Supplementary Information

Metal-free Porous Phosphorus-Doped g-C_3N_4 Photocatalyst Achieving Efficient Synthesis of Benzoin

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SUPPLEMENTARY EXPERIMENT DETAILS

Characterizations. The X-ray diffraction (XRD) observation was conducted on a Philips X'Pert Pro Super diffractometer. The microstructures of catalysts were investigated through a FEI Sirion200 field emission scanning electron microscope (SEM) and a JEM-2100F transmission electron microscope (TEM), with energy-dispersive spectroscopy (EDS) mapping characterized on the same instrument. The Zeta potential was measured via Micromeritics NANOPLUS 3. X-ray photoelectron spectroscopy (XPS) was done on a VGESCALAB MK II spectrometer. N_2 adsorption isotherms were recorded from an ASAP 2020 M PLUS analyzer. The ultraviolet–visible (UV–vis) spectra were acquired from a Perkin Elmer Lambda950 spectrophotometer. Photoluminescence (PL) spectra were evaluated by an Edinburgh FLS920 fluorescence spectrometer. X-ray absorption near edge structure (XANES) spectra were executed in the National Synchrotron Radiation Laboratory (NSRL) in Hefei, China.

SUPPLEMENTARY FIGURES

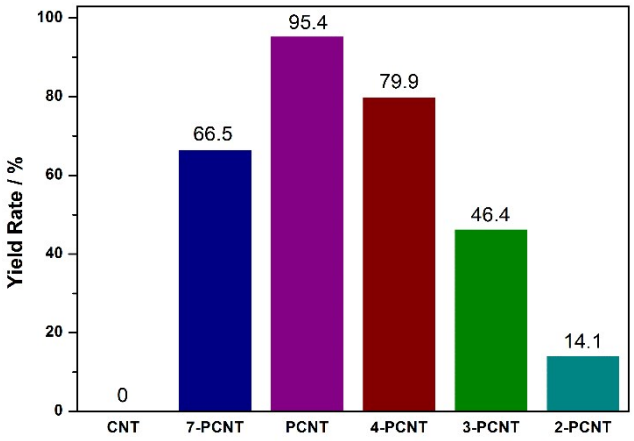

Figure S1. Yield rate of benzoin on PCNT with different phosphorus doping concentration within 6 h.

In order to determine the optimal doping content of phosphorus in PCNT for synthesis of benzoin, a series of PCNT, i.e., 7-PCNT, 4-PCNT, 3-PCNT and 2-PCNT were synthesized, following the same procedure as that of PCNT except that the mass ratio of 2-aminoethylphosphonic acid (AEP): melamine (ME) was changed to 1/70, 1/40, 1/30 and 1/20, respectively. Then the effect of mass ratio (AEP:ME) on the photocatalytic benzoin synthesis activity was investigated. As shown in Fig.S1, the highest yield rate of benzoin is 95.4%, which is achieved at the mass ratio of 1/60 (PCNT). On basis of the above result, PCNT with the optimal mass ratio (AEP:ME) of 1/60 was selected for investigation in this work.

