Supporting Information for

Au@Cu(II)-MOF: Highly Efficient Bifunctional Heterogeneous Catalyst for Successive Oxidation-Condensation Reactions

Jing-Si Wang, Fa-Zheng Jin, Hui-Chao Ma, Xiao-Bo Li, Ming-Yang Liu, Jing-Lan Kan, Gong-Jun Chen, and Yu-Bin Dong**

College of Chemistry, Chemical Engineering and Materials Science, Collaborative Innovation Center of Functionalized Probes for Chemical Imaging in Universities of Shandong, Key Laboratory of Molecular and Nano Probes, Ministry of Education, Shandong Normal University, Jinan 250014, P. R. China. E-mail: yubindong@sdnu.edu.cn.

Content

XPS spectra of Au in 1 (Figure S1).

The ESR spectra of Cu(II)-MOF and Au@Cu(II)-MOF (Figure S2).

CO_2 adsorption and pore widths of Cu(II)-MOF and Au@Cu(II)-MOF (1) (Figure S3).

HRTEM and SEM-EDS measurement of Au@Cu(II)-MOF (1) after 1-2 runs of 4-nitrophenol reduction reaction (Figure S4).

The UV-vis spectra of 2- and 3-nitrophenol reduction (Figure S5 and S6).

GC analysis for oxidation reactions of benzyl alcohol under different conditions (Figure S7-S20)

HRTEM and SEM-EDS measurement of Au@Cu(II)-MOF (1) after 1-4 runs of benzyl alcohol oxidation reaction (Figure S21).

GC analysis for oxidation of benzyl alcohols with different substituted groups in toluene (Figure S22-S27).

GC analysis for oxidation-knoevenagel of benzyl alcohol (Figure S28-S31).

HRTEM and SEM-EDS measurement of Au@Cu(II)-MOF (1) after 2 runs of benzyl alcohol oxidation-knoevenagel reaction (Figure S32).

GC analysis for oxidation-knoevenagel reactions of benzyl alcohols with different substituted groups (Figure S33).

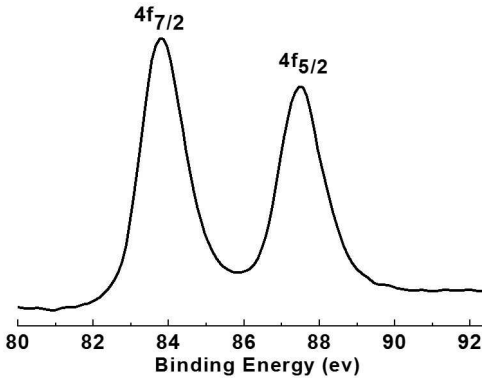

Figure S1. XPS spectra corresponding to the Au-$4f_{7/2}$ and $4f_{5/2}$ of Au@Cu(II)-MOF (**1**).

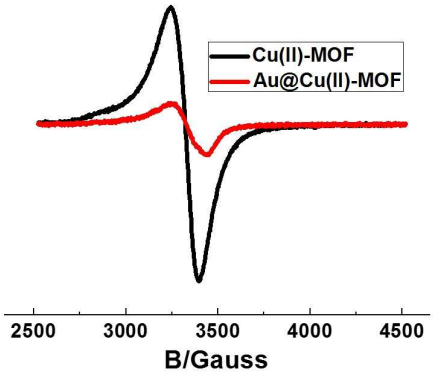

Figure S2. The ESR spectra of Cu(II)-MOF and Au@Cu(II)-MOF (**1**).

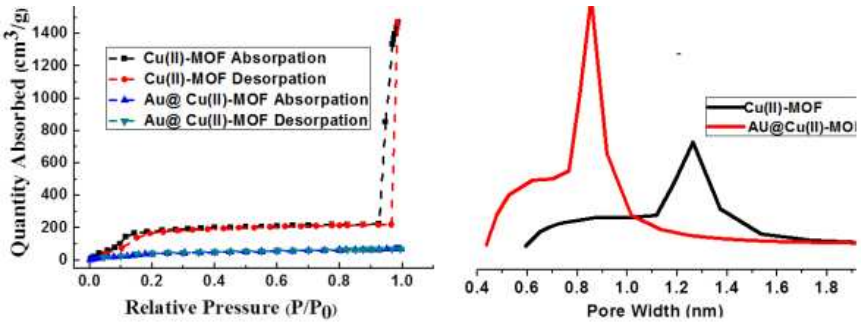

Figure S3. Left: CO_2 adsorption isotherms for Cu(II)-MOF and Au@Cu(II)-MOF (**1**) at 195 K. Right: The pore widths of Cu(II)-MOF and Au@Cu(II)-MOF (**1**) are centered at 1.3 nm and 0.9 nm, respectively.

