

Supporting information

Bifunctional hybrid catalysts derived from Cu/Zn-based nanoparticles for single-step dimethyl ether synthesis

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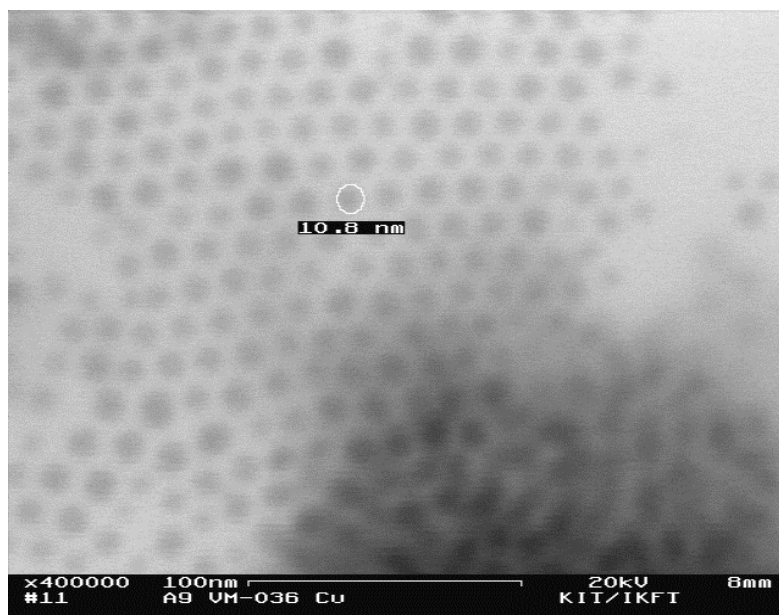
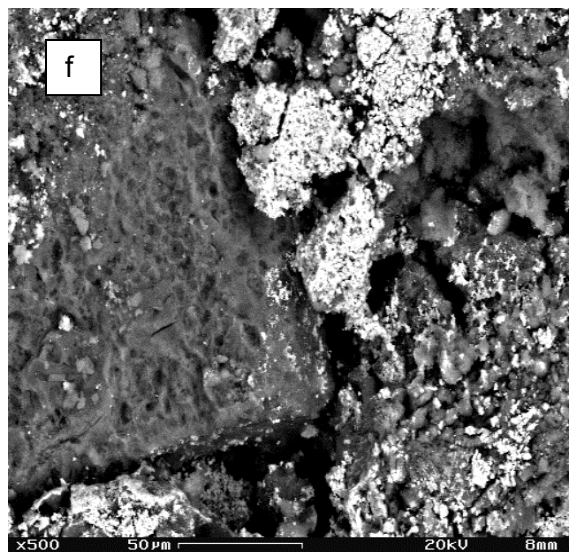
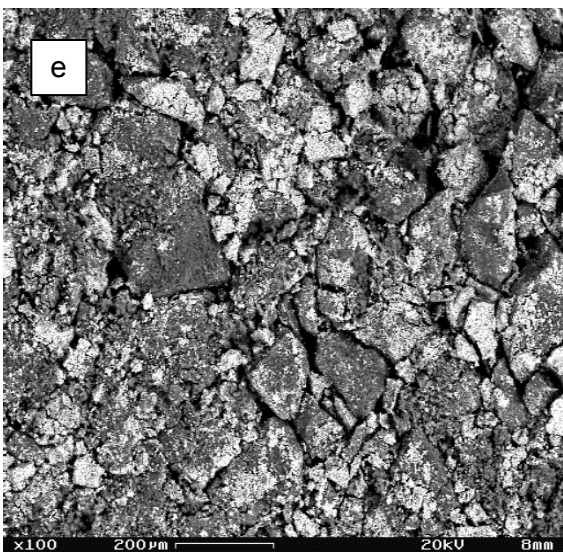