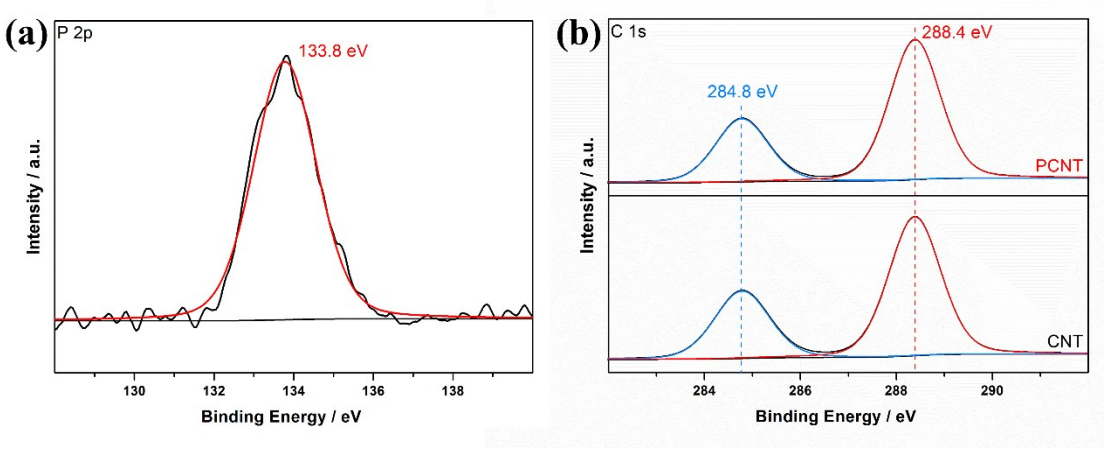

Figure S2. (a) XPS P 2p spectra of PCNT. (b) XPS C 1s spectra of PCNT and CNT.

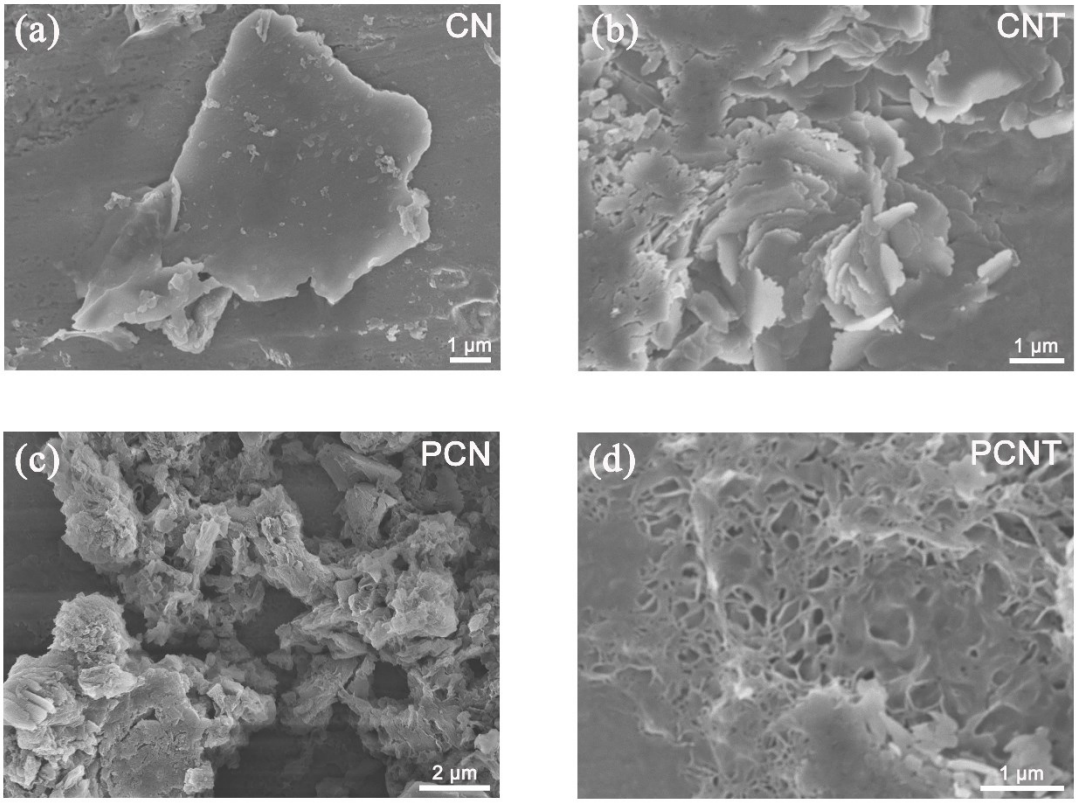

Figure S3. (a-d) SEM images of (a) CN, (b) CNT, (c) PCN, and (d) PCNT.