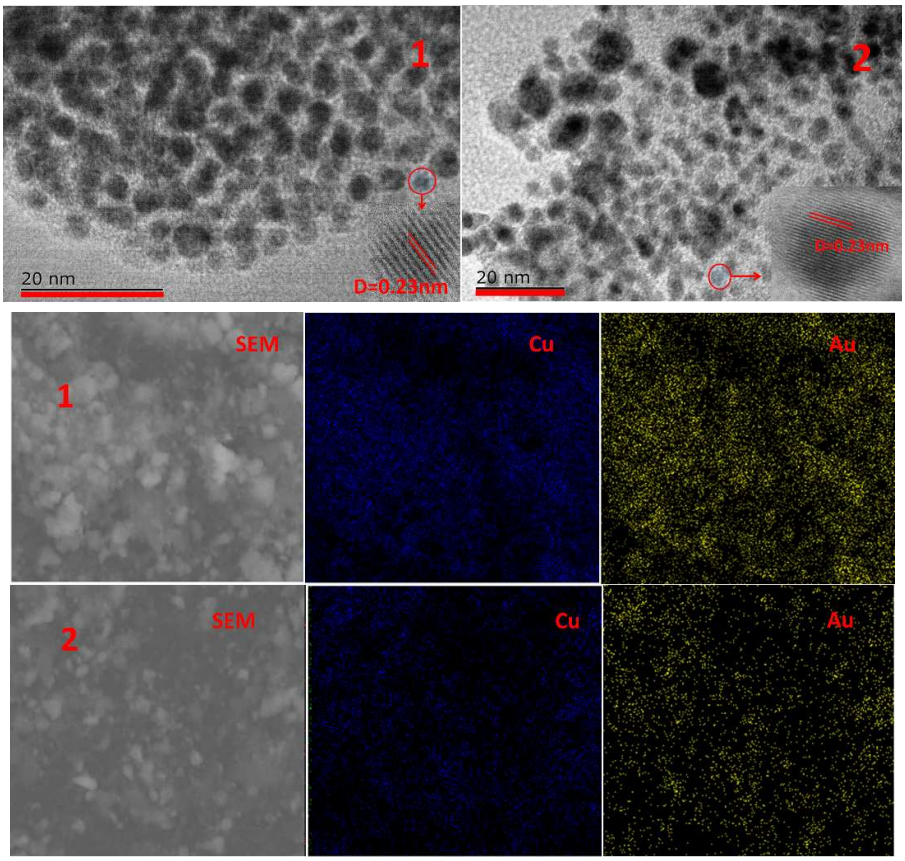

Figure S4. HRTEM and SEM-EDS measurement of Au@Cu(II)-MOF (**1**) after 2 runs of 4-nitrophenol reduction reaction.

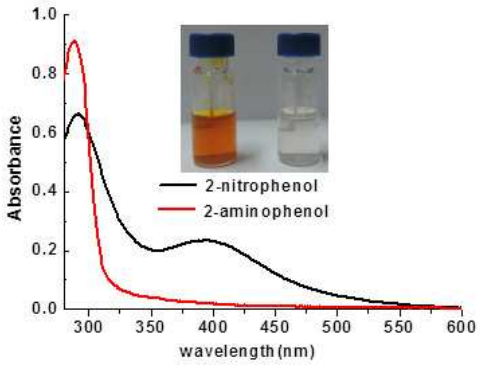

Figure S5. The UV-vis spectra of the reduction of 2-nitrophenol catalyzed by Au@Cu(II)-MOF (**1**) and the inset shows the color changed before and after reaction.

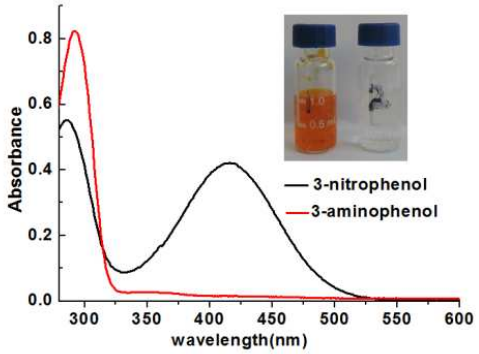

Figure S6. The UV-vis spectra of the reduction of 3-nitrophenol catalyzed by Au@Cu(II)-MOF (**1**) and the inset shows the color changed before and after reaction.

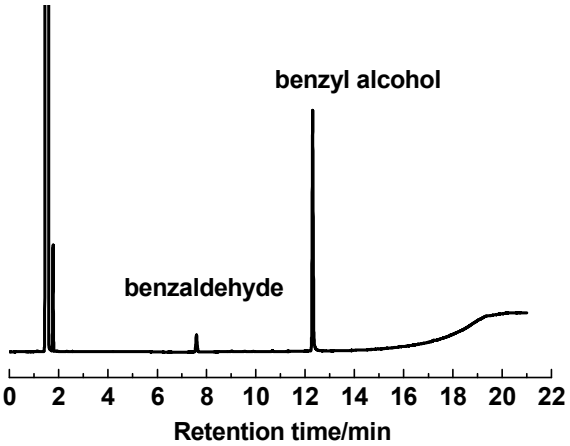

Figure S7. GC analysis: benzyl alcohol oxidation in H_2O (95°C, 20h) catalyzed by Au@Cu(II)-MOF (**1**) extracted with dichloromethane (conversion, 12 %).

