Supporting information

Cellulose Derived Pd Nano-Catalyst for Efficient Catalysis

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Materials

Cellulose powders were purchased from Golden-Shell Biochemical Co., Ltd. (Zhejiang, China). Palladium chloride (PdCl$_2$, Pd 59-60%, Shanghai Macklin Biochemical Co., Ltd), Palladium acetate (Pd(OAc)$_2$, 99%, Beijing Bailing Wei Technology Co., Ltd). Commercial palladium-carbon catalyst (Pd/C, 5%), nano palladium (nano-Pd NPs, 99.9%) powders were purchased from Aladdin. *O*-chlorotoluene, 3-chlorotoluene, 4-chlorotoluene, 2-chloroanisole, 3-chloroanisole, 1-chloro-4-methoxybenzene were purchased from Macklin. *O*-chloroaniline, 4-nitrochlorobenzene, 2-chlorobenzaldehyde and 2-bromotoluene were purchased from Alfa. 3-bromotoluene, and 4-bromotoluene, *o*-bromoanisole, 3-bromoanisole and 1-bromo-4-methoxy-benzen were purchased from J&K Chemical. 2-Chlorobenzonitrile, iodobenzene, 4-iodotoluene, 4-iodonitrobenzene, phenylboronic acid, 4-methylphenylboronic acid, 3-methoxybenzeneboronic acid and 4-

methoxyphenylboronic acid were purchased from Aladdin. All the other reagents such as ethanol, toluene, etc. were gained from various merchant resources, which could be used without further purification.

Characterization

The morphology of the sample and EDS mapping were examined by a field-emission scanning electron microscope (FESEM, Zeiss SUPRA 55 Sapphire, Germany) at an accelerating voltage of 5 kV. Transmission electron microscopy (TEM, JEM-2010 HT, Japan) images were collected on a JEM-2010 (HT) electron microscope with an accelerating voltage of 200 kV. Before the TEM observation, we first grinded the sample thoroughly, then impregnated it with ethanol and dropped the suspension onto a copper grid. X-ray diffraction (XRD) pattern was recorded by X-ray powder diffraction (XRD, Rigaku Miniflex600 with Cu Kα radiation, $\lambda = 1.5406$ Å, Japan). Infrared spectroscopy was carried out using a Fourier transform infrared spectrometer (FT-IR, PerkinElmer Corporation/model 1600, USA). X-ray photoelectron spectroscopy (XPS) was collected on a VG Multi Lab 2000 system with a monochromatic A1 Kα X-ray source (XPS, VG Multi Lab 2000, USA). The Pd percentages of catalysts were determined with inductively coupled plasma optical emission spectrometer (ICP-OES) analyses (ICP-OES, IRIS Intrepid II XSP, USA) after samples were completely dissolved. GC yields were performed with a Varian GC 3900 gas chromatography instrument (GC, Varian GC 3900, USA) with a FID detector. GC-MS spectra were recorded on a Varian GC-MS 3900-2100T (GC-MS, Varian GC-MS 3900-2100T, USA).

