Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Electronic Supplementary Information

A facile strategy for enhancing FeCu bimetallic promotion for catalytic phenol oxidation

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1 XRD patterns of (a) Fe_{10}/MI, (b) Fe_{10}/ME, (c) Fe_5Cu_5/MI, (d) Fe_5Cu_5/ME, (e) Cu_{10}/MI, (f) Cu_{10}/ME.

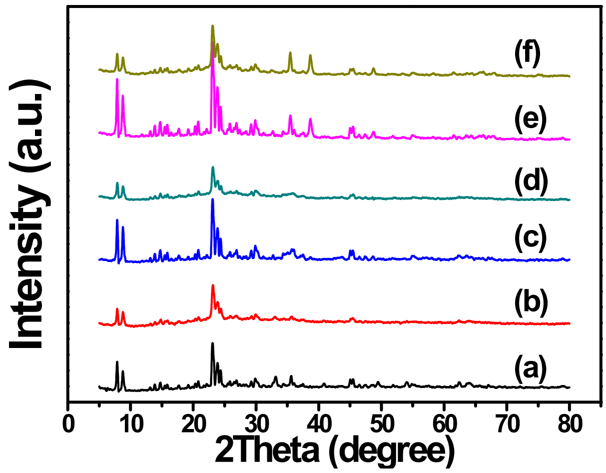

Fig. S1. XRD patterns of (a) Fe_{10}/MI, (b) Fe_{10}/ME, (c) Fe_5Cu_5/MI, (d) Fe_5Cu_5/ME, (e) Cu_{10}/MI, (f) Cu_{10}/ME.

2 Phenol oxidation reaction catalyzed by Fe_5/ME and Cu_5/ME.

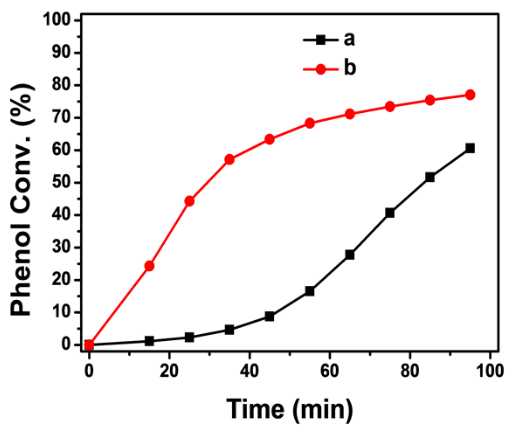

Fig. S2. Phenol conversion in the presence of (a) Fe_5/ME, (b) Cu_5/ME. Reaction conditions: Molar ratio: 14 H_2O_2: 1 phenol, 20 mg catalyst: 50 ml phenol (1 g/L), temperature is 323 K.

3 TEM images of (a) Fe_{10}/MI, (b) Fe_{10}/ME, (c) Fe_5Cu_5/MI, (d) Fe_5Cu_5/ME, (e) Cu_{10}/MI, (f) Cu_{10}/ME.

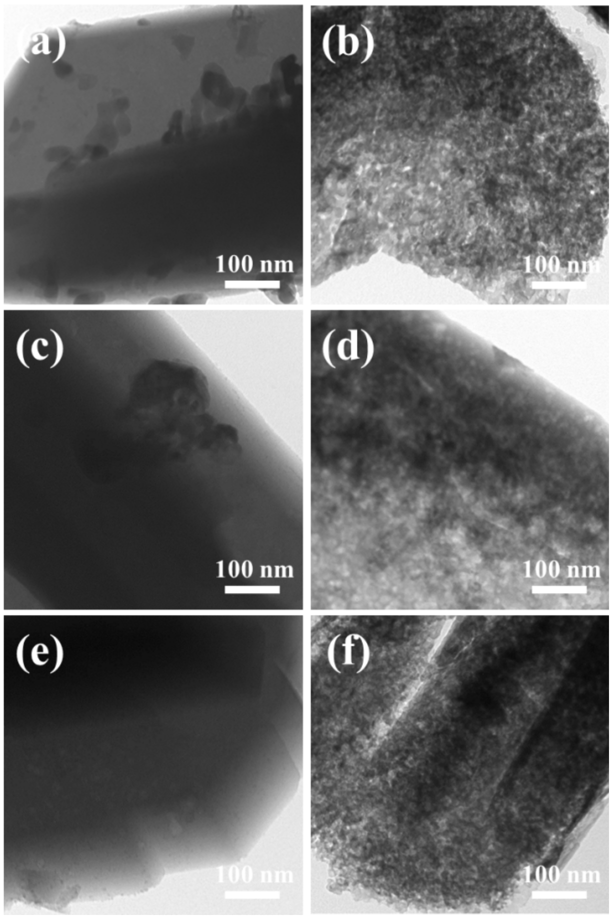

Fig. S3. TEM images of (a) Fe_{10}/MI, (b) Fe_{10}/ME, (c) Fe_5Cu_5/MI, (d) Fe_5Cu_5/ME, (e) Cu_{10}/MI, (f) Cu_{10}/ME.