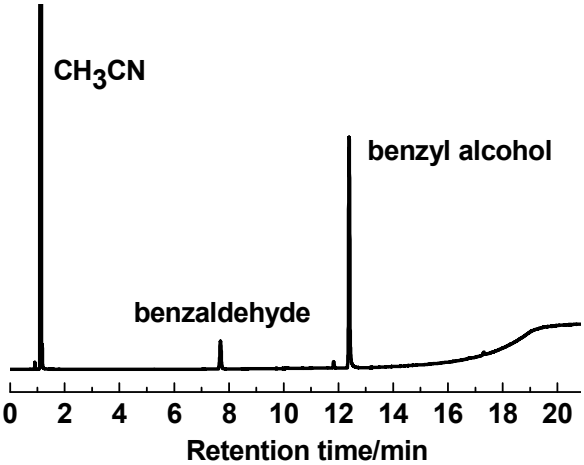

Figure S8. GC analysis: benzyl alcohol oxidation in CH_3CN catalyzed by Au@Cu(II)-MOF (**1**) (70°C, 20 h, conversion, 12 %).

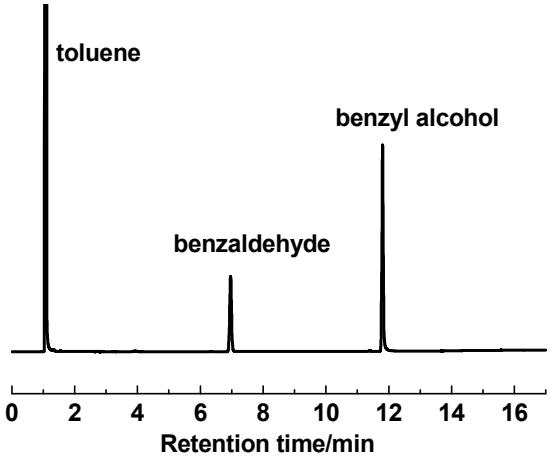

Figure S9. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) (60°C, 20 h, conversion, 37 %).

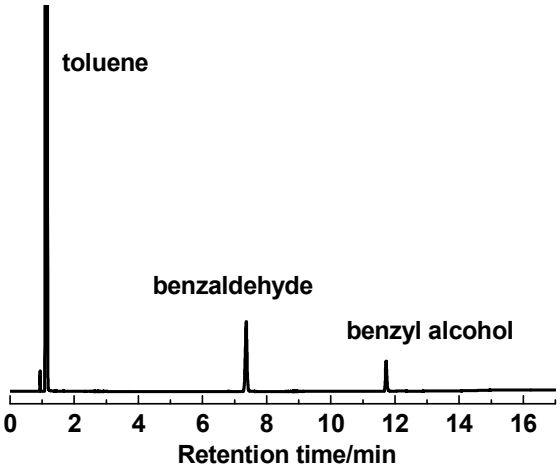

Figure S10. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) (90°C, 20 h, conversion, 65 %).

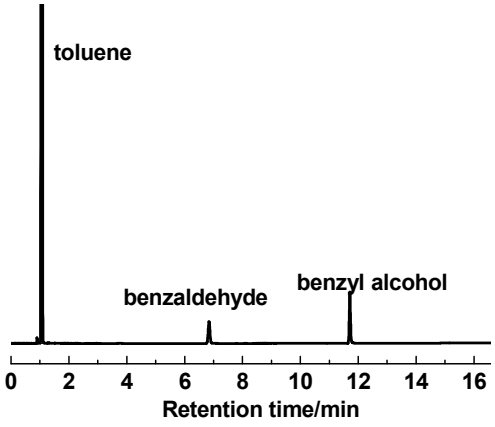

Figure S11. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) (110°C, 3 h, conversion, 37 %).

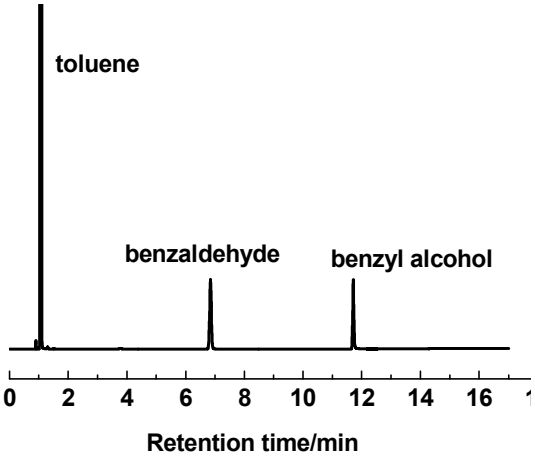

Figure S12. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) (110°C, 6 h, conversion, 58 %).

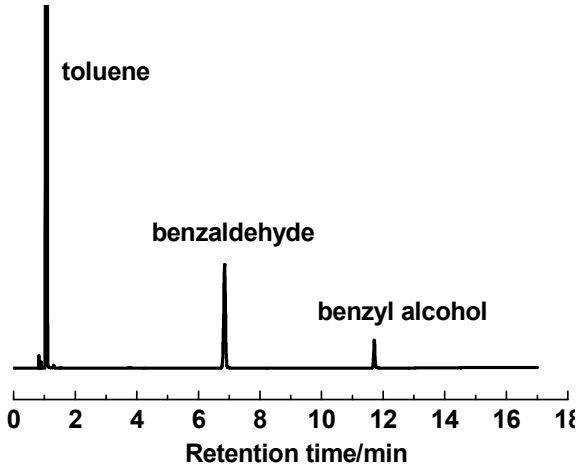

Figure S13. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) (110°C, 9 h, conversion, 82 %).

