Electronic Supplementary Information

Arsenate Stabilized Cu_2O Nanoparticle Catalyst for One-Electron Transfer Reversible Reaction

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Characterization of As(0): From the FESEM, TEM and UV-vis spectra (Figure S1a,b,c) we did not get clear idea about the oxidation state of arsenic in the yellowish brown solution. Not much information regarding As(0) has been reported in literature. According to the literature report As(0) shows its charteristic XPS peak at 40.7 eV and that of our synthesized amorphous yellowish brown solution shows a peak at 40.3 eV(Figure S1d).[1-3] As the material is amorphous in nature we did not get any conclusive information from the XRD data of the drop casted spots. But upon annealing the sample on a glass slide at 400°C for 2 h the peaks corresponding to As(0), As_2O_5 and SiO_2 have been observed [Figure S1e, inst contains the image of the annealed As(0)]. This is because of the acquired crystaline character of As(0) due to annealing and in turn some As(0) is oxidized to As_2O_5.

Thus from the above discussion it is clear that as-synthesized yellowish brown solution contains As(0) nanoparticles in dispersion.

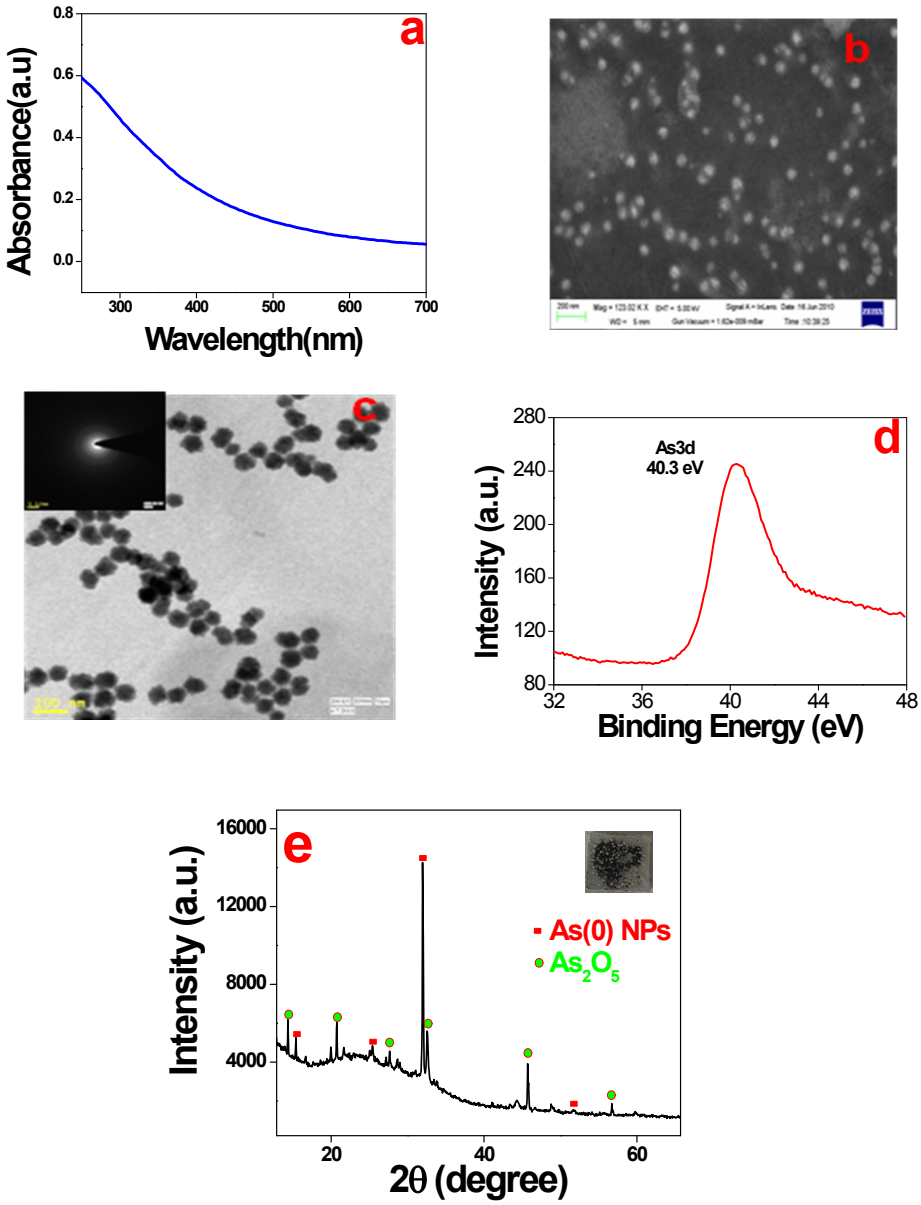

Figure S1: (a) UV-vis spectrum (b) FESEM (c) TEM [inset SAED] (d) XPS and (e) XRD [inset digital image of the annealed As(0)] of as-synthesized As(0) NPs