Determination of Pd Loading

The obtained C-Pd catalyst (8 mg) was stirred in concentrated nitric acid (5 mL) at 80 °C overnight. After the C-Pd catalyst was dissolved, 2 mL of concentrated hydrochloric acid was added and diluted to 100 mL with deionized water. Subsequently, the resulting solutions were subjected to ICP-OES, which showed that the Pd loading of the catalyst activated under argon atmosphere was 0.245 wt%.
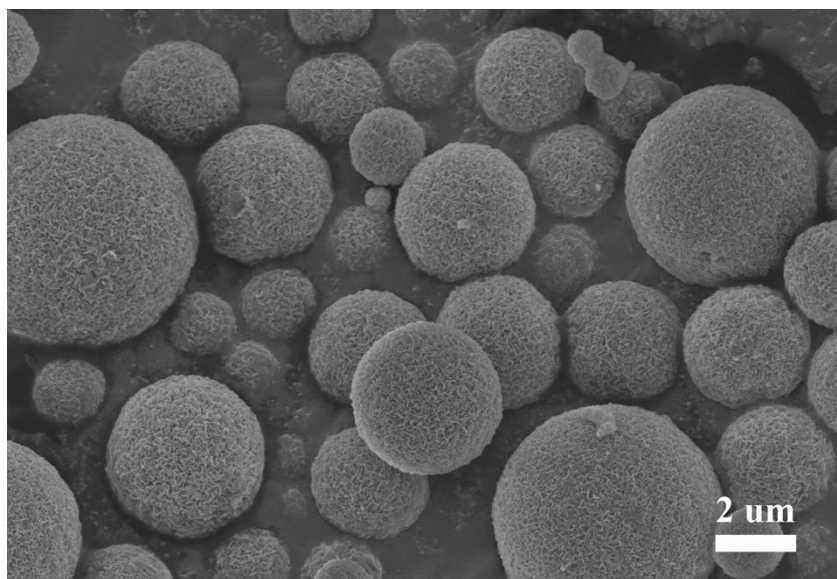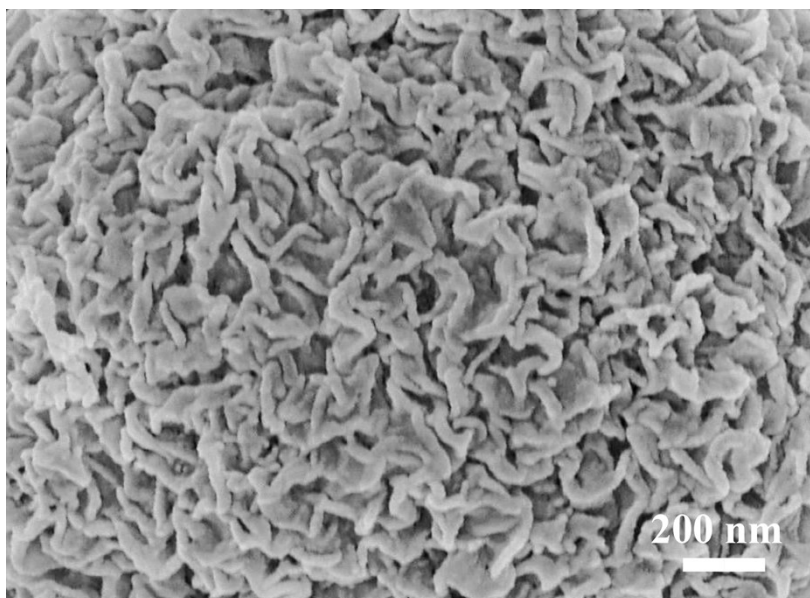

Fig. S1 SEM image of the blank cellulose microsphere.

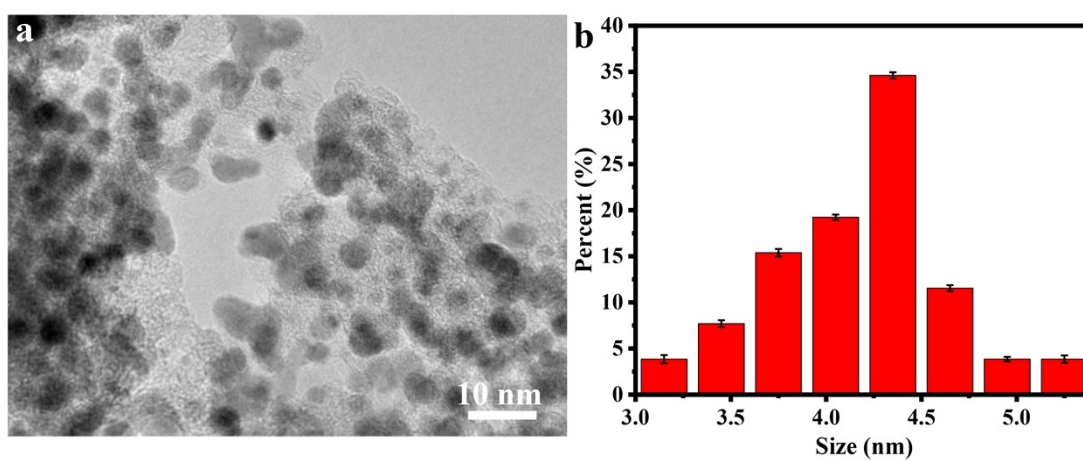**Fig. S2** SEM image of the partial enlargement of an blank cellulose microsphere.