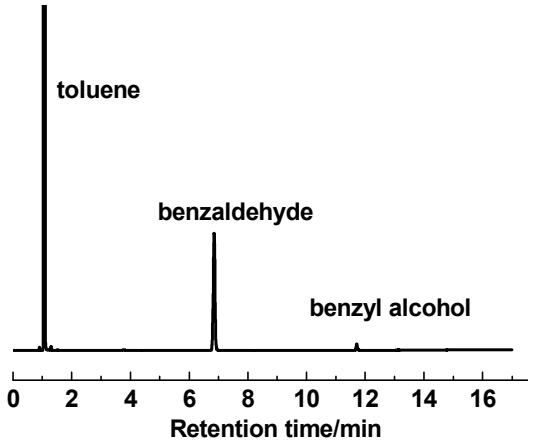

Figure S14. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) (110°C, 12 h, conversion, 96 %).

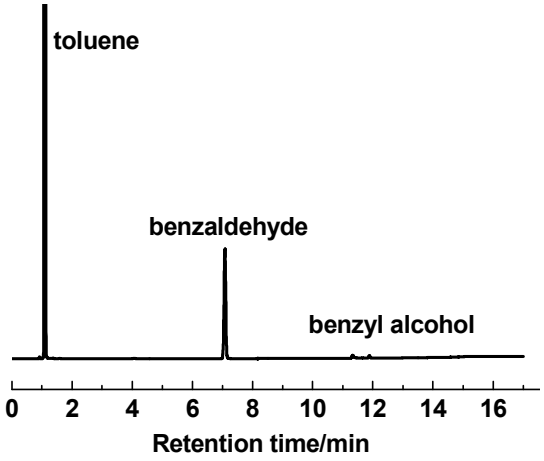

Figure S15. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) (110°C, 15 h, conversion, 98 %).

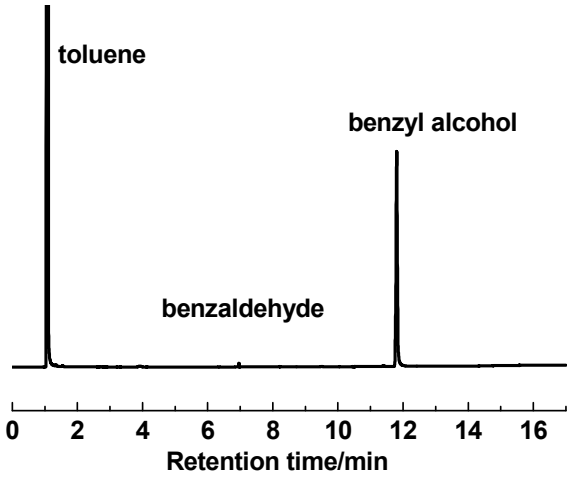

Figure S16. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Cu(II)-MOF (110°C, 15 h, conversion, 3 %).

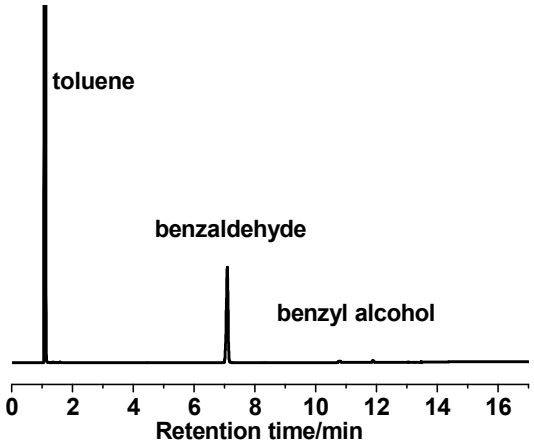

Figure S17. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (2 run, conversion, 98 %).

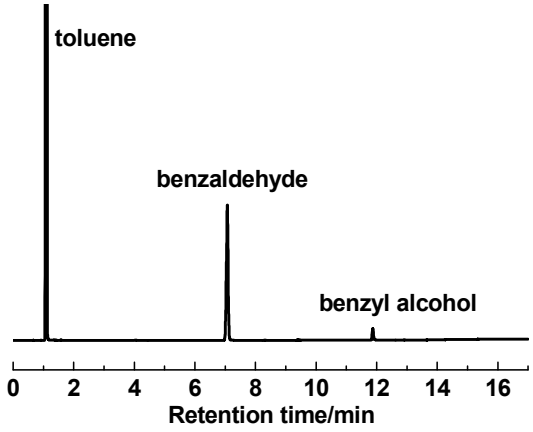

Figure S18. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (3 run, conversion, 94 %).

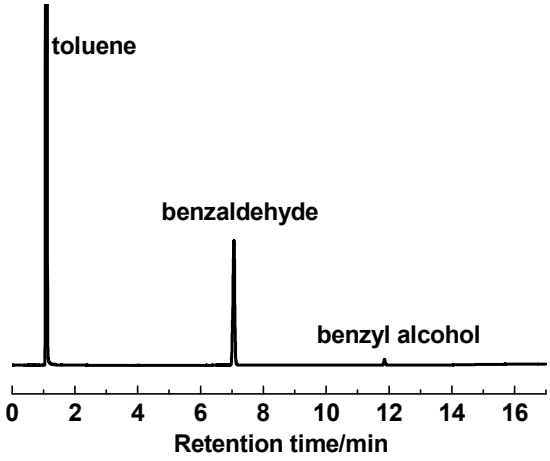

Figure S19. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (4 run, conversion, 96 %).