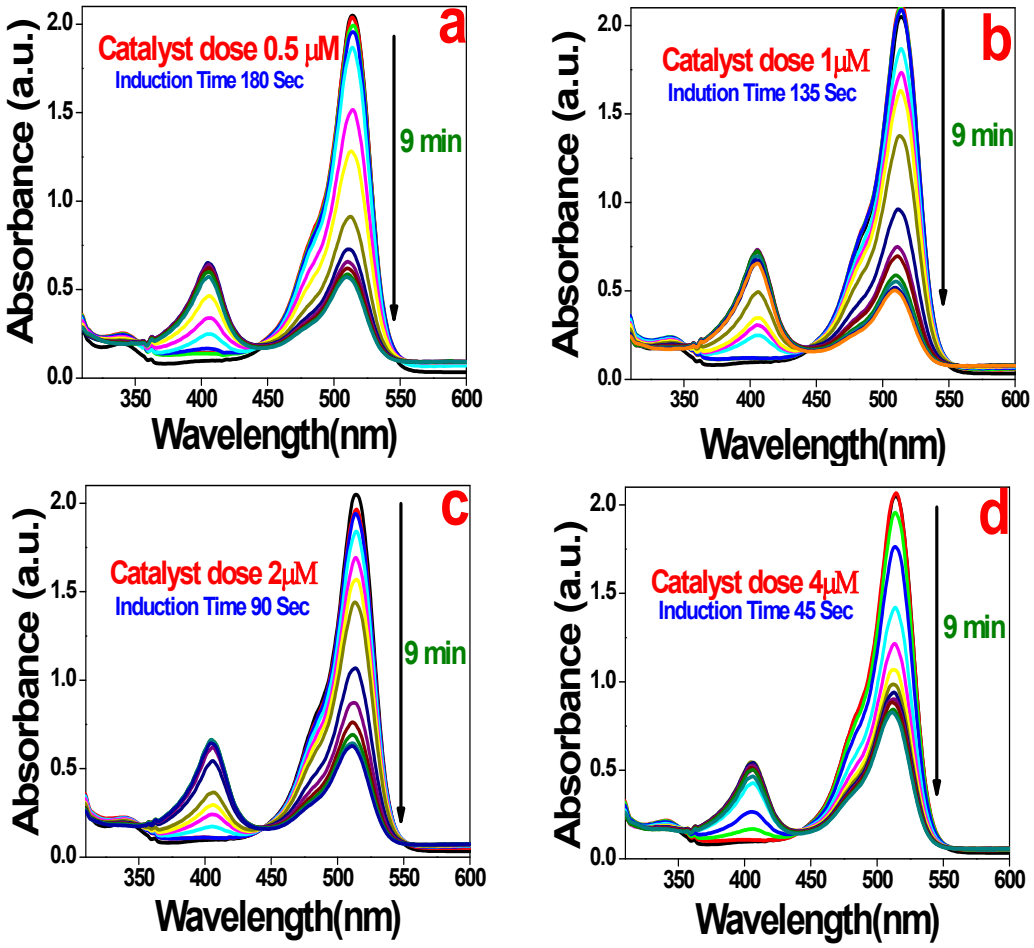

Figure S2: Accounts of reduction of Eosin Y by $NaBH_4$ with different doses of catalyst using UV-visible spectra

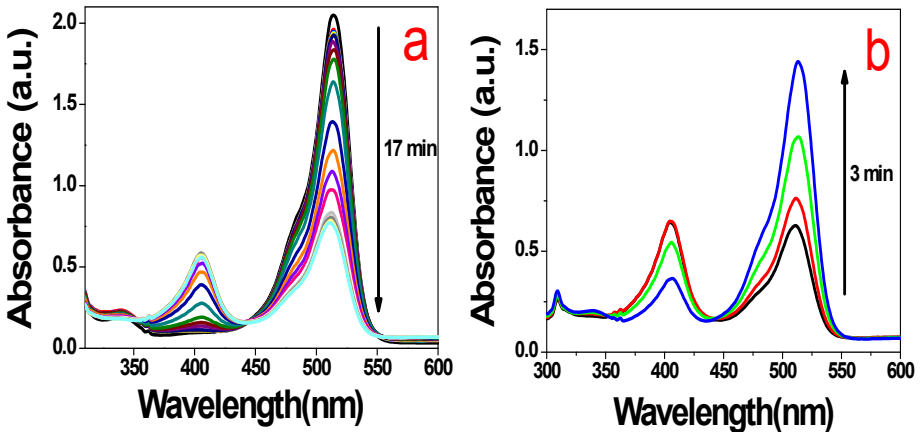

Figure S3: UV-visible spectra of (a) reduction of Eosin Y by $NaBH_4$ by already reported Cu_2O nanoparticle, (b) oxidation of Eosin Y by dissolved oxygen.

References:

1. Mauricio A. V. Ramos, Weile Yan, Xiao-qin Li, Bruce E. Koel, and Wei-xian Zhang, *J. Phys. Chem. C,*2009, **113(33)**, 14591.

2. J. F. Moulder, W. F. Stickle, P. E. Sobol and K. D. Bomben, *Handbook of X-ray Photoelectron Spectroscopy; Perkin-Elmer Corporation: Eden Prairie, MN,* 1992.

3. A. Pal, S. Saha, S. K. Maji, M. Kundu and A. Kundu, *Adv. Mat. Lett*. 2012, **3**, 177.