Electronic Supplementary Information (ESI)

Highly efficient reusable catalyst based on silicon nanowire arrays decorated with copper nanoparticles

Xiaoling Yang, Hua Zhong, Yihua Zhu,* Hongliang Jiang, Jianhua Shen, Jianfei huang and Chunzhong Li

Key Laboratory for Ultrafine Materials of Ministry of Education, School of Materials Science and Engineering, East China University of Science and Technology, Shanghai 200237, China

*Corresponding author: Tel.: +86-21-64252022, Fax: +86-21-64250624

E-mail address: yhzhu@ecust.edu.cn (Y. Zhu)

Characterization of SiNWAs-Cu

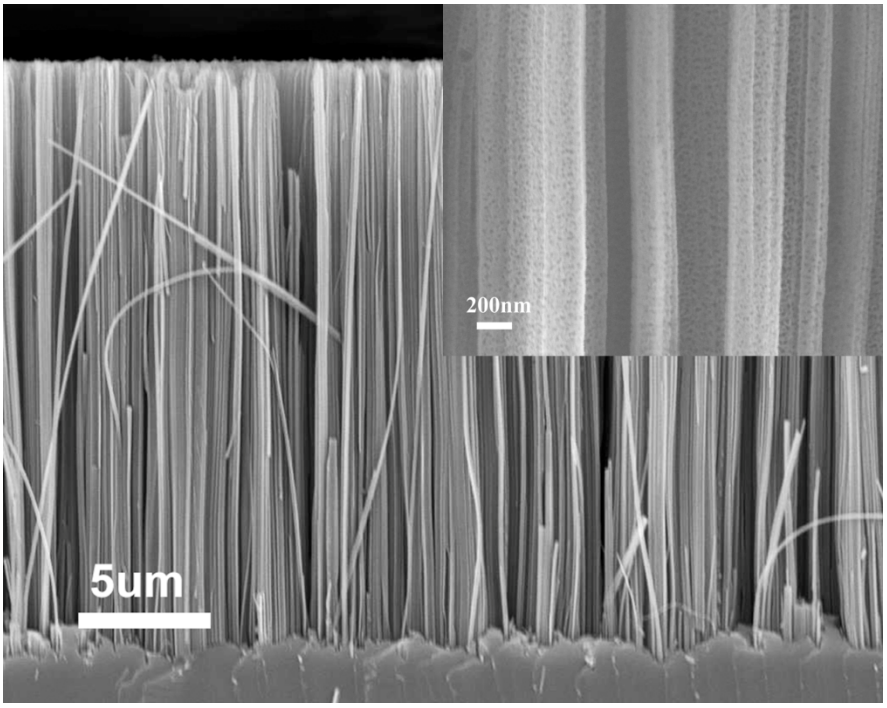

Figure S1. The cross section view SEM images of SiNWAs.