4 Amount of Cu and Fe in synthetic gel and Fe_xCu_y/ZSM-5 samples.

Table S1. Amount of Cu and Fe in synthetic gel and Fe_xCu_y/ZSM-5 samples.

Sample	Amount of metal in synthetic gel, (wt.%)[a]			Amount of metal in samples[b]		
	Fe	Cu	n_{Fe}/n_{Cu}	Fe	Cu	n_{Fe}/n_{Cu}
Fe_{10}/MI	10	0	/	9.73	/	/
Fe_{10}/ME	10	0	/	9.64	/	/
Fe_5Cu_5/MI	5	5	1.1	4.77	5.31	1.03
Fe_5Cu_5/ME	5	5	1.1	4.74	5.25	1.03
Cu_{10}/MI	0	10	/	/	10.5	/
Cu_{10}/ME	0	10	/	/	10.7	/

a Weight ration of M/support, where M is Fe and Cu. b Measured by ICP analysis.

Table S2. Molar ratios of Si/Al in the two supports.

Sample	Theoretical Si/Al (mol/mol)	Experimental Si/Al[a] (mol/mol)
Micro-ZSM-5	40	87.2
Meso-ZSM-5	/	43.5

a Measured by ICP analysis.

5 Ar adsorption/desorption isotherms of sample (a) Fe_{10}/MI, (b) Fe_{10}/ME, (c) Fe_5Cu_5/MI, (d) Fe_5Cu_5/ME, (e) Cu_{10}/MI, (f) Cu_{10}/ME.

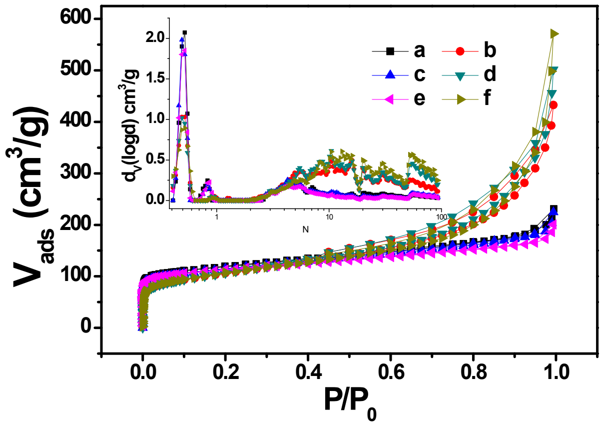

Fig. S4. Ar adsorption/desorption isotherms at 87 K and pore size distributions of (a) Fe_{10}/MI, (b) Fe_{10}/ME, (c) Fe_5Cu_5/MI, (d) Fe_5Cu_5/ME, (e) Cu_{10}/MI, (f) Cu_{10}/ME. The pore size distributions were determined by non-local density functional theory (NLDFT).

Table S3. Textural properties of (a) Fe_{10}/MI, (b) Fe_{10}/ME, (c) Fe_5Cu_5/MI, (d) Fe_5Cu_5/ME, (e) Cu_{10}/MI, (f) Cu_{10}/ME.

Sample	S_{micro}[a] [m^2g^{-1}]	S_{meso}[a] [m^2g^{-1}]	S_{BET}[b] [m^2g^{-1}]	V_{micro}[a] [cm^3g^{-1}]	V_{pore}[c] [cm^3g^{-1}]
a	260	127	387	0.10	0.29
b	133	199	332	0.05	0.55
c	230	138	368	0.08	0.29
d	128	203	331	0.05	0.64
e	260	108	368	0.10	0.26
f	148	183	331	0.06	0.73

[a] t-plot method [b] BET method [c] P/P_0=0.99.

6 Recycling performance of Fe_5Cu_5/MI and Fe_5Cu_5/ME.

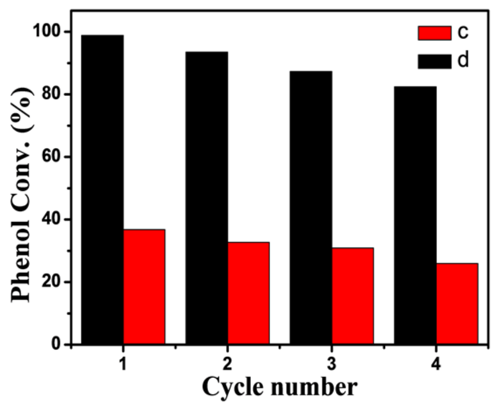

Fig. S5. The recycling performance of sample (c) Fe_5Cu_5/MI and (d) Fe_5Cu_5/ME.

