

SUPPORTING INFORMATION

for

Solid-state ion-exchanged Cu/mordenite catalyst for the direct conversion of methane to methanol

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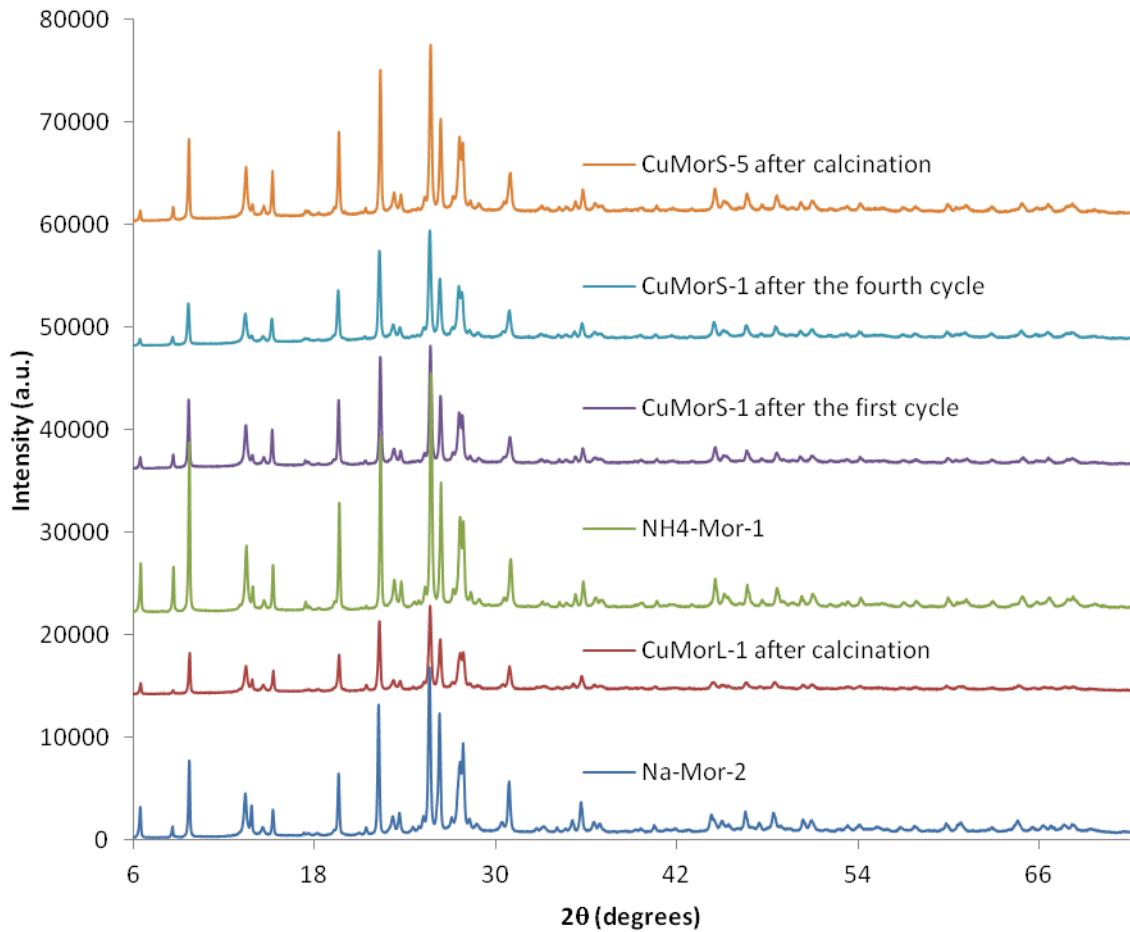


Figure S1. XRD patterns of Cu/mordenites.

