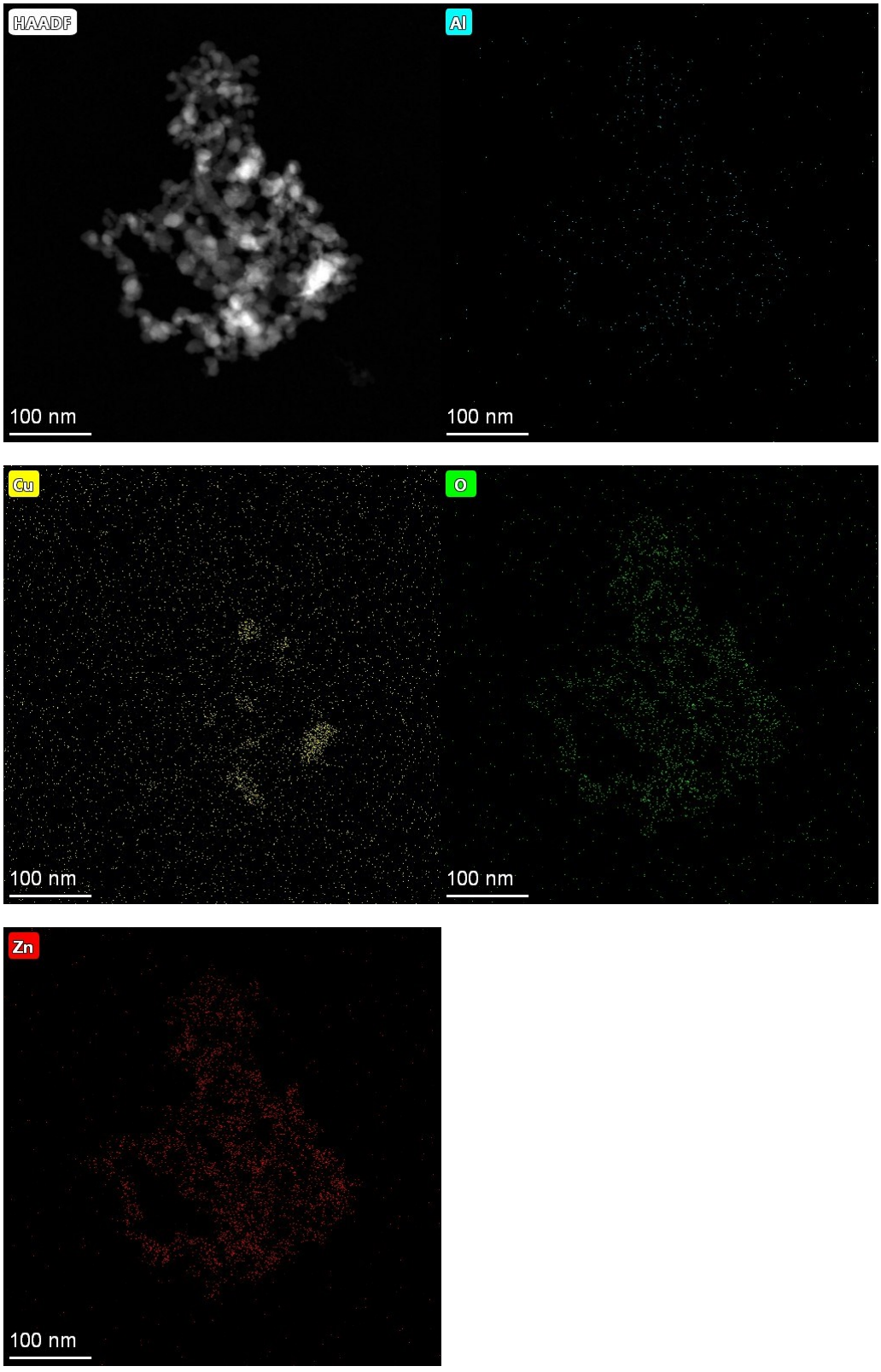


Figure S3. EDX elemental mapping spectra of Cu-2.