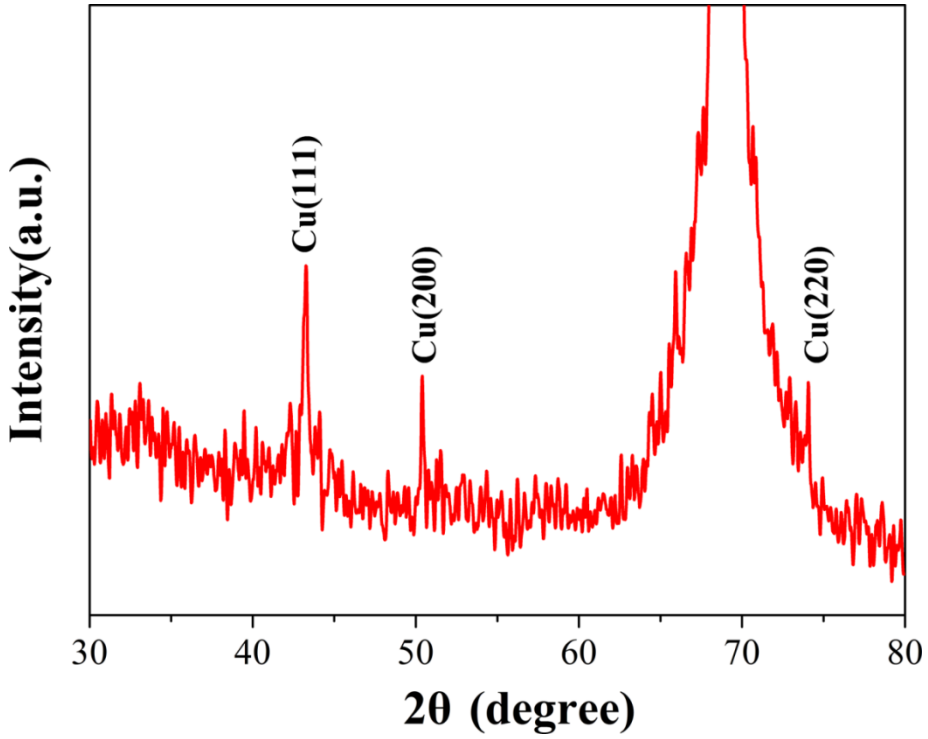

Figure S2. XRD pattern of SiNWAs-Cu obtained by immersing into 0.01 M $Cu(NO_3)_2$ aqueous solution.

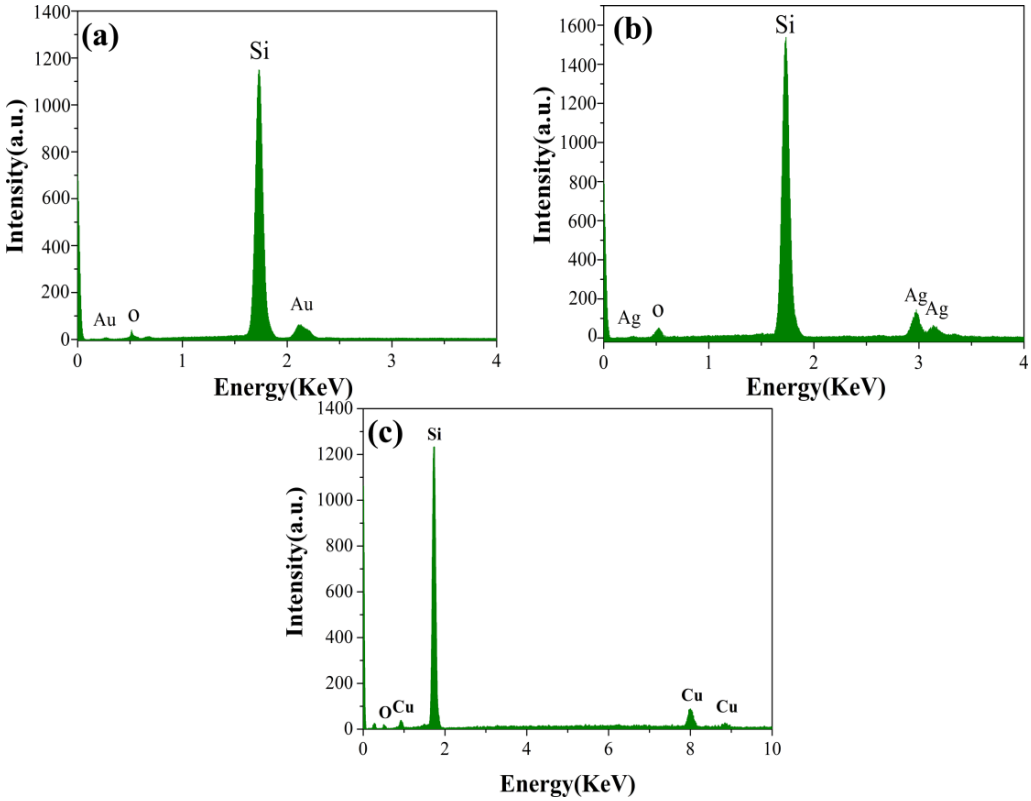

Figure S3. The EDX patterns of SiNWAs-Au (a), SiNWAs-Ag (b), and SiNWAs-Cu (c).

