Electronic Supplementary Information (ESI)

CuO nanoclusters coated with mesoporous SiO_2 as highly active and stable catalyst for olefin epoxidation

Chaoqiu Chen,[ab] Jin Qu,[ab] Changyan Cao,[c] Fang Niu[ab] and Weiguo Song*[a]

[a]Beijing National Laboratory for Molecular Sciences (BNLMS), Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, P. R. China. Tel & Fax: (+86)10-62557908, E-mail: wsong@iccas.ac.cn

[b]Also in the Graduate School of Chinese Academy of Sciences, Beijing 100049, P. R. China

[c]Also in the School of Materials Science and Engineering, Harbin Institute of Technology, Harbin, 150001, P. R. China

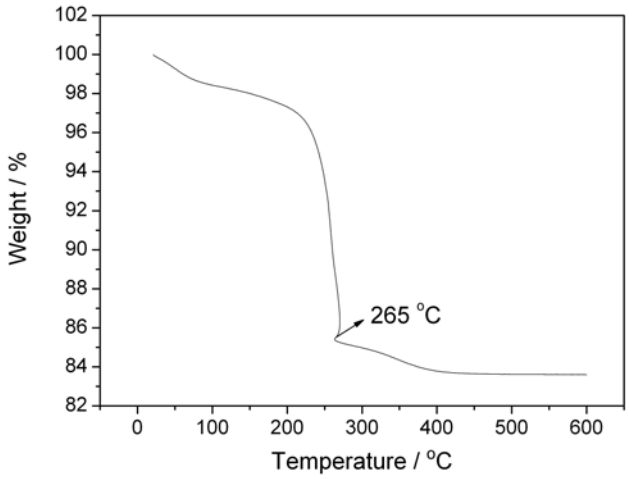


Fig. S1 TG profile of CuO CNCs. The TG plot shows three major weight loss regimes, the two areas before 250 °C can be mainly assigned to the loss of adsorbed and hydrated water in the CuO CNCs. The final one starting around 265 °C is corresponded to the degradation of PVP, resulting in 1.8% weight loss.[1]

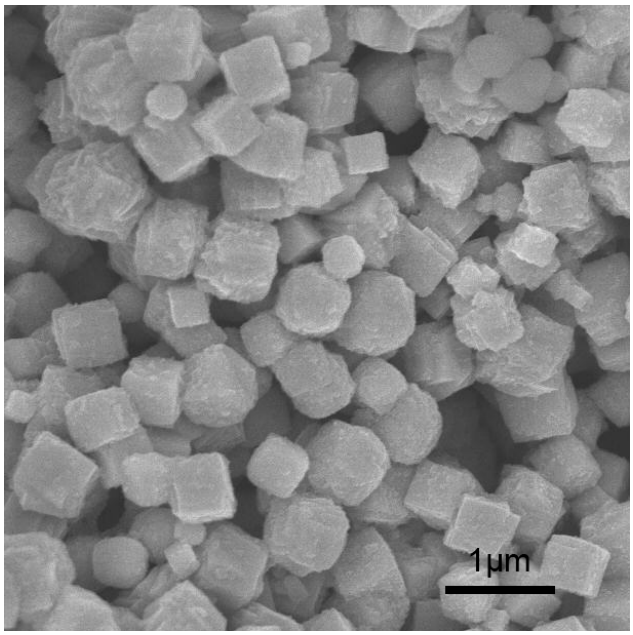


Fig. S2 SEM image of sample obtained at the same reaction conditions without the addition of surfactant PVP.

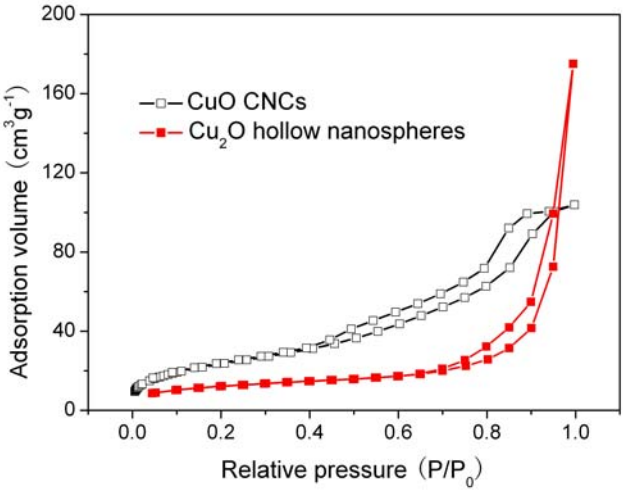


Fig. S3 N_2 adsorption-desorption isotherms of the CuO CNCs and Cu_2O hollow nanospheres.