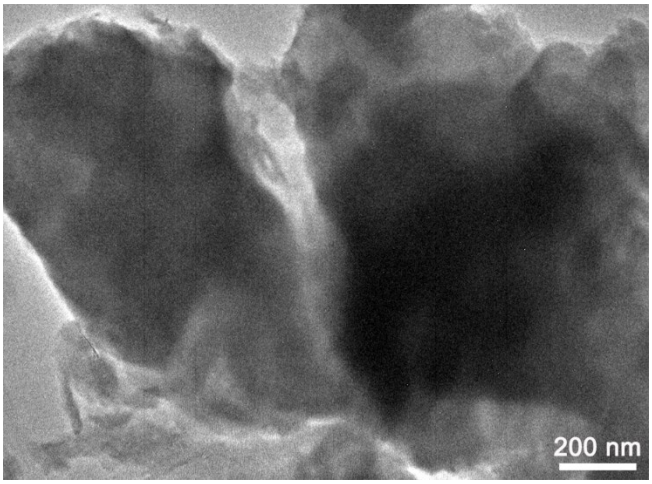

Figure S4. TEM image of CN.

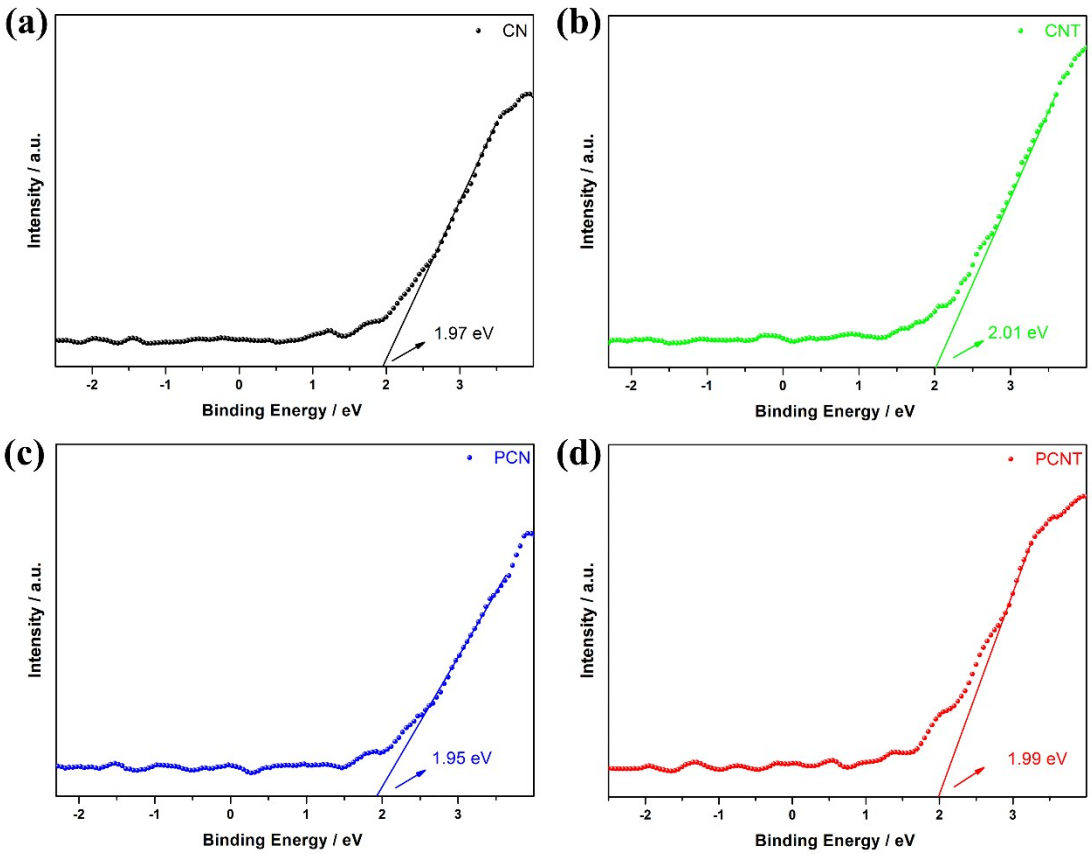

Figure S5. (a-d) XPS valence band spectra of (a) CN, (b) CNT, (c) PCN, and (d) PCNT.