Catalytic activity measurement

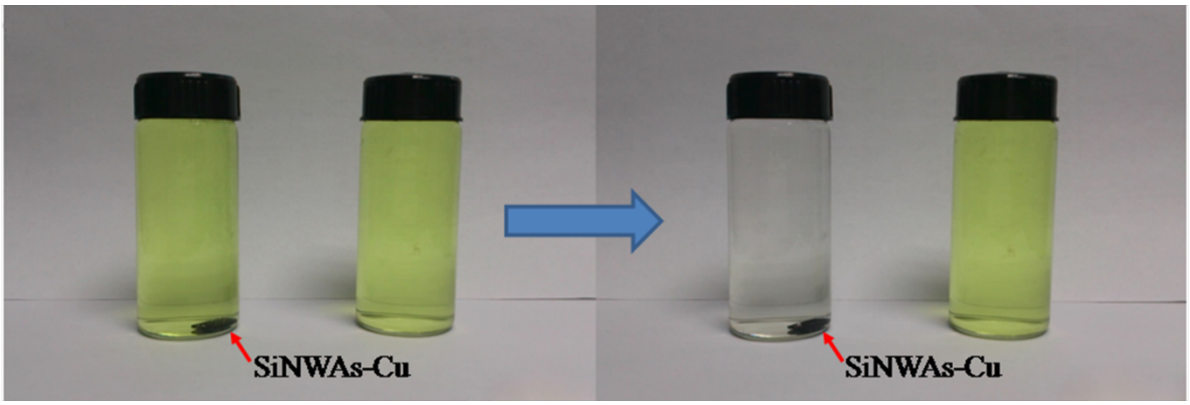

Figure S4. Photographs of the SiNWAs-Cu catalyst used in the catalytic reaction.