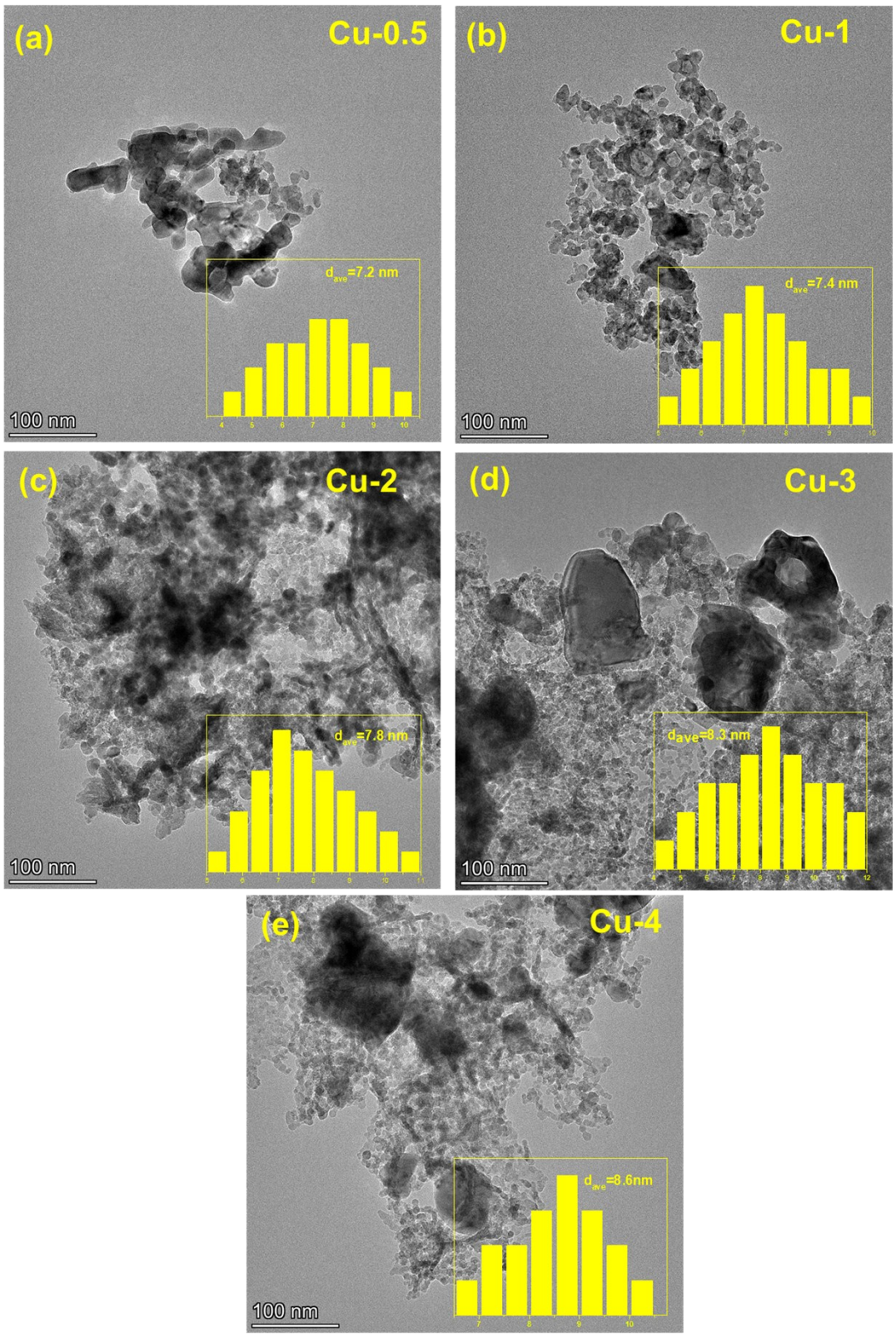


Figure S4. TEM imagines of Cu /Zn/Al catalysts.