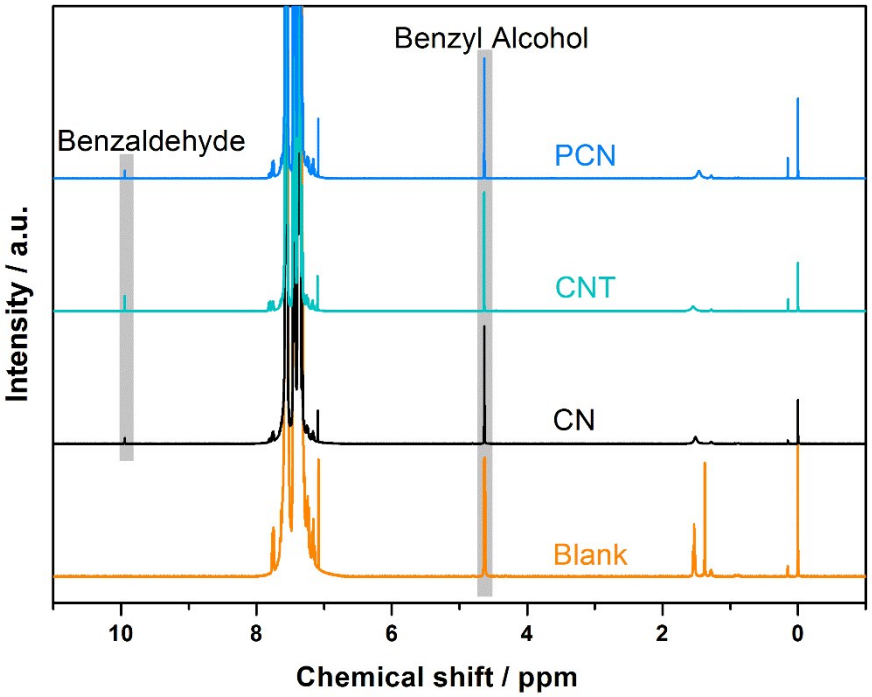

Figure S6. Representative ^{1}H NMR spectra of photocatalytic reaction process on CN, CNT, and PCN within 6 h.

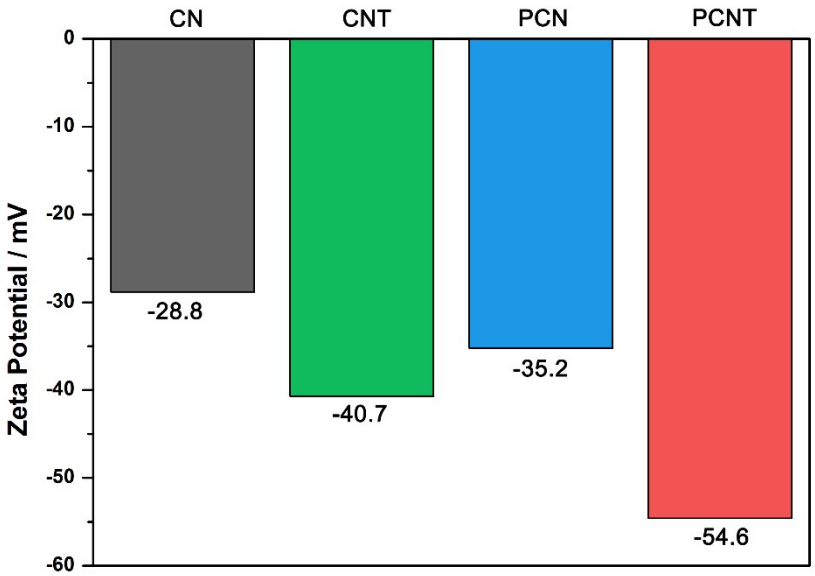

Figure S7. Zeta Potential of CN, CNT, PCN, and PCNT.