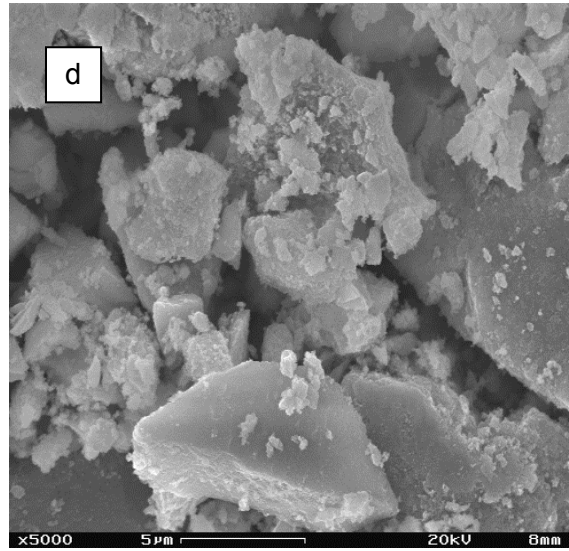
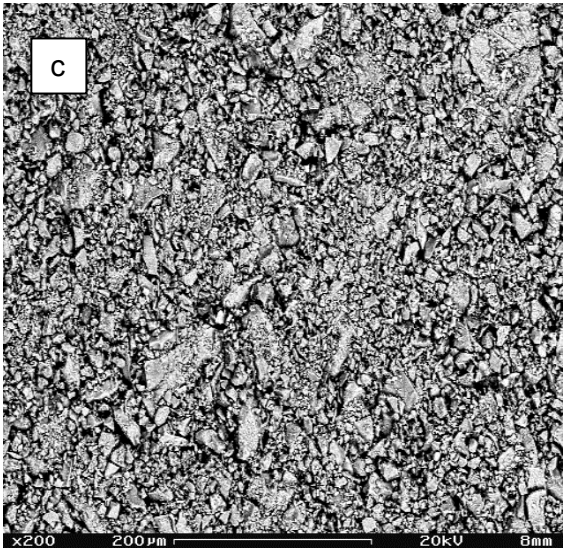
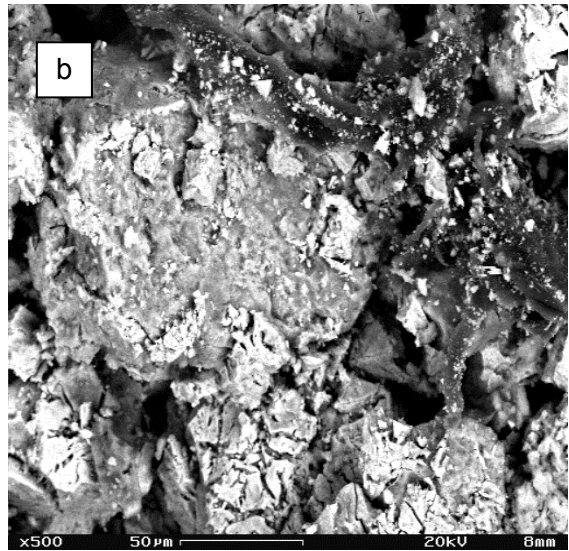
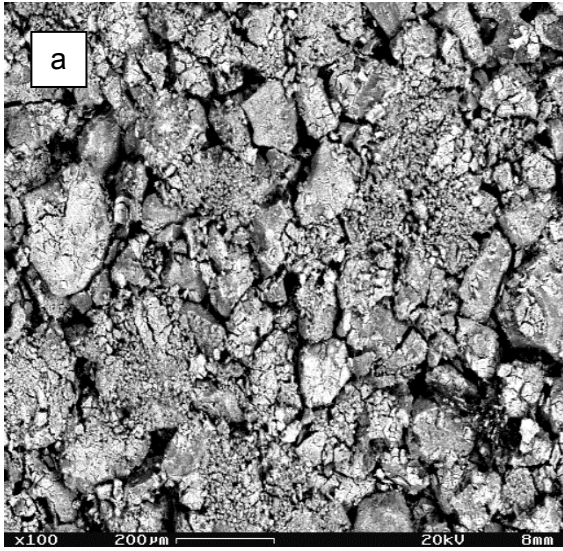


Fig. S1. SEM image of Cu nanoparticles (CuZn-NP-3) synthesized by thermal decomposition of $\text{Cu}(\text{acac})_2$ in OA.