(a) Cu-0.5, (b) Cu-1, (c) Cu-2, (d) Cu-3, (e) Cu-4

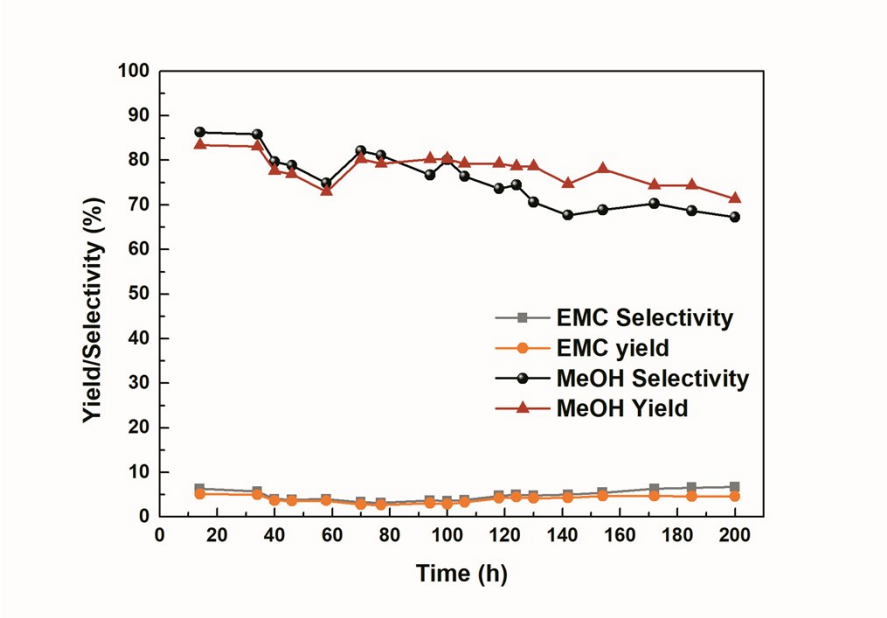
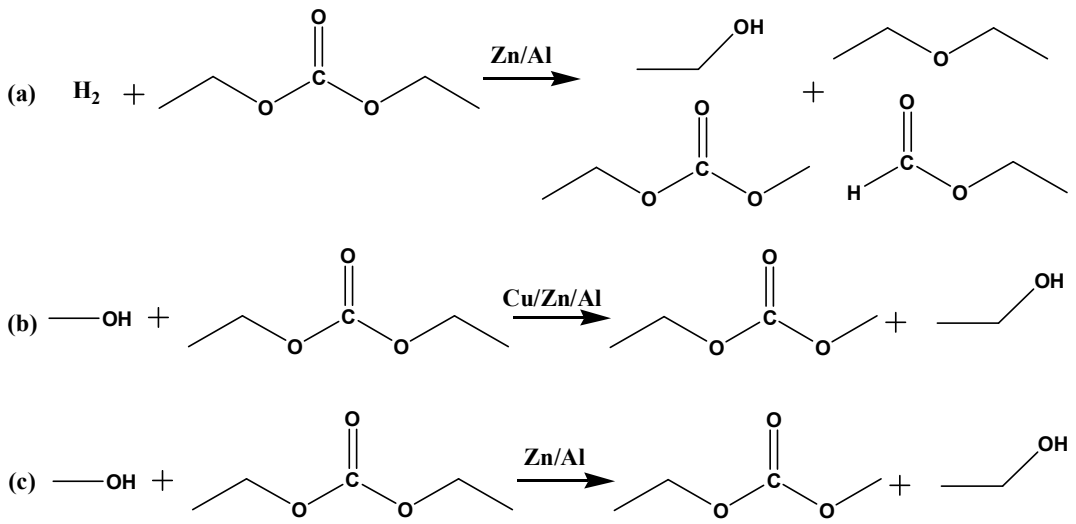


Figure S5. Hydrogenation performance of Cu-2 catalyst as a function of time on stream for methanol and EMC. Temperature: 200 ^{o}C, Liquid hour space velocity (LHSV)~0.2 h^{-1}, H_2/DEC=200, 2.5 MPa.



Scheme S1. Transesterification of methanol and diethyl carbonate over Cu-2 catalyst. Reaction conditions: (a) 10 mmol DEC, 5 MPa H_2, 10 mL THF and 0.24g Zn/Al catalyst (20 wt% DEC). (b) 10 mmol DEC, 10 mmol methanol, 10 mL THF and 0.24g Cu-2 catalyst (20 wt% DEC). (c) 10mmol DEC, 10 mmol methanol, 10 mL THF and 0.24g Zn/Al catalyst (20 wt% DEC).

Table S1. The results of transesterification of methanol and diethyl carbonate over Cu-2 catalyst and Zn/Al catalyst.

Catalyst	Conversion of methanol	Conversion of DEC	Selectivity of EMC
Cu/Zn/Al (Cu-2)	68.0%	61.1%	25.3%
Zn/Al	76.2%	76.9%	16.3%

Zn/Al catalyst was prepared as the similar way as the Cu-2 catalyst with the mole ratio of Zn to Al of 1:1. Reaction conditions: the transesterification reaction was carried out at 200 ^{o}C, both the dosage of DEC and methanol are10 mmol in the solvent of 10 mL THF and 20 wt% catalyst (based on the DEC).

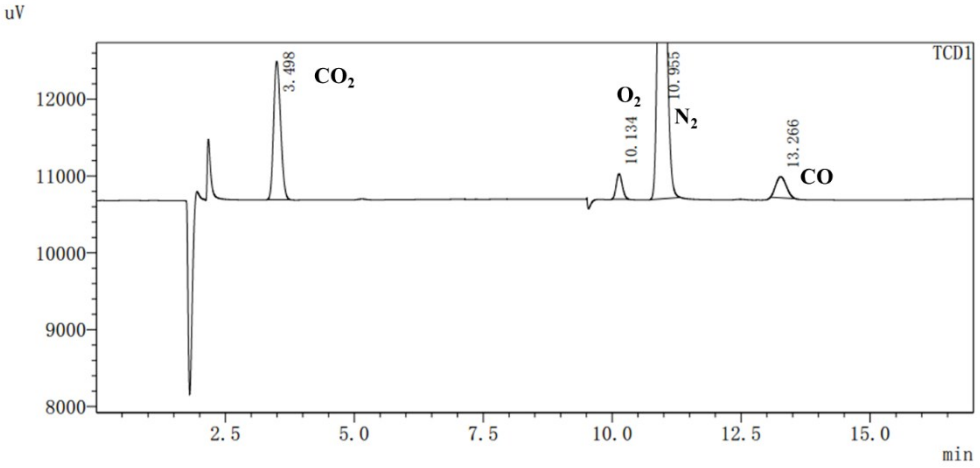


Figure S6. The GC traces of the gas contents of DEC hydrogenation after the reaction.