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Supporting information:

Pd-Sodium Carboxymethyl Cellulose Nanocomposites Display a Morphology Dependent Response to Hydrogen Gas

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S1. The synthesis of Pd- Sodium Carboxymethyl Cellulose nanocomposites:

The Pd-Sodium Carboxymethyl Cellulose (Pd-SCMC) nanocomposites were synthesized by reducing H_2PdCl_4 in the presence of sodium carboxymethyl cellulose (MW~90,000) using a spinning disc processing (SDP) platform. In a typical synthesis, the H_2PdCl_4 aqueous solution (0.6 mmol L^{-1}) was mixed with SCMC and then the mixture was fed from one feed jet at a feed rate of 0.7 mLs^{-1}. Hydrogen gas was fed through another feed jet to reduce Pd (II) to Pd (0). The speed of the spinning disc was set at 2000 rpm. For Pd nano-rosettes shown in Figure 1a, a 10 cm grooved disc was used. For Pd aggregates shown in Figure 1b, a 20 cm smooth disc was used. The SCMC to Pd equivalents was 2 and 5, respectively. The as synthesized nanocomposites were washed using MilliQ water (>18 MΩ) three times and re-dispersed in water before any further test. The size and morphology of the samples were determined using transmission electron microscopy (TEM, JEOL 3000F) operating at 300 kV. Powder XRD pattern of the Pd aggregates was measured using an Oxford Diffraction Gemini-R CCD diffractometer (using Cu Kα= 1.54178 Å radiation).

S2. The setup of hydrogen sensor:

The Pd- SCMC nanocomposites solution were drop cast onto the surface of each IDE (interdigitated electrode) using aliquots of 0.02 µL from a 0.5 µL glass syringe which were subsequently air-dried. The procedure involved alternating nitrogen gas (20 min) and varying concentrations of hydrogen gas (4 min) for tests in Figure 2a and 3a. Alternating nitrogen gas (10 min) and varying concentrations of hydrogen gas (2 min) feature in Figures 2b and 3b. The change of the current was monitored at the same time. The total flow rate of gas was 1000 $mLmin^{-1}$. The voltage applied between two electrodes was 100 mV dc or 10 mV dc. The images of sensor were recorded with scanning electron microscope (SEM, Zeiss 1555 VPSEM) operating at an accelerating voltage of 8 kV.

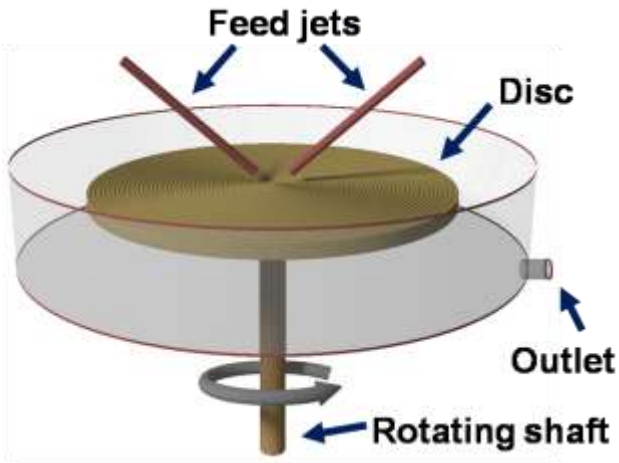

Fig. S1 Schematic illustration of spinning disc processing (SDP).