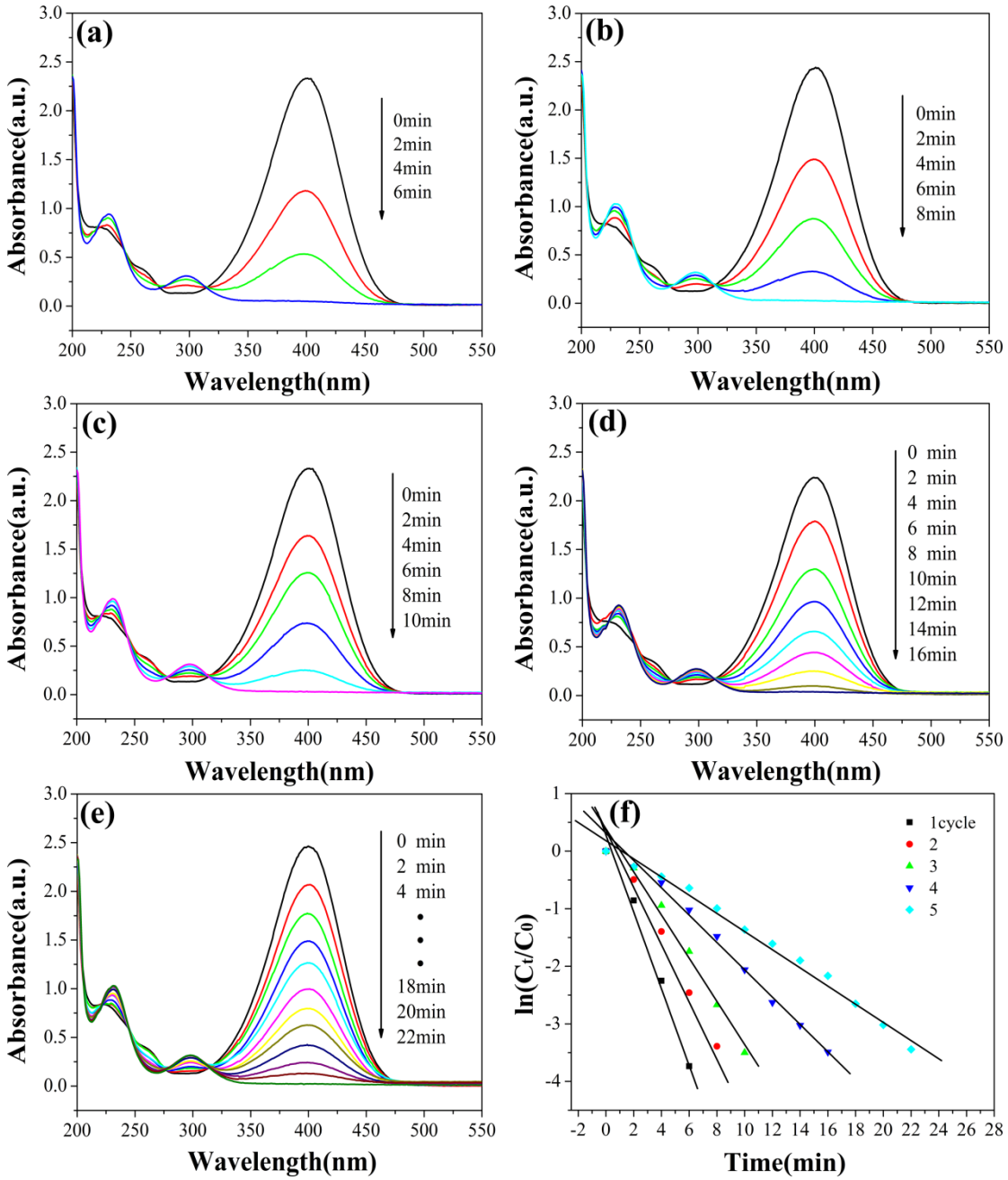

Figure S5. Time-dependent UV-visible absorption spectra for (a) 1st, (b) 2nd, (c) 3rd, (d) 4th and (e) 5th cycles of the catalytic reduction of 4-NP with the same S-2 catalyst. (f) Plots of $\ln(C_t/C_0)$ against reaction time for five successive cycle reactions with the S-2 catalyst.