Fig. S3 TEM image of the commercial Pd/C (a), and size distribution of the Pd NPs (b).

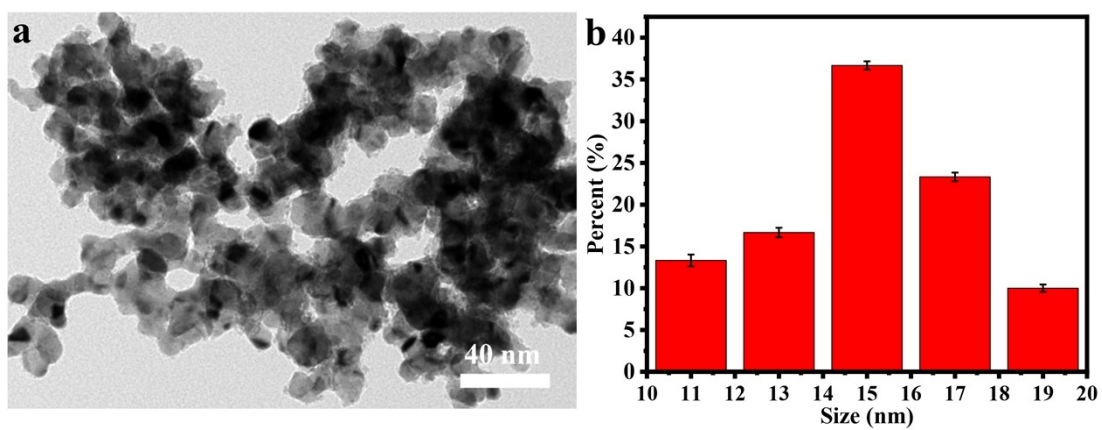**Fig. S4** TEM image of the commercial Nano-Pd (a), and size distribution of the Pd NPs (b).
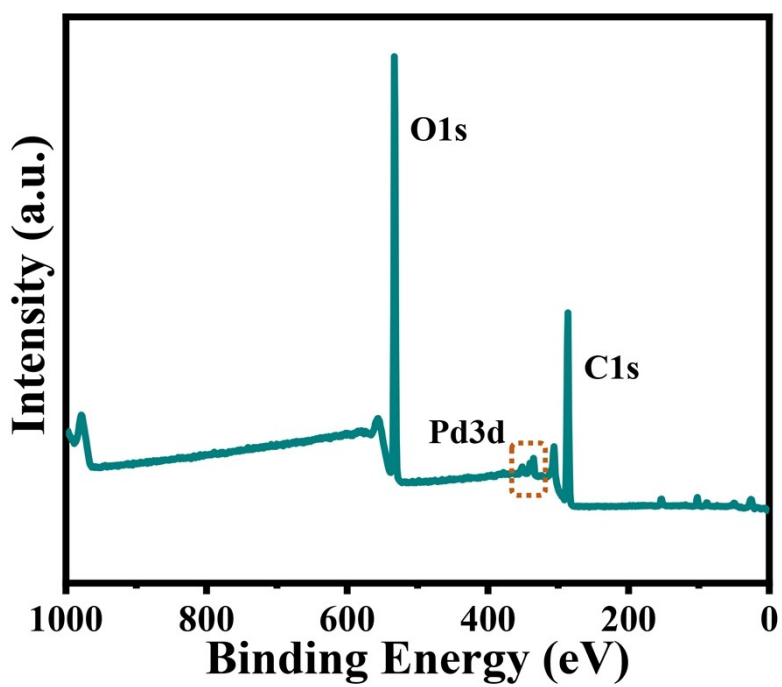

Fig. S5 Full-scale XPS spectra of the C-Pd after six cycles.