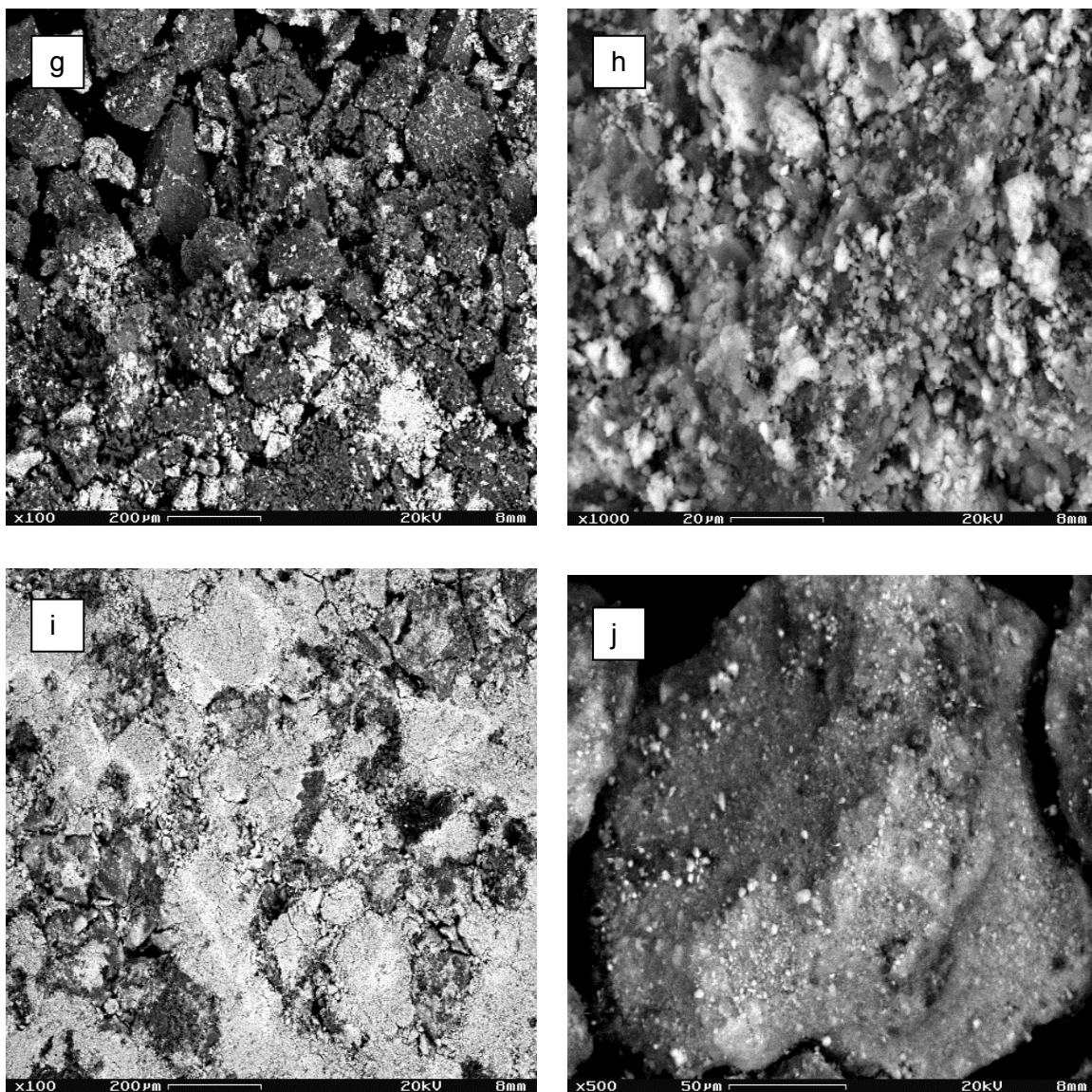


Fig. S2. SEM images of the calcined, bifunctional STD catalysts before catalysis: (a,b) CZA-1, (c,d) CZA-2, (e,f) CA-3, (g,h) CZA-4 and (i, j) CZA-5.