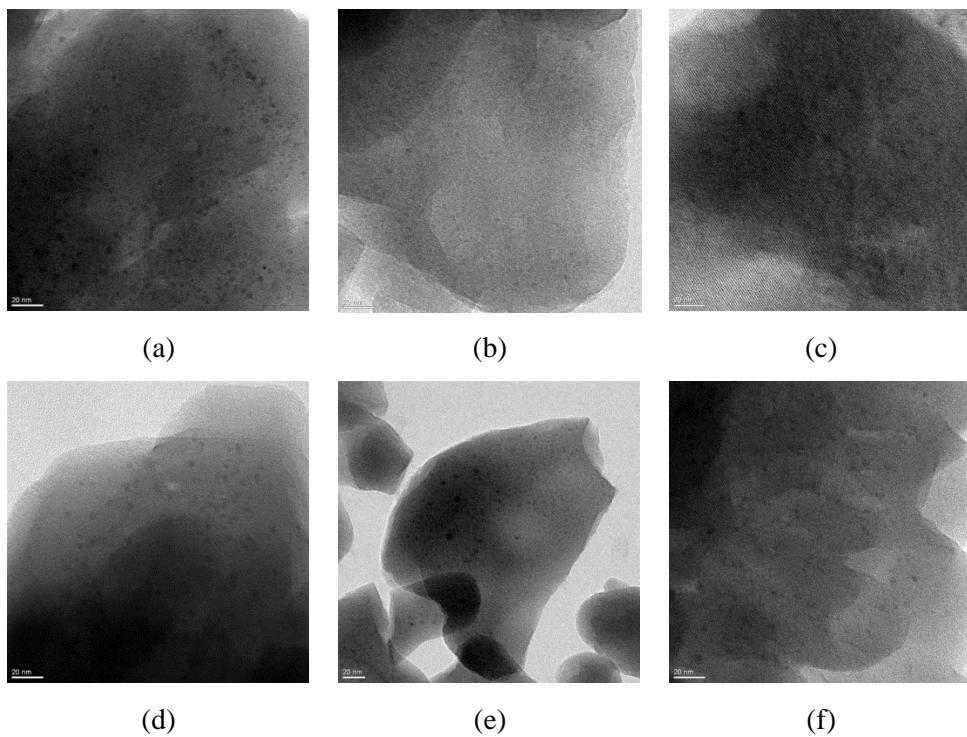


Figure S2. TEM images of Cu/mordenites (a) calcined CuMorS-1, (b) CuMorS-1 after the 4th cycle, (c) calcined CuMorS-3, (d) calcined CuMorS-4, (e) calcined CuMorL-1, (f) CuMorS-1 after the 1st cycle, scale bar: 20 nm.

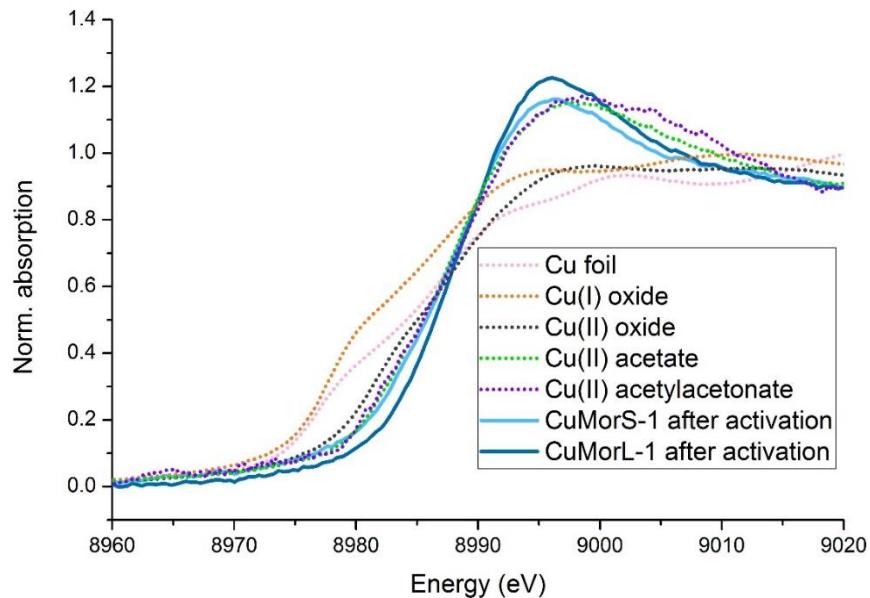


Figure S3. XANES spectra of CuMorS-1 and CuMorL-1 after activation in O₂.

