Synthesis of Fe_3O_4-CuO@meso-SiO_2 Nanostructure as a Magnetically Recyclable and Efficient Catalyst for Styrene Epoxidation

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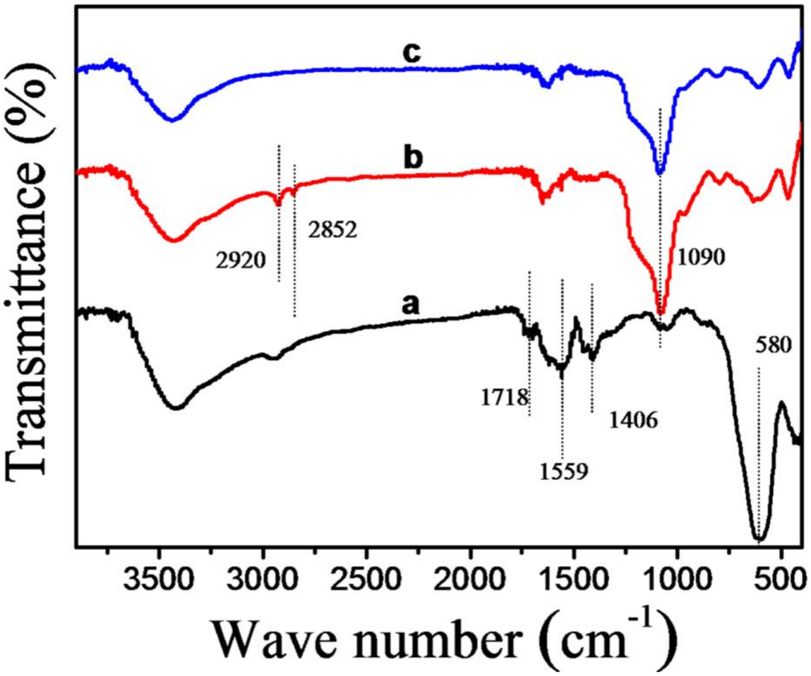

Fig. S1 FT-IR spectra of (a) Fe_3O_4(PAA), (b) Fe_3O_4-CuO@meso-SiO_2(CTAB) without the treatment of acetone and (c) Fe_3O_4-CuO@meso-SiO_2 after the treatment of acetone.

The existence of PAA (curve a) was confirmed by the C-O bond at 1406 cm^{-1}, C=C bond at 1559 cm^{-1} and C=O bond at 1718 cm^{-1} from carboxyl groups.[1] For Fe_3O_4-CuO@meso-SiO_2 with CTAB (curve b), the bonds at around 2852 cm^{-1} and 2920 cm^{-1} correspond to the vibrations of -CH_2 from CTAB. The disappearance of the two peaks at 2852 cm^{-1} and 2920 cm^{-1} (curve c) after the extraction treatment with acetone, indicate the complete removal of the CTAB template.[2]

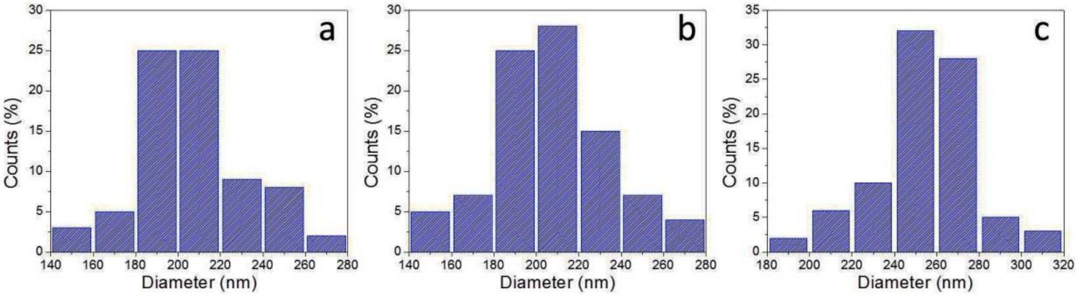

Fig. S2 The particle size distributions of (a) Fe_3O_4, (b) Fe_3O_4-CuO and (c) Fe_3O_4-CuO@meso-SiO_2.