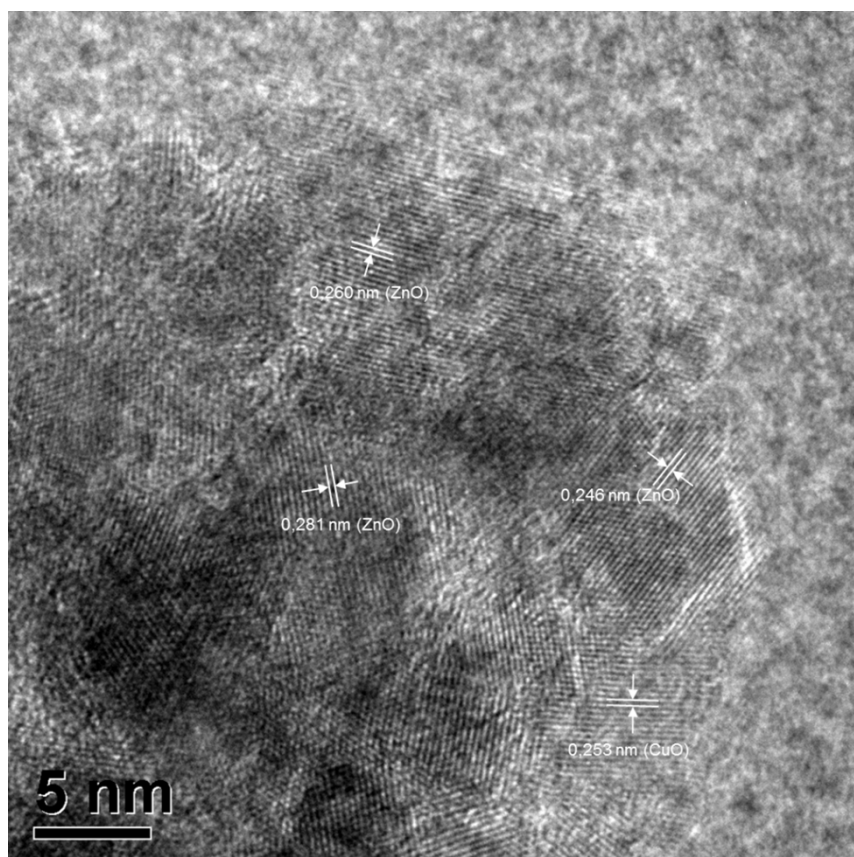
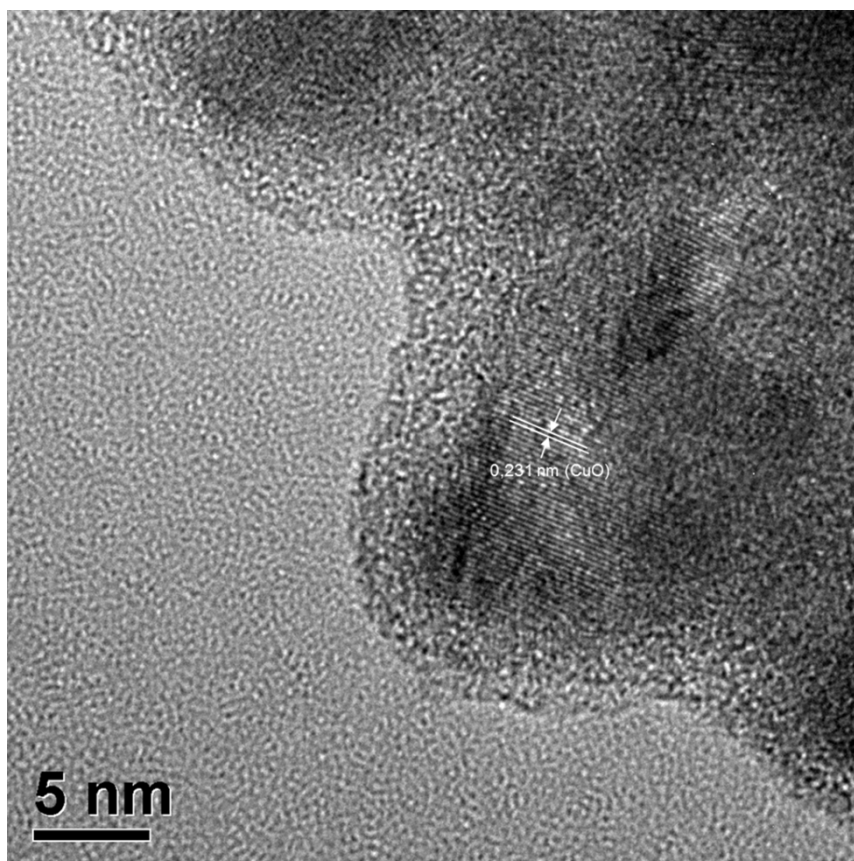


