Electronic Supplementary Information (ESI)

Porous ZnO and ZnO-NiO composite nano/microspheres: synthesis, catalytic and biosensor properties

Ji-Min Yang,[ab] Wei Zhang,[b] Qing Liu[a] and Wei-Yin Sun*[a]

[a] *Coordination Chemistry Institute, State Key Laboratory of Coordination Chemistry, School of Chemistry and Chemical Engineering, Nanjing National Laboratory of Microstructures, Nanjing University, Nanjing 210093, China. E-mail: sunwy@nju.edu.cn; Fax: +86 25 83314502*

[b] *School of Chemistry & Chemical Engineering, Linyi University, Linyi 276005, China*

Apparatus and materials

The CILE was prepared by hand-mixing of ionic liquid $BMIMPF_6$ with graphite powder at a ratio of 1/4 (w/w) in an agate mortar. The homogeneous paste was packed firmly into one end of a glass tube with the diameter of 4 mm. The electrical contact was provided by inserting a copper wire to the paste in the inner hole of the tube. Prior to modification, the surface of the electrode was smoothed with a weighting paper. 10 μL of 1.0 mg mL^{-1} nano-ZnO suspension was coated on the CILE and allowed to dry at room temperature, thus a uniform membrane modified electrode (ZnO/CILE) was obtained.

The 18-base oligonucleotides probe (ssDNA), its complementary DNA (cDNA, target DNA, namely an 18-base fragment of PML/RARA fusion gene sequence), single-base mismatched DNA, double-base mismatched DNA and noncomplementary DNA (ncDNA) were obtained from Shanghai Sangon Bioengineering Limited Company (Shanghai, China). Their base sequences are listed below:

probe DNA (ssDNA): 5'-TCT CAA TGG CTG CCT CCC-3';

target DNA (cDNA): 5'-GGG AGG CAG CCA TTG AGA-3';

single-base mismatched DNA: 5'-GGG A**A**G CAG CCA TTG AGA-3';

double-base mismatched DNA: 5'-GGG A**A**G CAG **A**CA TTG AGA-3';

ncDNA: 5'-AGT TCA TCC TGC GCT CTT-3'.

All oligonucleotides stock solutions of 18-base oligomers (1.0×10^{-8} mol L^{-1}) were prepared with Tris-HCl buffer (5.0 mmol L^{-1} Tris-HCl, 50.0 mmol L^{-1} NaCl, pH 7.0), and stored at 4 ℃. More diluted solutions were obtained by diluting aliquot of the stock solution with ultrapure water prior to use. The hybridization solution was diluted with 2×SSC (pH 7.5), which consisted of 0.30 mol L^{-1} NaCl and 0.03 mol L^{-1} sodium citrate tribasic dihydrate ($C_6H_5Na_3O_7\cdot 2H_2O$).

2.3. Immobilization and hybridization of DNA

Immobilization of ssDNA probes was performed by immersing the ZnO/CILE into 2.0 mL Tris-HCl buffer solution (pH 7.0) containing 1.0×10^{-8} mol L^{-1} ssDNA probes for 2 h at room temperature, followed by washing the electrode with 0.5% sodium dodecylsulfate (SDS) solution and then rinsing it with ultrapure water to remove the unimmobilized ssDNA, and this probe-captured electrode was denoted as ssDNA/ZnO/CILE.

The ssDNA/ZnO/CILE was immersed into a hybridization solution (2×SSC buffer, pH 7.5) containing the target DNA and hybridized at 0.4 V for 500 s, followed by washing the electrode with 0.5% SDS solution to remove the unhybridized DNA, and this hybridization modified electrode was denoted as dsDNA/ZnO/CILE. The hybridizations of probe ssDNA with single-base mismatched DNA, double-base mismatched DNA and ncDNA were carried out through similar procedure.

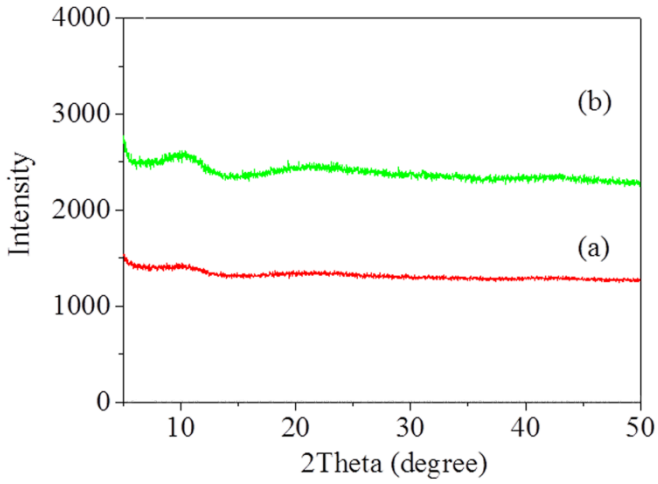

Fig. S1 PXRD patterns of (a) Zn-CPPs and (b) Ni(II)-doped Zn-CPPs microspheres.