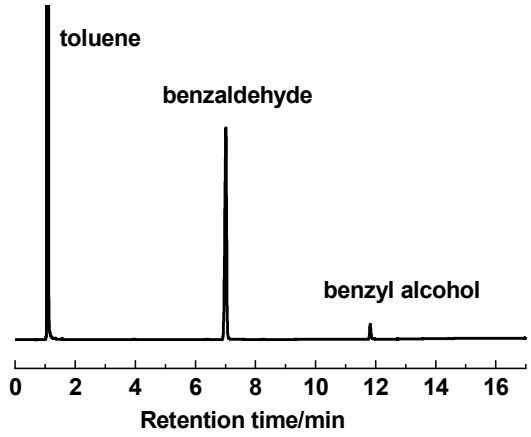

Figure S20. GC analysis: benzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (5 run, conversion, 94 %).

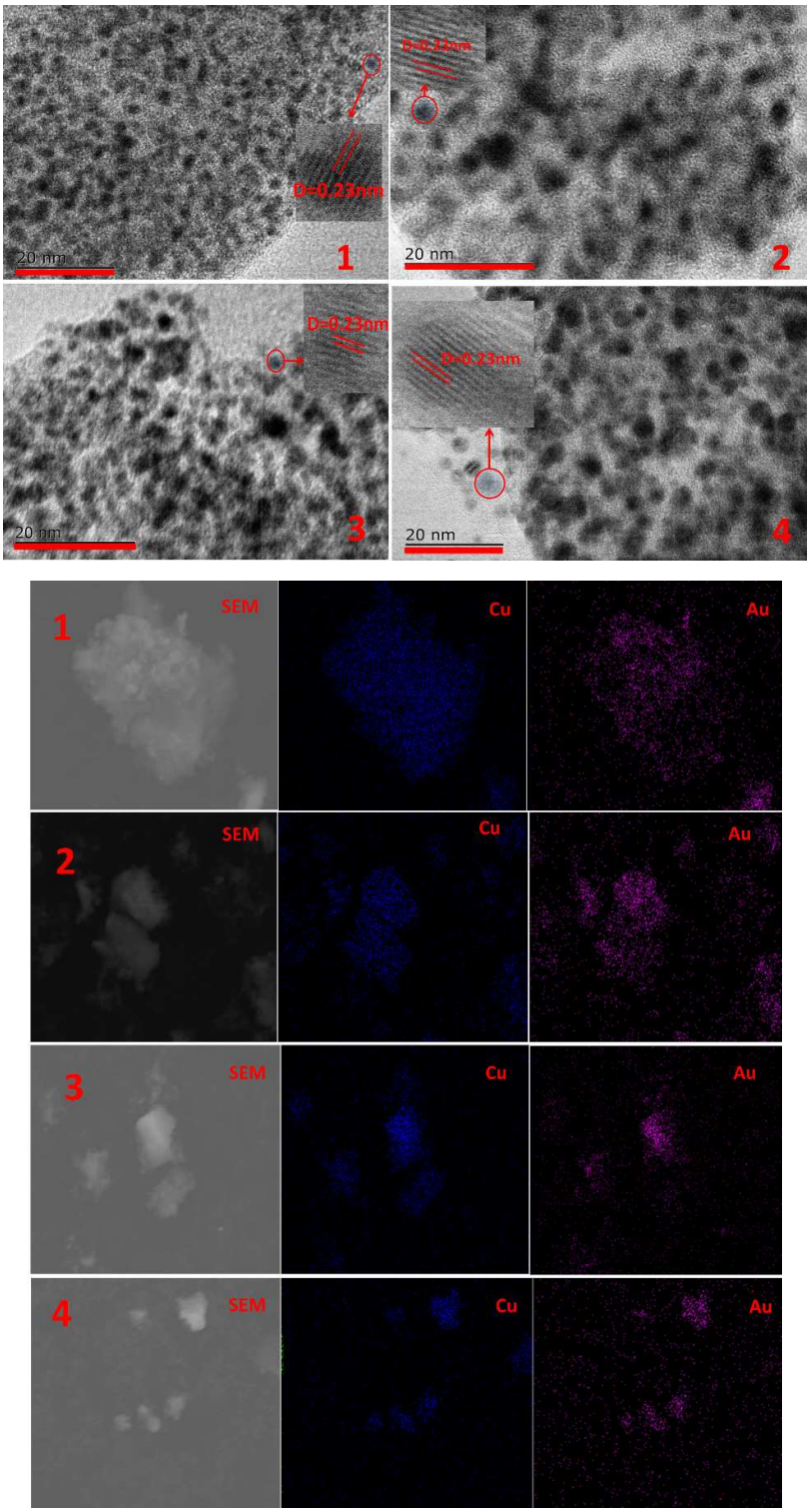

Figure S21. HRTEM and SEM-EDS measurement of Au@Cu(II)-MOF (**1**) after 1-4 runs.