Fig. S3. HRTEM images of the calcined, bifunctional STD catalysts (a) CZA-1 and (b) CZA-2 before catalysis. Lattice fringes are marked by arrows and assigned to the CuO and ZnO phase of the particles.

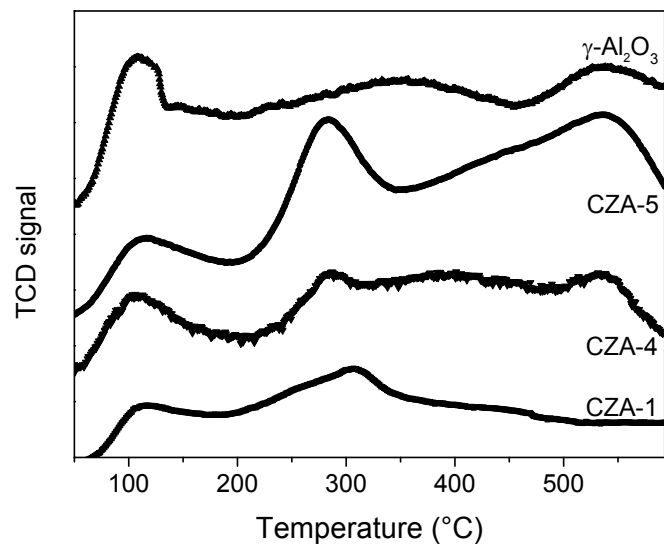


Fig. S4. NH_3 -TPD profiles of bifunctional catalysts CAZ-1, CAZ-4, and CAZ-5.

Table S1. Fitting results for EXAFS spectra at Cu K edge for nanoparticles (CuZn-NP-1) and the bifunctional catalyst after reaction (CZA-1).

Catalyst	Cu-O distance (Å)	Coordination number (O)	Cu-Cu distance (Å)	Coordination number (Cu)	σ^2 (10^{-3} Å ²)	δE_0 (eV)	ρ (%)	Corrected ^[a] coordination number (Cu)	Diameter of metallic cluster (Å) ^[b]
CuZn-NP-1	1.85±0.025	2.3±0.35	2.54±0.02	3.3±0.8	9.3±2.1	4.7±2.7	1.4	4.8	-
CZA-1 (after reaction)	1.85±0.04	0.8±0.3	2.54±0.01	7.9±0.8	8.7±0.9	4.0±1.1	0.3	8.6	~21

[a] Corrected to account for asymmetric pair distribution function according to [B.S. Clausen and J.K. Nørskov, *Top. Catal.* 2000, 10, 221-230]; [b] Calculated assuming spherical clusters according to Ref. [24].