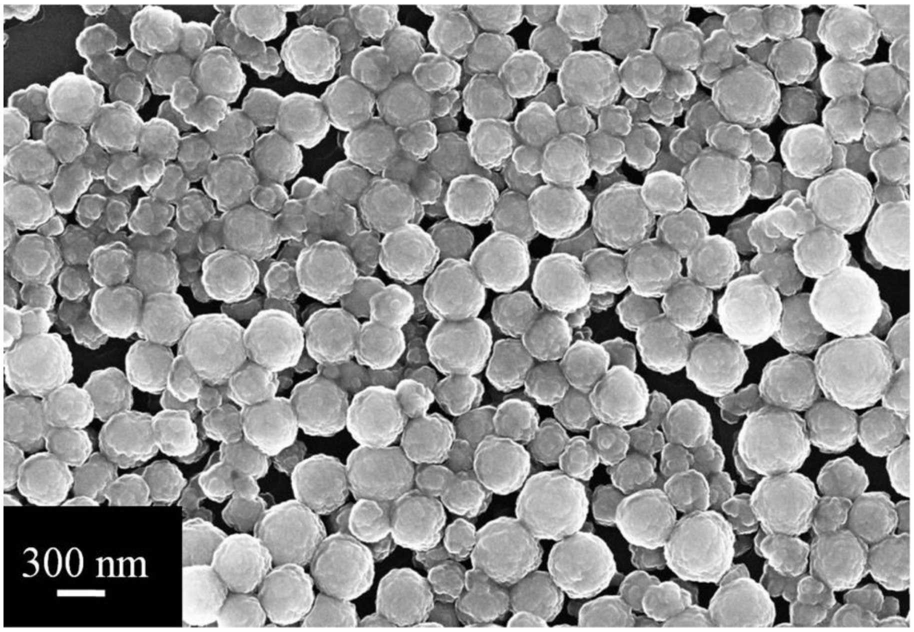

Fig. S3 SEM photograph of the as-synthesized CuO nanoparticles.

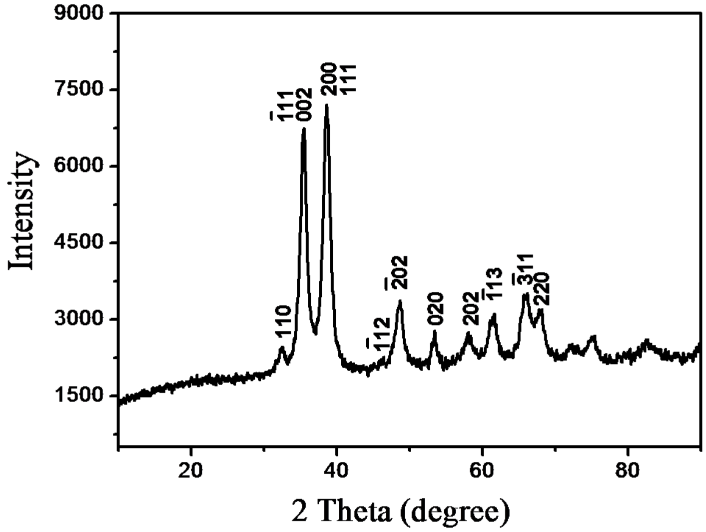

Fig. S4 X-ray diffraction patterns of the as-synthesized CuO nanoparticles.