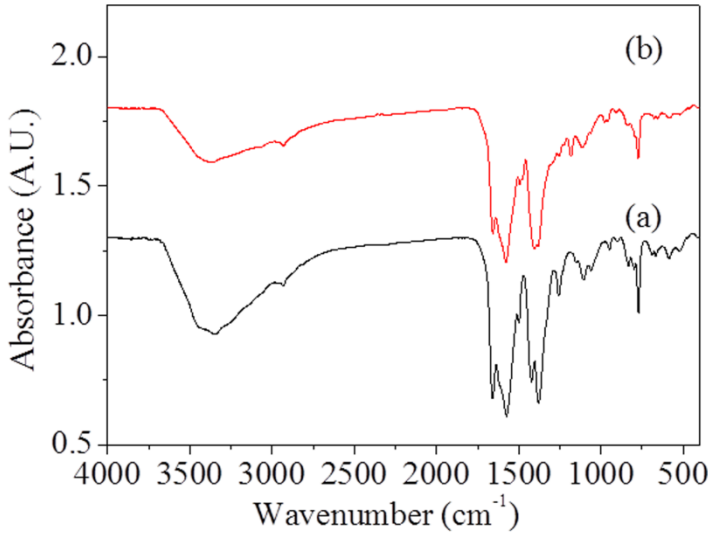

Fig. S2 FT-IR spectra of (a) Zn-CPPs and (b) Ni(II)-doped Zn-CPPs microspheres.

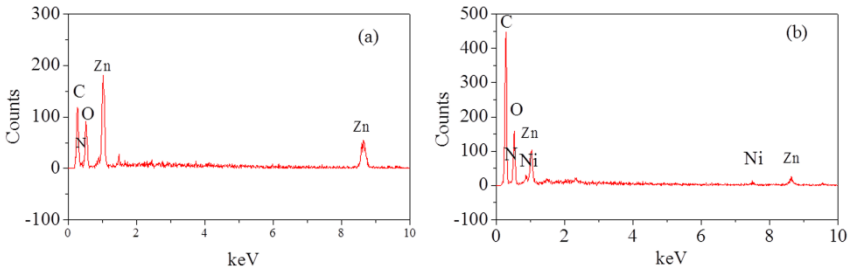

Fig. S3 EDS spectra of (a) Zn-CPPs and (b) Ni(II)-doped Zn-CPPs microspheres.

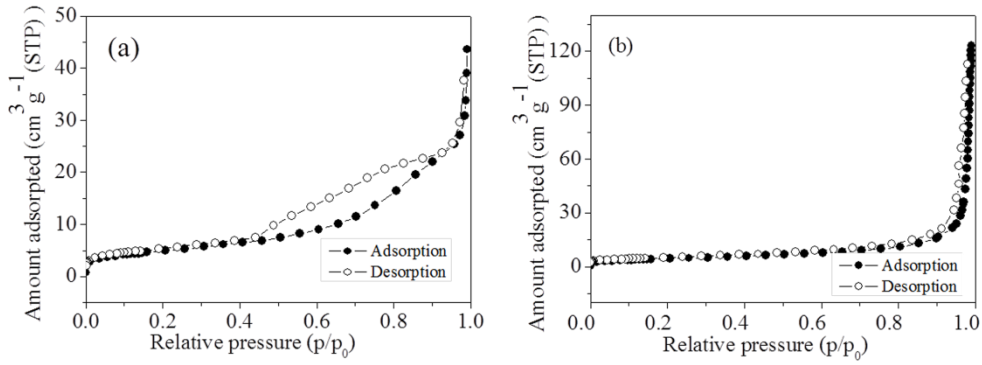

Fig. S4 N_2 adsorption-desorption isotherms of as-prepared products at 77 K: (a) ZnO and (b) ZnO-NiO composites.

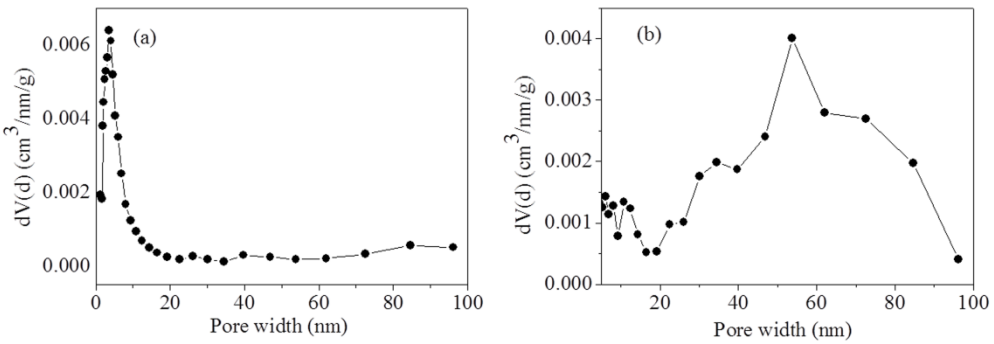

Fig. S5 The pore size distributions of as-prepared products: (a) ZnO and (b) ZnO-NiO composites.