7 Metal leaching performance analysis by ICP.

Table S4. Metal leaching performance analysis by ICP.

Sample	Metal leaching	
	Fe (mg/L)	Cu (mg/L)
Fe_{10}/MI	0.08	/
Fe_{10}/ME	1.27	/
Fe_5Cu_5/MI	0.27	2.81
Fe_5Cu_5/ME	1.62	2.13
Cu_{10}/MI	/	3.41
Cu_{10}/ME	/	3.16

8 Catalytic performance of Fe_5Cu_5/SBA-15.

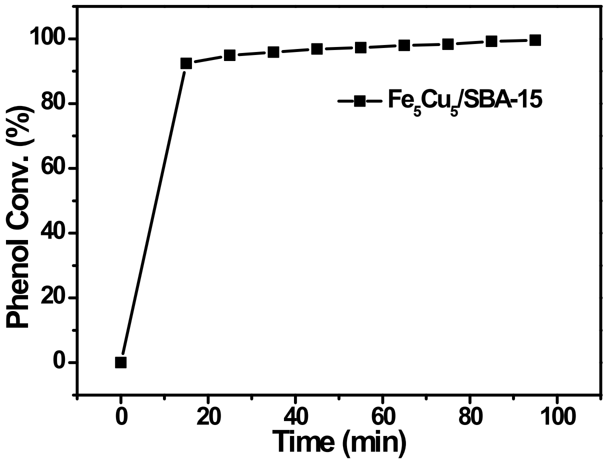

Fig. S6. Phenol conversion in the presence of Fe_5Cu_5/SBA-15.

9 Efficiency of H_2O_2.

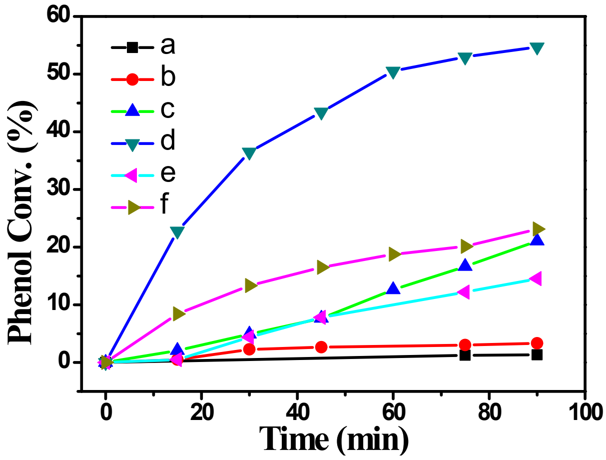

Fig. S7. H_2O_2 degradation in the presence of (a) Fe_{10}/MI, (b) Fe_{10}/ME, (c) Fe_5Cu_5/MI, (d) Fe_5Cu_5/ME, (e) Cu_{10}/MI, (f) Cu_{10}/ME. Reaction conditions: Molar ratio: 14 H_2O_2: 1 phenol, 20 mg catalyst : 50 ml phenol (1 g/L), temperature is 323 K.

10 Catalytic performance of Fe_5Cu_5/meso-S-1.

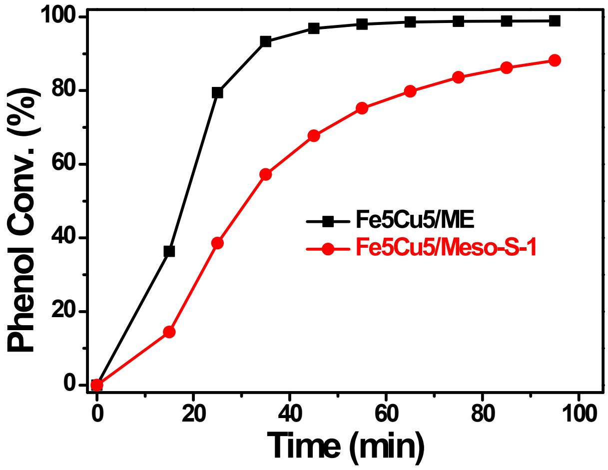

Fig S8. Phenol conversion in the presence of Fe_5Cu_5/ME and Fe_5Cu_5/meso-S-1.