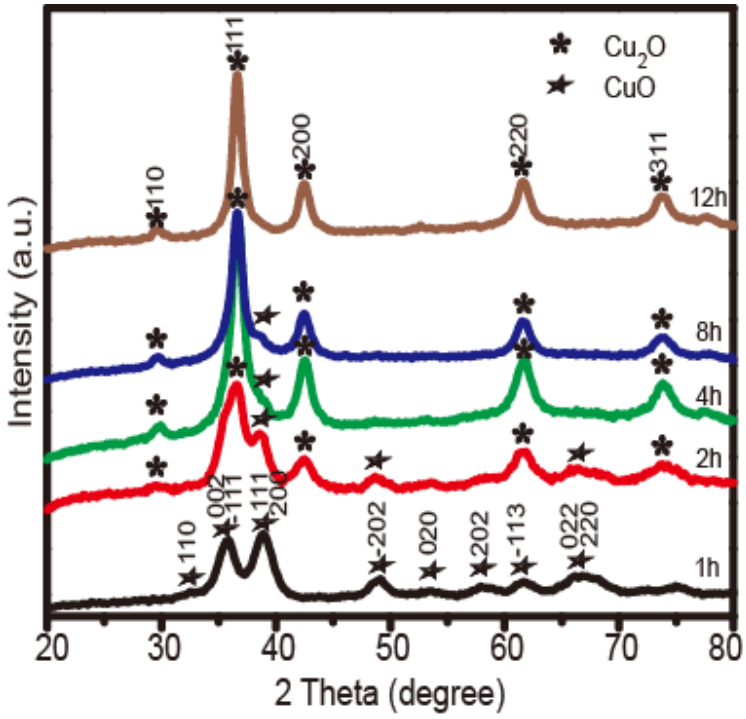


Fig. S4 X-ray diffraction patterns of samples obtained with different reaction times.

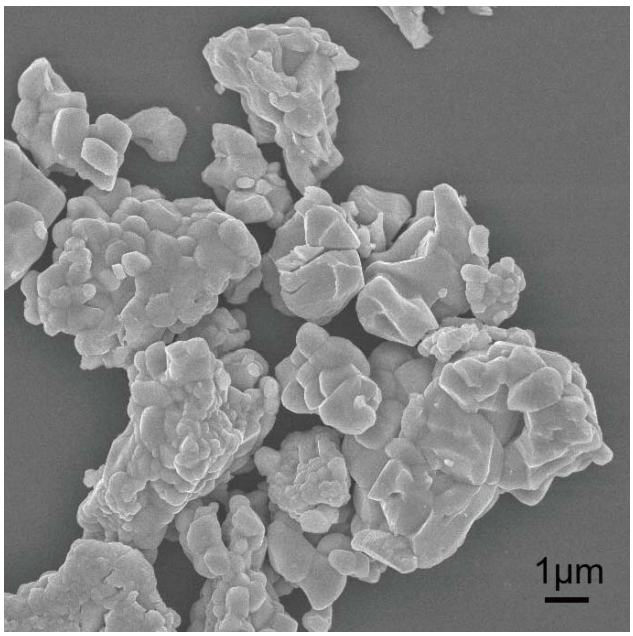


Fig. S5 SEM image of commercial available CuO.

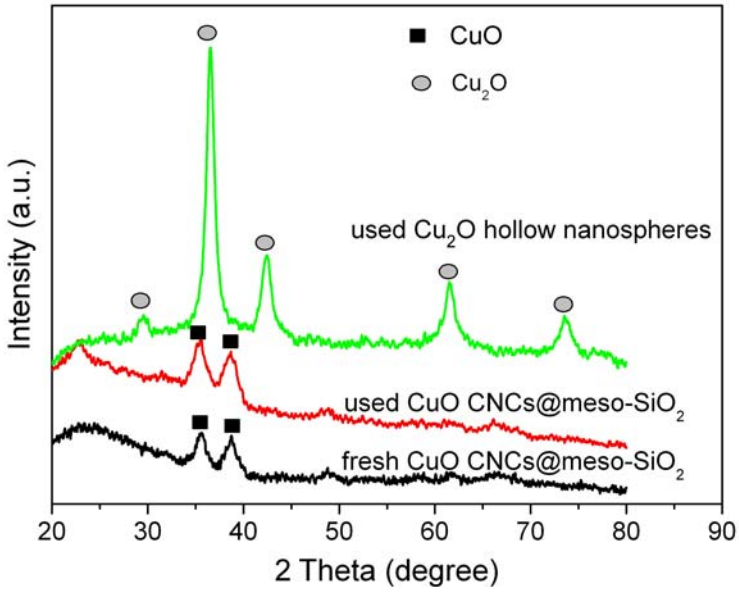


Fig. S6 X-ray diffraction patterns of fresh, used CuO CNCs@meso-SiO_2 nanocomposite and used Cu_2O hollow nanospheres.