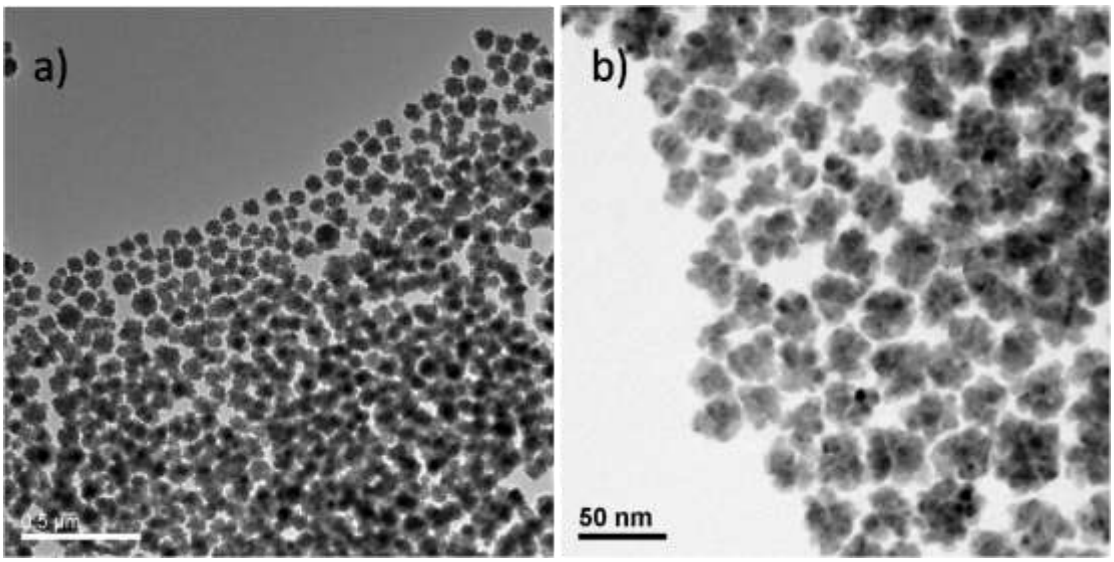

Fig. S2 Low magnification TEM images of as-prepared Pd nanocomposites from spinning disc processing: the molar equivalents of SCMC to Pd were 2 and 5, respectively.

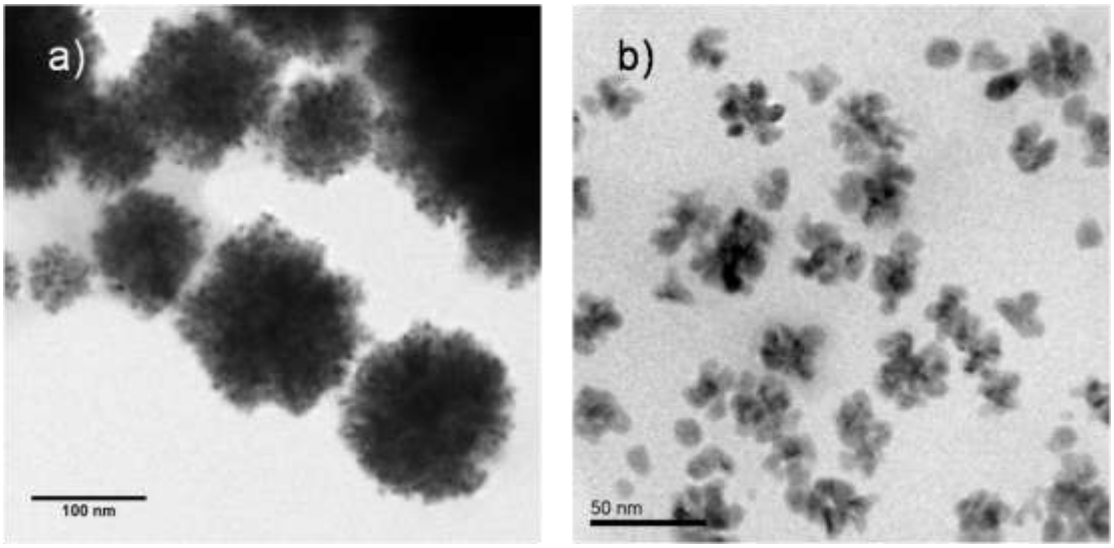

Fig. S3 TEM images of as-prepared Pd-SCMC nanocomposites formed using SDP, a) the molar equivalents of SCMC to Pd of 1:1, and b) the molar equivalents of SCMC to Pd of 30:1.

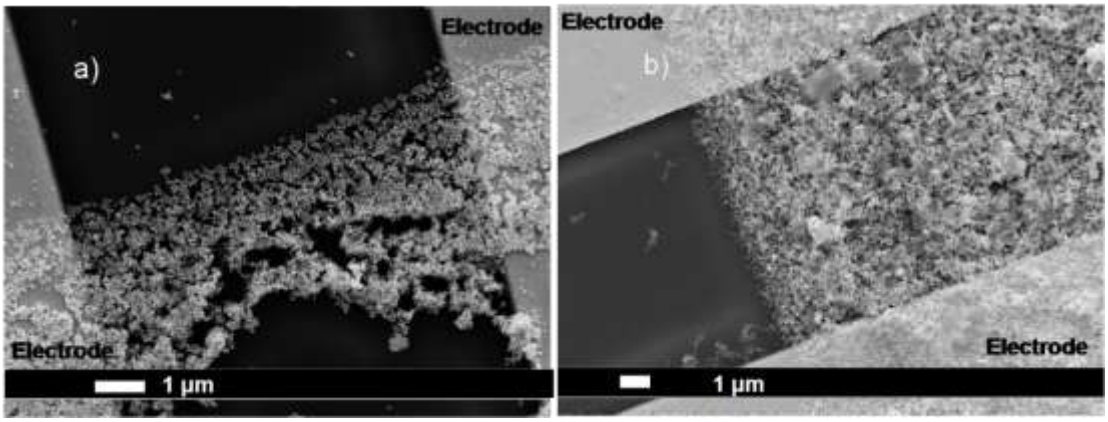

Fig. S4 SEM images of Pd-SCMC nanocomposites bridging two electrodes, sensor 1 (a) and sensor 2 (b).