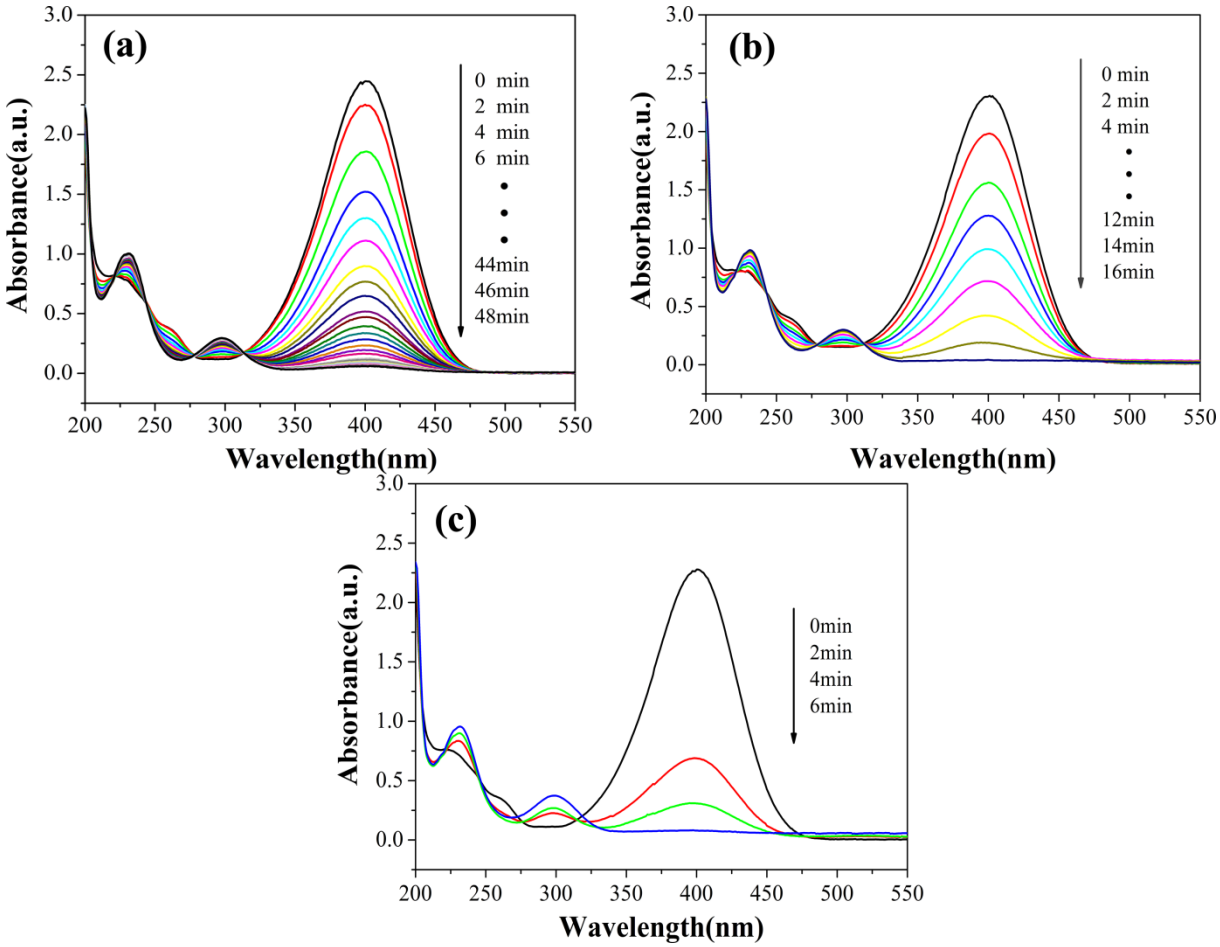

Figure S6. Time-dependent UV-visible absorption spectra for the catalytic reduction of 4-NP with the (a) Si-Cu, (b) SiNWAs-Ag and (c) SiNWAs-Au catalysts.