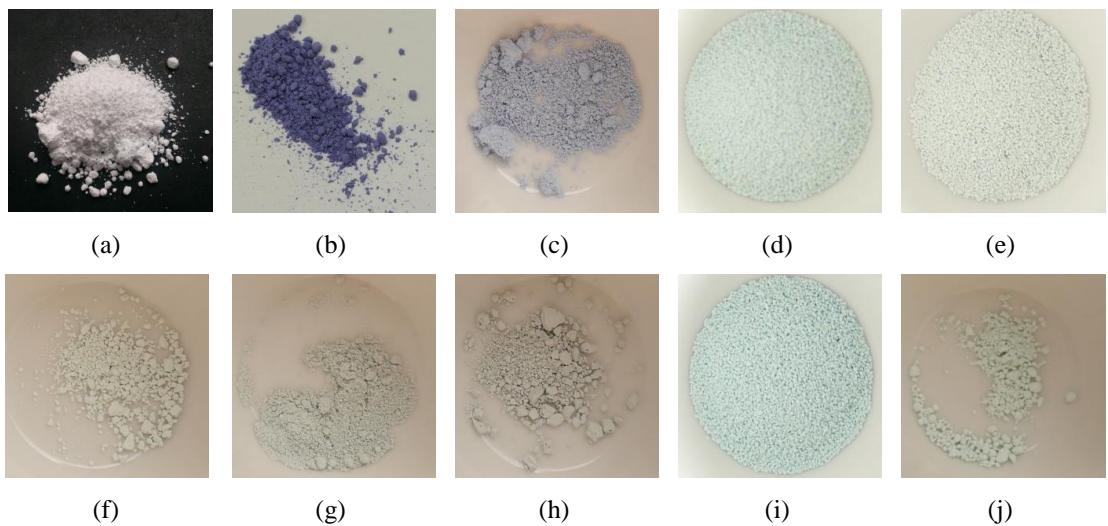


Figure S4. Photographs of the materials used in the study (a) NH₄-Mor-1, (b) Cu(acac)₂, (c) a well-ground mixture of NH₄-Mor-1 and Cu(acac)₂, (d) calcined CuMorS-1, (e) CuMorS-1 after the 1st cycle, (f) CuMorS-1 after the 4th cycle, (g) calcined CuMorS-4, (h) CuMorS-4 after the 1st cycle, (i) calcined CuMorL-1, (j) CuMorL-1 after the 1st cycle.

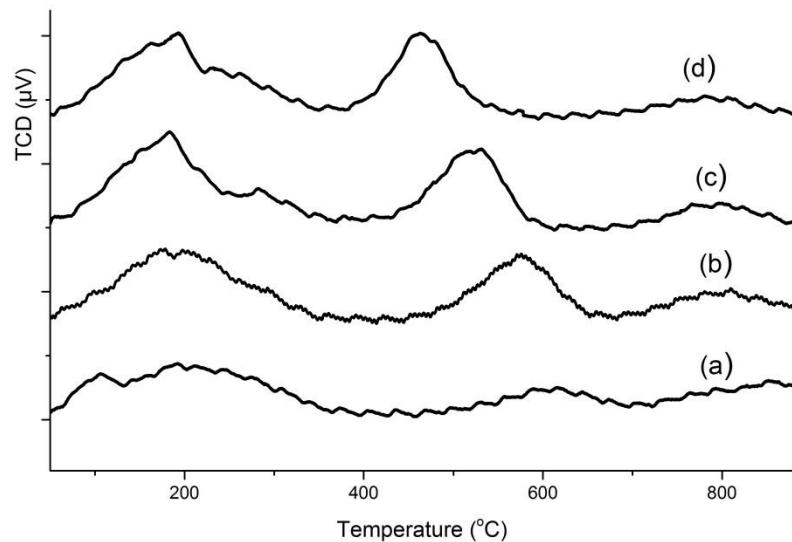


Figure S5. H₂-TPR profiles of CuMorS with varied Cu loading (a) 1.01 wt.%, (b) 1.84 wt.%, (c) 3.21 wt.%, (d) 3.74 wt.%.

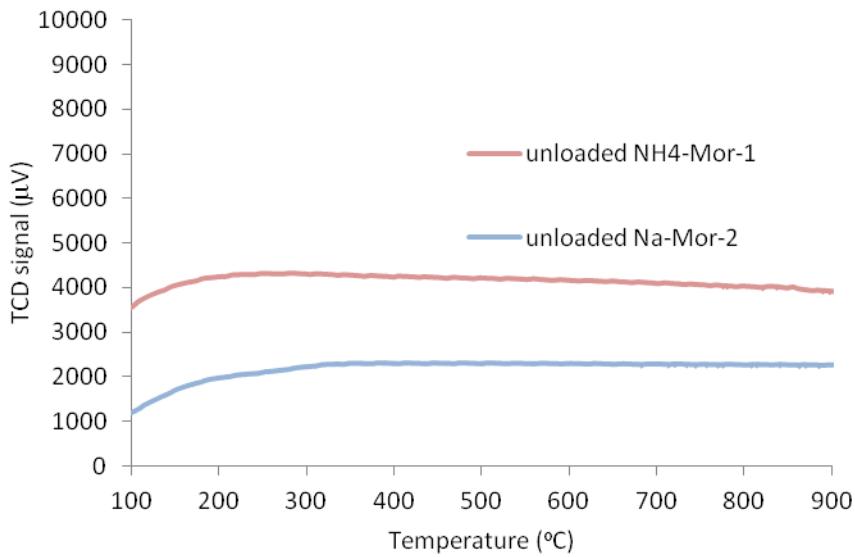


Figure S6. H₂-TPR profiles of fresh mordenites.

Table S1. N₂ sorption analysis of mordenites and Cu/mordenites.

Sample	Cu content (wt.%)	BET surface area (m ² g ⁻¹)	Total volume (cm ³ g ⁻¹)
NH ₄ -Mor-1	0	346.7	0.303
CuMorS-1	2.58	307.0	0.209
CuMorS-1 - after the 4 st run	2.58	313.5	0.245
CuMorS-2	1.01	339.7	0.342
CuMorS-3	1.84	336.0	0.289
CuMorS-4	3.74	305.9	0.228
CuClMorS	2.84	327.5	0.255
Na-Mor-2	0	336.0	0.289