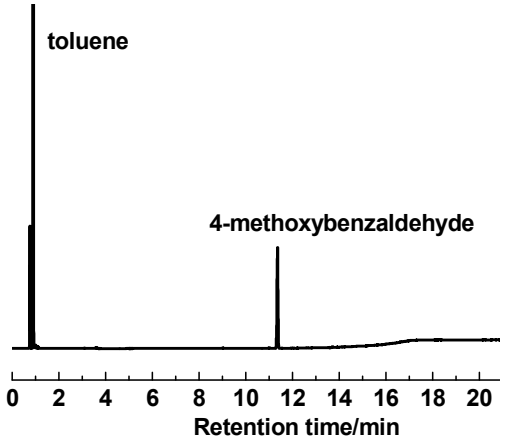

Figure S22. GC analysis: 4-methoxybenzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (conversion, 99 %).

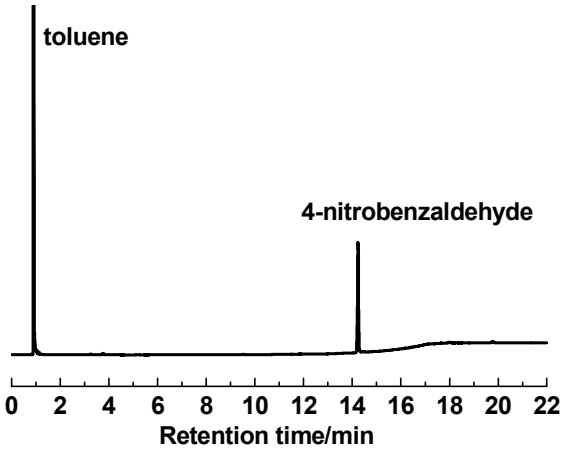

Figure S23. GC analysis: 4-nitrobenzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (conversion, 97 %).

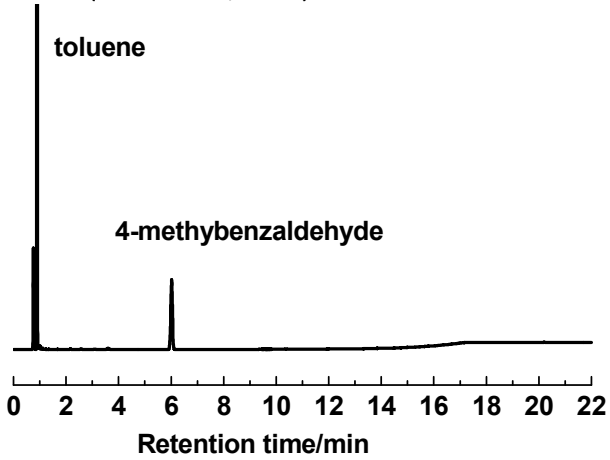

Figure S24. GC analysis: 4-methylbenzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (conversion, 99%).

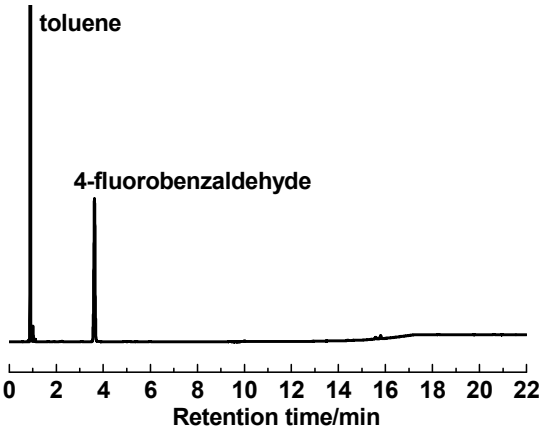

Figure S25. GC analysis: 4-fluorobenzeneacetaldehyde oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (conversion, 99 %).

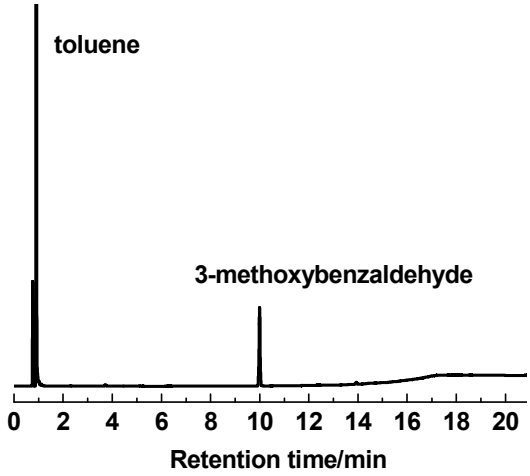

Figure S26. GC analysis: 3-methoxybenzenemethanol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 130°C (conversion, 99 %).

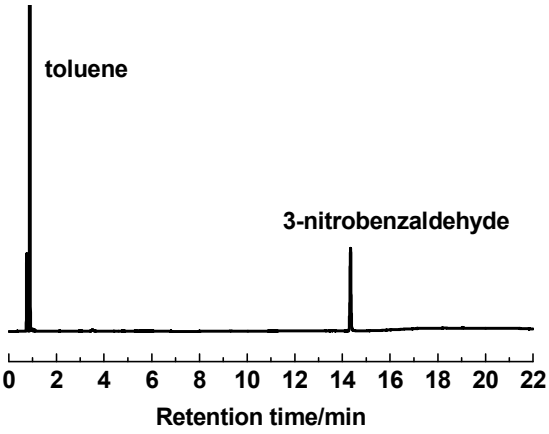

Figure S27. GC analysis: 3-nitrobenzyl alcohol oxidation in toluene catalyzed by Au@Cu(II)-MOF (**1**) at 110°C (conversion, 99 %).

