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Supporting Information

# Visible Light-Driven Photocatalytic Heck Reaction over Carbon Nanocoils Supported

**Pd Nanoparticles** 

Xiao-Wei Guo<sup>a</sup>, Cai-Hong Hao<sup>b,d</sup>, Cheng-Yu Wang<sup>a</sup>\*, Sarina Sarina<sup>c\*</sup>, Xiao-Ning Guo<sup>b</sup>\*

and Xiang-Yun Guo<sup>b</sup>

<sup>a</sup> Key Laboratory of Bio-Based Material Science and Technology, Ministry of

Education, Northeast Forestry University, Harbin 150040, China.

<sup>b</sup> State Key Laboratory of Coal Conversion, Institute of Coal Chemistry, Chinese

Academy of Sciences, Taiyuan, Shanxi 030001, P. R. China.

<sup>c</sup> School of Chemistry, Physics and Mechanical Engineering, Queensland University of Technology, Brisbane QLD4001, Australia.

<sup>d</sup> University of the Chinese Academy of Sciences, Beijing 100039, P. R. China.

### **Experimental Section**

## Preparation of CNCs and 3wt% Pd/CNCs catalyst

The CNCs support was prepared by decomposition of acetylene with a Cu catalyst. To prepare the Cu catalyst precursor, 50 mL of 0.1 M CuCl<sub>2</sub> aqueous solution was slowly added to 50 mL of 0.1 M sodium–potassium tartrate aqueous solution under vigorous stirring. After the formation of a light blue precipitate (copper tartrate), the precipitate was filtered and washed with absolute ethanol. Then it was dried for 1 h at 110 °C and transferred to the reaction tube. After the Cu catalyst precursor was heated to 250 °C in a vacuum with 5 °Cmin<sup>-1</sup> and decomposed to produce metallic copper particles (by holding at 250 °C for 10 min), acetylene was introduced into the reaction tube. The reaction was carried out for 2 h under atmospheric pressure to obtain the raw product containing CNCs and Cu mixture. Then, the raw product was treated by nitric acid (HNO<sub>3</sub>) to eliminate Cu. A black powder was obtained after washing with distilled water. The Perkin-Elmer ELAN 5000 inductively coupled plasma-mass spectroscopy (ICP-MS) instrument was used to check whether the successful removal of Cu from the CNCs and the content of Cu is 0. The Cu nanoparticles were also not found in both scanning electron microscope (SEM) and transmission electron microscope (TEM) images (Fig. S1 A and B)

The catalyst was prepared by one-step impregnation-reduction method. 2g of prepared CNCs powder was dispersed to 56.4 mL Pd(NO<sub>3</sub>)<sub>2</sub> aqueous solution (0.01M). After 30 min of stirring, 20 mL lysine aqueous solution (0.53M) was added drop by drop into the above mixture. After another 30 min of stirring, 10 mL NaBH<sub>4</sub> solution (0.35M) was dropwise added, and followed 10 mL of 0.3M HCl was added. The mixture was stirred for 24 h under ambient air condition and then the solid was separated, washed and dried to obtain Pd/CNCs catalyst with theoretical loading of 3wt%. The accurate Pd loading was determined by ICP-MS and it is 2.94wt%, which is close to the theoretical value. For comparison, SiO<sub>2</sub> (S<sub>BET</sub>=220 m<sup>2</sup>/g) and active carbon (S<sub>BET</sub>=572 m<sup>2</sup>/g) supported Pd nanoparticles with the same Pd loading of 3wt% were also prepared in a similar method but using different supports.

#### Characterization

The microstructures of the catalysts were investigated by high-resolution transmission electron

microscope (HRTEM, JEM-2100F) at accelerating voltage of 200 kV. X-ray photoelectron spectroscopy (XPS) was measured on a Kratos XSAM800 spectrometer, using Al Ka (hk=1486.6 eV) X-ray source as the excitation source. The crystalline phases were characterized by X-ray diffractometer (XRD, Rigaku D-Max/RB). The UV-visible absorption spectra were measured using a UV-3600 spectrophotometer (Shimadzu).

## Photocatalytic Heck reaction of aryl halides with acrylates

The reactions were conducted in a 50 mL reactor with a quartz window for light transmission. 1mmol of aryl halides, 1mmol of alkenes, 2mmol of  $K_2CO_3$ , 10 mL of N,N-Dimethylformamide (DMF) and 50 mg of 3 wt% Pd/CNCs catalyst were put into the reactor, and the reactant mixture was protected in Ar atmosphere. The mixture was irradiated under a 300 W Xe lamp for 3 h and the light intensity was 1.0 Wcm<sup>-2</sup>. The temperature of the reaction system was precisely controlled at 40 °C by an oil bath. The dependence of the catalytic performance on the light wavelength was investigated by employing various optical filters to allow the transmission of specific-wavelength light while keeping the light intensity the same with the reaction system without optical filter. The light intensity was tuned by adjusting electricity of the Xe lamp, and it was measured by THORLABS S314C thermal power. After reaction, 1 mL aliquots were collected, centrifuged, and then filtered through a Millipore filter (pore size 0.22 µm) to remove the catalyst particulates. The filtrates were analyzed by BRUKER SCION SQ 456 GC-MS to measure the concentration change of reactants and products. The quantitative analysis of specific analytes was detected by SIM mode in GC-MS.

Conversions were based on the amount of substituted iodobenzene or its derivatives used. The turn-over frequency (TOF) in our case was calculated as following:

## Figures



**Fig. S1** SEM (A) and TEM (B) images of as-synthesized CNCs, and TEM (C and D) images of 3wt% Pd/CNCs photocatalyst.



Fig. S2 XRD patterns of 3wt% Pd/CNCs photocatalyst.



Fig. S3 TEM images of 3wt% Pd/SiO<sub>2</sub> (A) and Pd/active carbon (B) catalyst.



Fig. S4 TEM images of 6wt% Pd/CNCs photocatalyst.



Fig. S5 Iodobenzene-vapor adsorption isotherms of 3wt% and 6wt% Pd/CNCs catalyst.



**Fig. S6** TEM images of 6wt% Pd/CNCs photocatalyst after calculation in Ar atmosphere at 500oC for 6h.



Fig. S7 TEM micrograph (A) and XPS (B) of the Pd/CNCs catalyst after five atalytic cycles.



Fig. S8 The light spectrum of the Xe lamp without any optical filters.