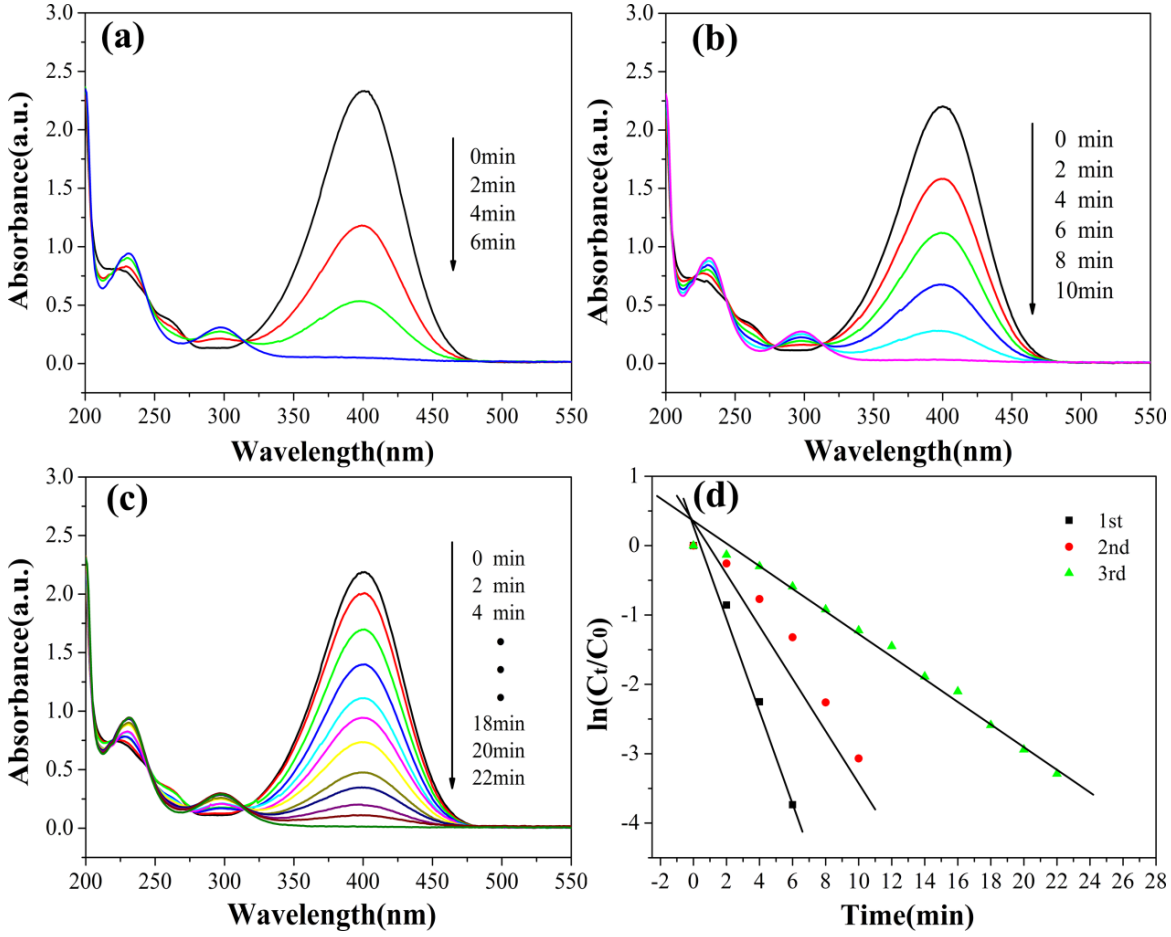

Figure S7. Time-dependent UV-visible absorption spectra for the catalytic reduction of 4-NP with the SiNWAs have be (a) 1st, (b) 2nd and (c) 3rd modified with Cu NPs. (b) Plots of ln(C_t/C_0) against reaction time for the catalytic reduction of 4-NP with above three different catalyst.

Calculation of turnover frequency (TOF) for catalysts:

An the turnover frequency (TOF) was used to evaluate the catalytic activity of the as-prepared composite catalysts, which is defined as the number of moles of reduced 4-NP per mole of surface Cu atoms per hour at when the conversion has reached 95%, was calculated.[1, 2] Although only a small portion of surface Cu atoms can actually serve as catalytic active sites-many will be bonded to capping ligands and unavailable for catalysis, in practice, it is common to take the total number of surface atoms as the number of active catalytic sites when the value is not known.[3]

Hence, the reduction of 4-NP to 4-AP by $NaBH_4$,for SiNWAs-Cu nanocomposites as the catalysts, using 1.0 × 10^{-4} M concentration of 4-NP and 0.0011g S-2 catalyst dose(

the SiNWs-Cu were collected by scratching the bulk silicon substrates using a blade, the contents of Cu NPs on the S-2 catalyst are about 17 wt.%, investigated by ICP-OES), the molar ratio: Cu/4-NP/$NaBH_4$ = 1/22/1210, was performed in this study. TOF was calculated for each of the catalysts carried out at 25°C, TOF = 220 h^{-1} for the Cu NPs.

References

1. M. H. Wang, J. W. Fu, D. D. Huang, C. Zhang and Q. Xu, *Nanoscale*, 2013, **5**, 7913.
2. B. C. Liu, S. L. Yu, Q. Wang, W. T. Hu, P. Jing, Y. Liu, W. J. Jia, Y. X. Liu, L. X. Liu and J. Zhang, *Chem. Commun.*, 2013, **49**, 3757.
3. P. H. Zhang, Y. M. Sui, G. J. Xiao, Y. N. Wang, C. Z. Wang, B. B. Liu, G. T. Zou and B. Zou, *J. Mater. Chem. A*, 2013, **1**, 1632.