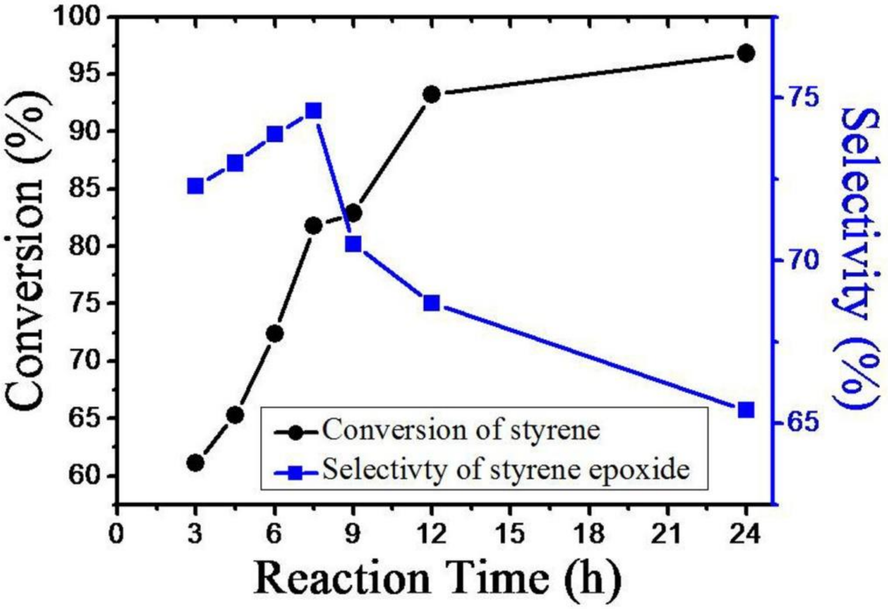

Fig. S5. Conversion of styrene and selectivity of styrene epoxide versus reaction time catalyzed by as-prepared CuO nanoparticles.

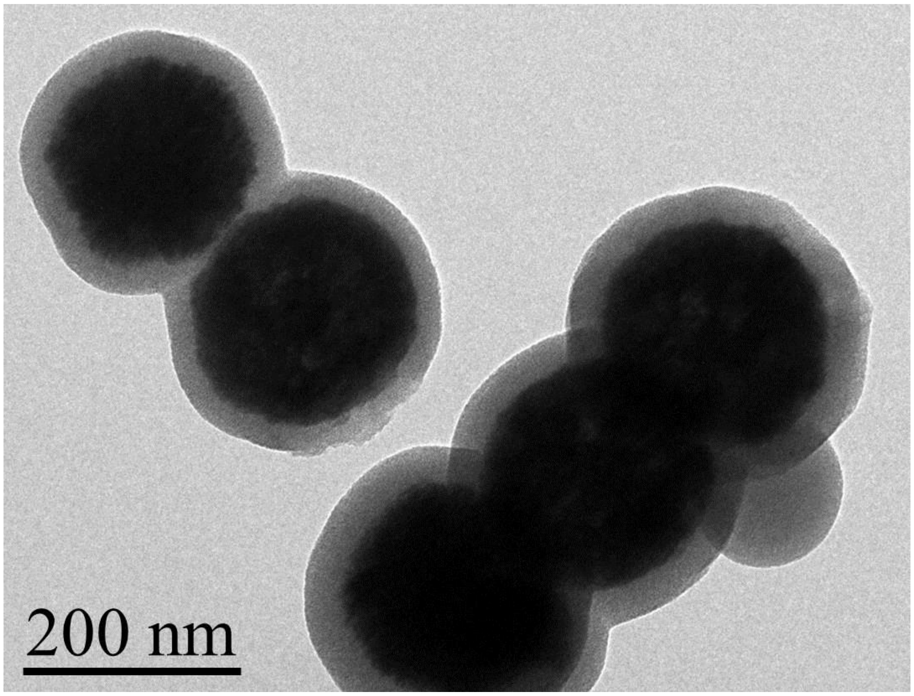

Fig. S6 HRTEM photograph of the Fe_3O_4-CuO@meso-SiO_2 catalyst after eight runs of styrene epoxidation.

References:

1. X. L. Huang, J. Zhuang, D. Chen, H. Y. Liu, F. Q. Tang, X. Y. Yan, X. W. Meng, L. Zhang and J. Ren, *Langmuir*, 2009, **25**, 11657.
2. Y. H. Deng, D. W. Qi, C. H. Deng, X. M. Zhang and D. Y. Zhao, *J. Am. Chem. Soc.*, 2008, **130**, 28.