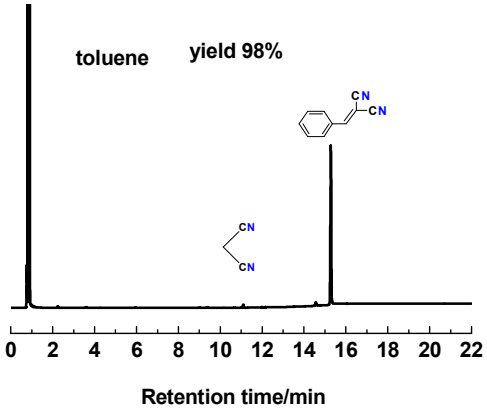

Fig. S28. The GC of the benzaldehyde and malononitrile in the presence of MeOH and toluene mixed solvent in the presence of Au@Cu(II)-MOF (**1**).

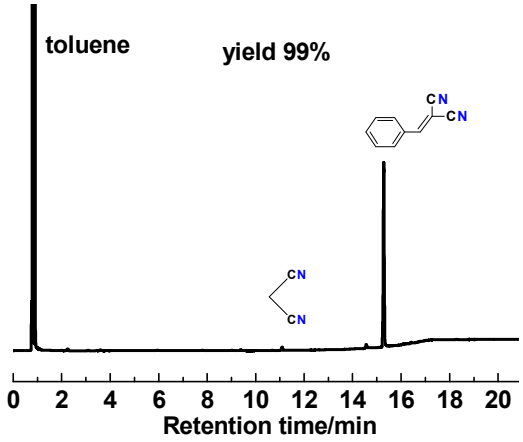

Figure S29. GC analysis: benzyl alcohol oxidation- knoevenagel by Au@Cu(II)-MOF (**1**) (1 run, conversion, 99 %).

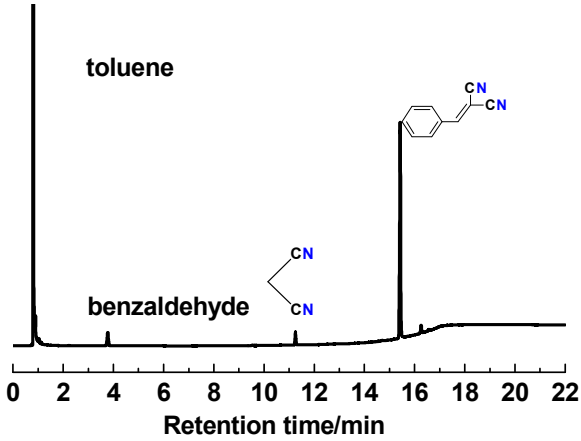

Figure S30. GC analysis: benzyl alcohol oxidation- knoevenagel by Au@Cu(II)-MOF (**1**) (2 run, conversion, 92 %).

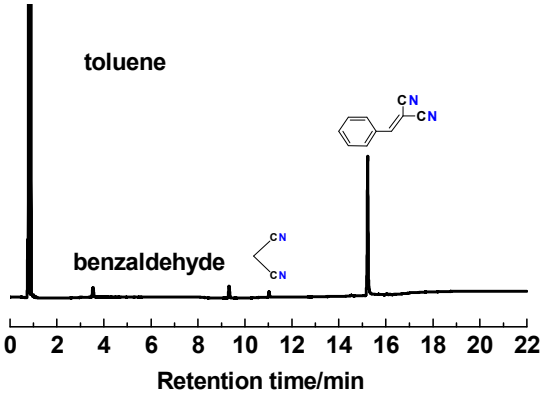

Figure S31. GC analysis: benzyl alcohol oxidation- knoevenagel by Au@Cu(II)-MOF (**1**) (3 run, conversion, 92 %).