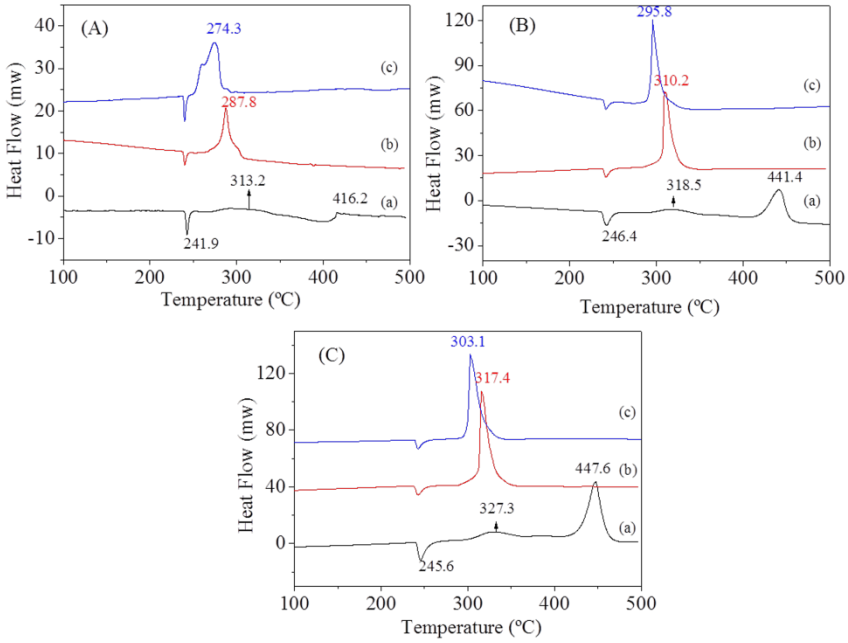

Fig. S6 DSC curves at different heating rates of (A) 5 ℃ min^{-1}, (B) 15 ℃ min^{-1} and (C) 20 ℃ min^{-1}, in absence and presence of different catalysts (a) pure AP, (b) AP + 2 wt% ZnO and (c) AP + 2 wt% ZnO-NiO composites.

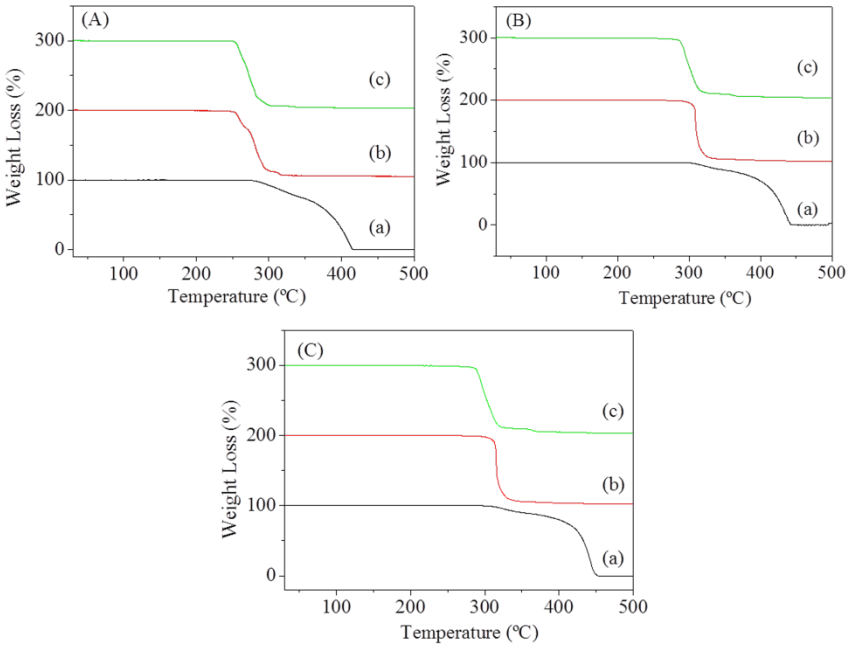

Fig. S7 TGA curves at different heating rates of (A) 5 ℃ min^{-1}, (B) 15 ℃ min^{-1} and (C) 20 ℃ min^{-1}, in absence and presence of different catalysts (a) pure AP, (b) AP + 2 wt% ZnO and (c) AP + 2 wt% ZnO-NiO composites.