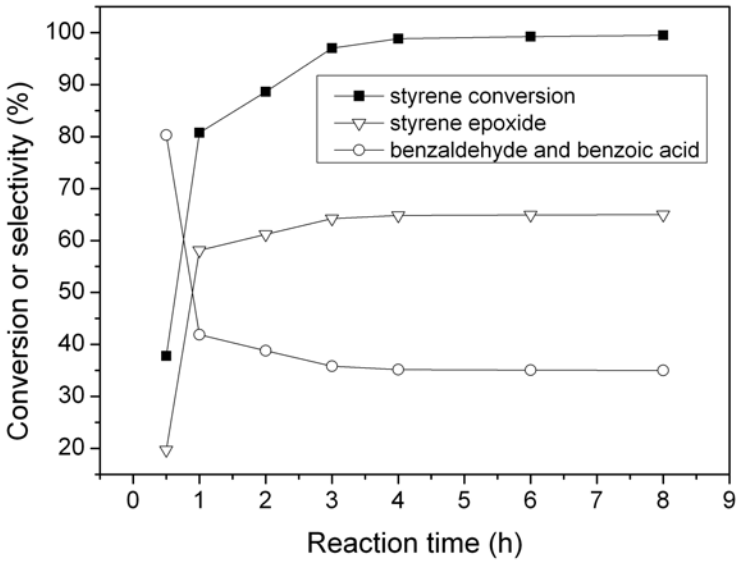


Fig. S7 The styrene epoxidation over CuO CNCs@meso-SiO_2 nanocomposite as a function of reaction time. Conditions: 1 mmol styrene, 5 mmol TBHP, 10 mg catalyst, stirred in 10 mL of actonitrile under reflux (70^{o}C).

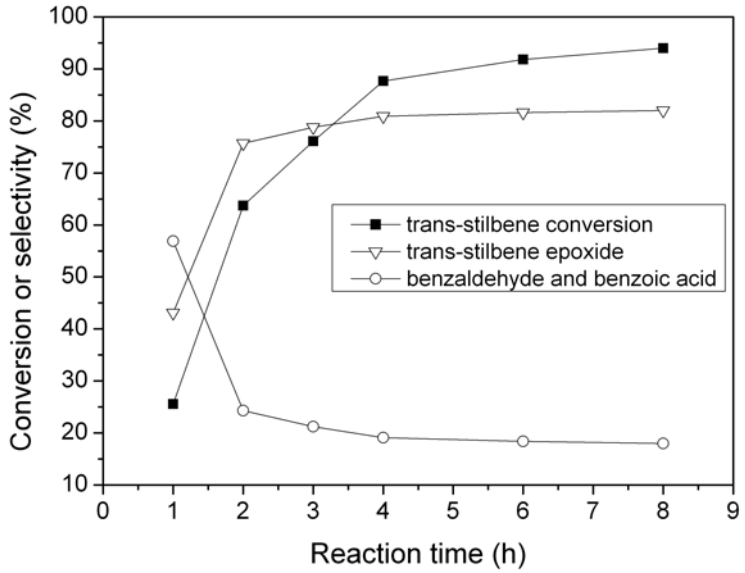
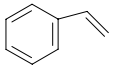
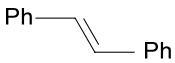


Fig. S8 The trans-stilbene epoxidation over CuO CNCs@meso-SiO_2 nanocomposite as a function of reaction time. Conditions: 1 mmol trans-stilbene, 5 mmol TBHP, 10 mg catalyst, stirred in 10 mL of actonitrile under reflux (70^{o}C).

Table S1 Influence of reaction temperature on alkene epoxide selectivities over CuO CNCs@meso-SiO_2 nanocomposite*

Temperature, ^{o}C						
	Time, h	Conversion, %	Selectivity of alkene epoxide, %	Time, h	Conversion, %	Selectivity of alkene epoxide, %
60	2	51.1	28.9	4	45.2	58.6
70	2	88.6	61.2	4	87.7	80.9
80	2	98.2	56.1	4	93.4	78.3

*1 mmol alkene, 5 mmol TBHP, and 10 mg catalyst, stirred in 10 mL of acetonitrile under given reaction temperature

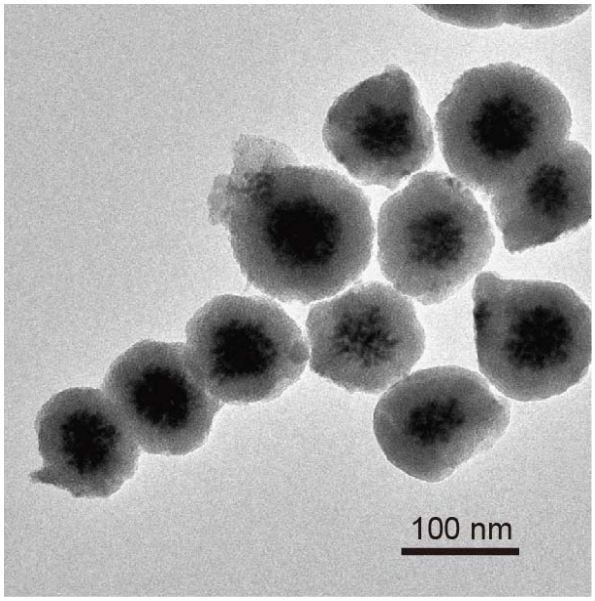


Fig. S9 TEM image of CuO CNCs@meso-SiO_2 nanocomposite stirred uninterruptedly in the same reaction mixture for 720 h.

References:

1. Azhari, S.; Diab, M. *Polymer Degradation and Stability* **1998**, *60*, 253-256.