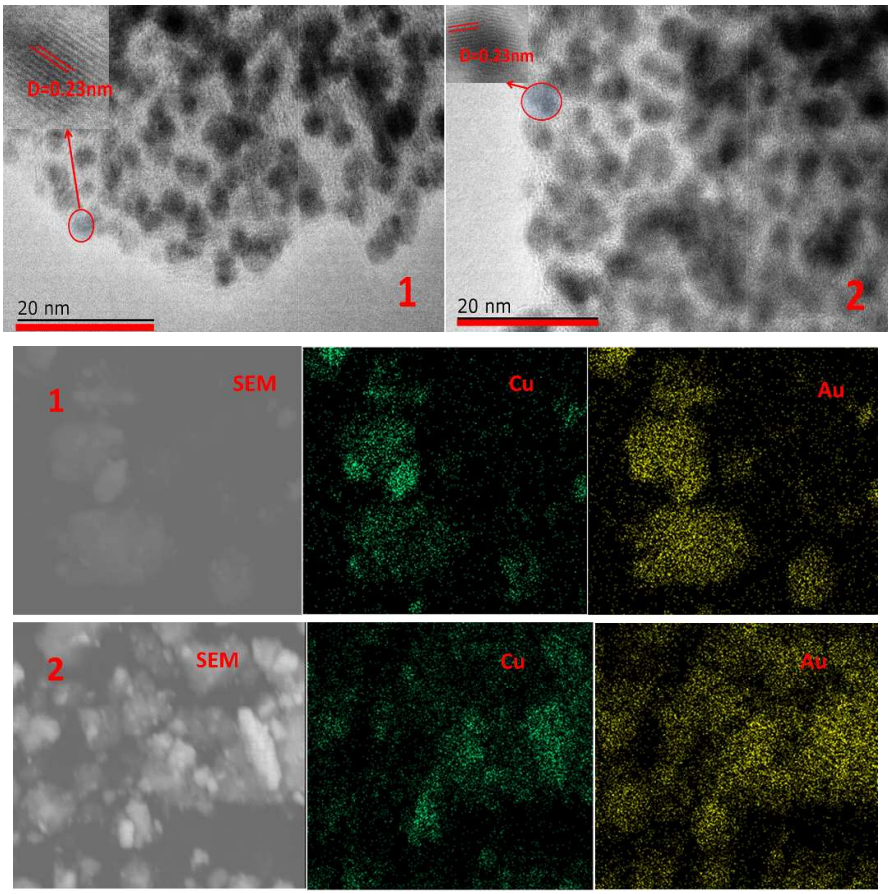

Figure S32. HRTEM and SEM-EDS measurement of Au@Cu(II)-MOF (**1**) after 2 runs of benzyl alcohol oxidation-knoevenagel reaction.

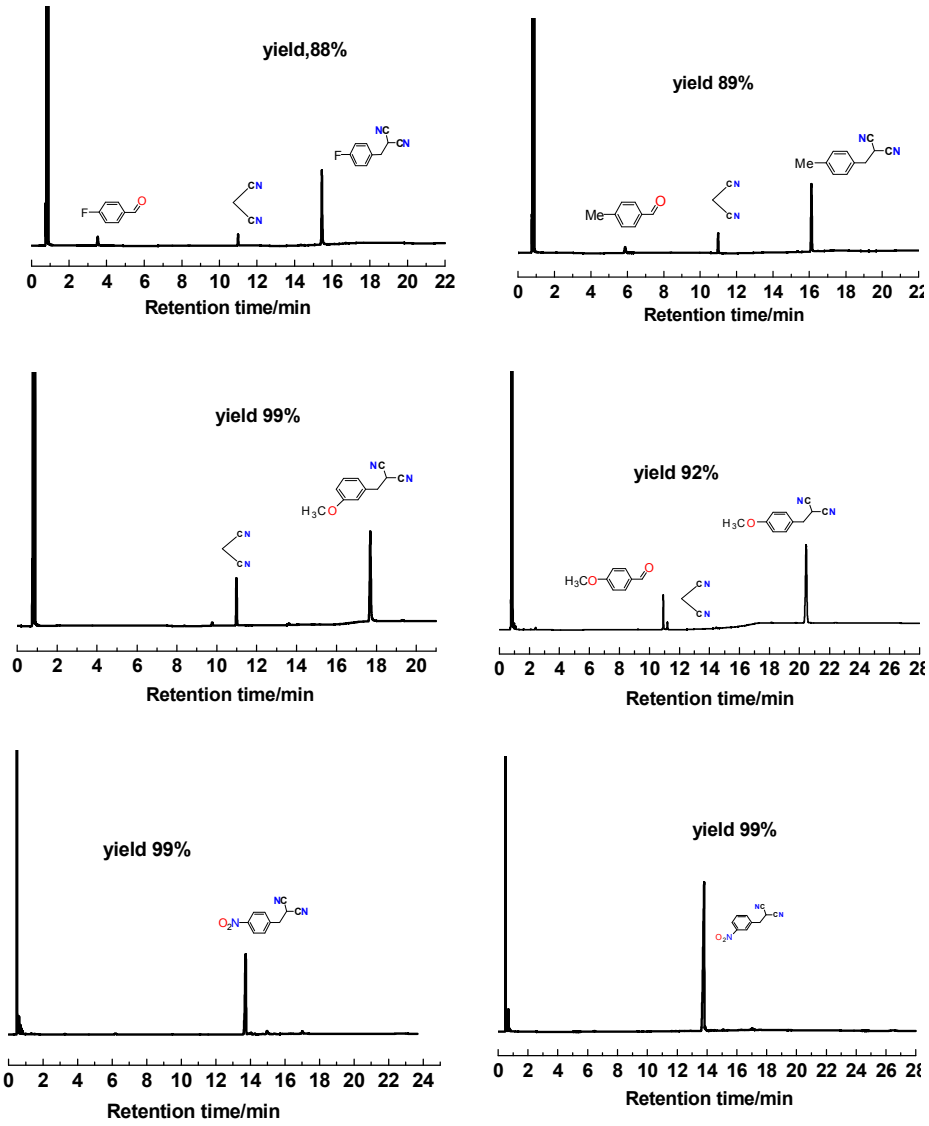

Figure S33. GC of oxidation-Knoevenagel reaction of the substituted benzaldehydes catalyzed by Au@Cu(II)-MOF (**1**).