Electronic Supplementary Material (ESI) for New Journal of Chemistry
This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

Supplementary Information for

Photosensitized Hydrogen Evolution from Water Using Single-Walled Carbon Nanotube/Fullerodendron/Pt(II) Coaxial Nanohybrids

Yukari Sasada[a], Tomoyuki Tajima[a], Takaaki Wada[a], Tetsuya Uchida[b], Masayasu Nishi[b], Takahiro Ohkubo[b] and Yutaka Takaguchi*[a]

[a] Graduate School of Environmental and Life Science, Okayama University, Tsushima-Naka 3-1-1, Kita-Ku, Okayama, 700-8530, JAPAN. [b] Graduate School of Natural Science and Technology, Okayama University, Tsushima-Naka 3-1-1, Kita-Ku, Okayama, 700-8530, JAPAN.

Fax: +81 (0)86 251 8903; Tel: +81 (0)86 251 8903; E-mail: yutaka@cc.okayma-u.ac.jp

Page 1: Contents
Page 2: General
Page 3: Synthesis of fullerodendron/Pt(II) complex
Fabrication of colloidal PVA-Pt
Page 4: Time-dependent UV-vis spectra observed after mixing K_2PtCl_4 with fullerodendron.
Page 5: HRTEM image of fullerodendron/Pt(II) complex
Page 6: IR spectra of fullerodendron and fullerodendron/Pt(II) complex
Page 7: XANES spectra and magnitude of the Fourier transform of EXAFS spectra for fullerodendron/Pt(II) complex
Page 8: Vis-NIR spectra of raw-SWCNT/fullerodendron and purified-SWCNT/fullerodendron
Page 9: TGA of raw−SWCNTs and purified−SWCNTs
Page 10: AFM image of purified-SWCNT/fullerodendron.
Page 11: Raman spectra of SWCNT/fullerodendron supramolecular nanocomposites and SWCNT/fullerodendron/Pt(II) coaxial nanohybrids
Page 12: Schematic energy diagram for hydrogen evolution systems using SWCNT/fullerodendron nanohybrid, of which SWNT is (9,7) SWCNT

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

General

Raman spectra of the powders and solutions were obtained with a HORIBA Jobin Yvon XploRA Raman spectrometer using laser excitation at a wavelength of 488 nm and 785 nm. FT-IR spectra were recorded using Shimazu IR Affinity-1. Microwave irradiation experiment was carried out using a Biotage Initiator^{TM}. The reaction was performed with temperature and power-controlled program in a glass vial (0.5-2.0 mL) sealed with a Teflon septum. The externally temperature was measured by an IR sensor. The reaction time was counted when the reaction mixture was reached the stated temperature. TGA was measured on a Shimadzu DTG-60 in platinum pans at a heating rate of 10 °C / min under air flow.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

Synthesis of fullerodendron/Pt(II) complex

To an aqueous solution of fullerodendron (50 μM, pH 7.5, 100 mL) was added a solution of K_2PtCl_4 (0.01 M, 0.38 mL) in water and stirred for 12 h at 50 ˚C under N_2 atmosphere. The reaction was monitored by UV-vis spectroscopy.

Fabrication if colloidal PVA-Pt

An aqueous of NaOH (1.0 M) was added to an aqueous solution (40 mL) of PVA (0.80 g, average number of repeating units = 1750 ± 50) and $H_2PtCl_6 \cdot 6H_2O$ (154 mg, 297 μmol) until the pH value reached 8.0. The mixture was diluted with water up to a total volume of 100 mL, and the solution was stirred at 0 °C for 1 h. After the solution was stirred under reflux conditions for 4 h, the reaction mixture was cooled to room temperature. The resulting solution was bubbled with H_2 for 1.5 h. After the mixture was centrifuged at 15,000 rpm for 13 h, and a clear phase was collected to give a colloidal PVA–Pt. The average diameter of the colloidal PVA–Pt, as evaluated by DLS, was 22.3 nm.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

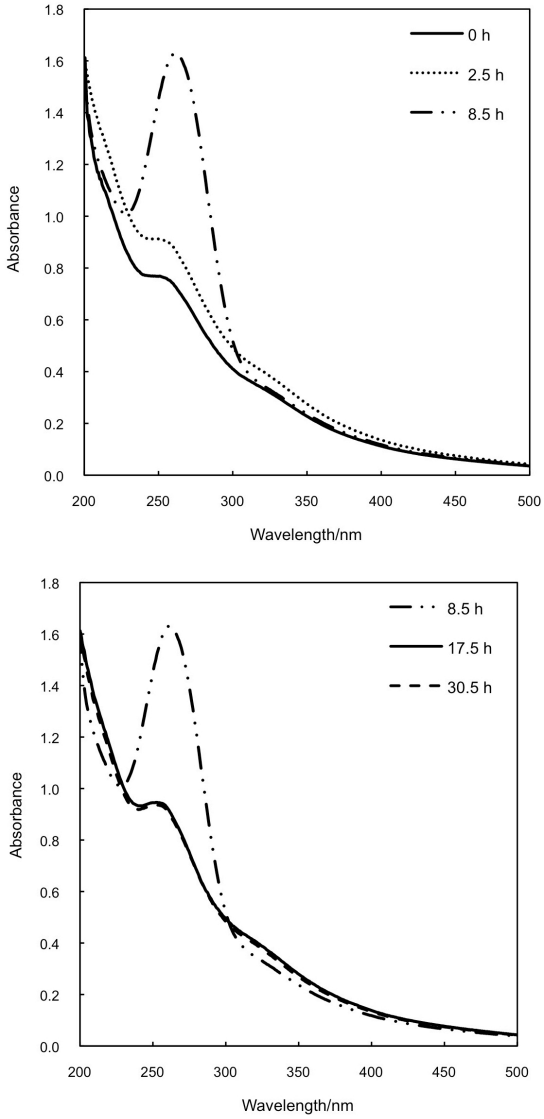

Fig. S1. Time-dependent UV-vis spectra observed after mixing K_2PtCl_4 with fullerodendron.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

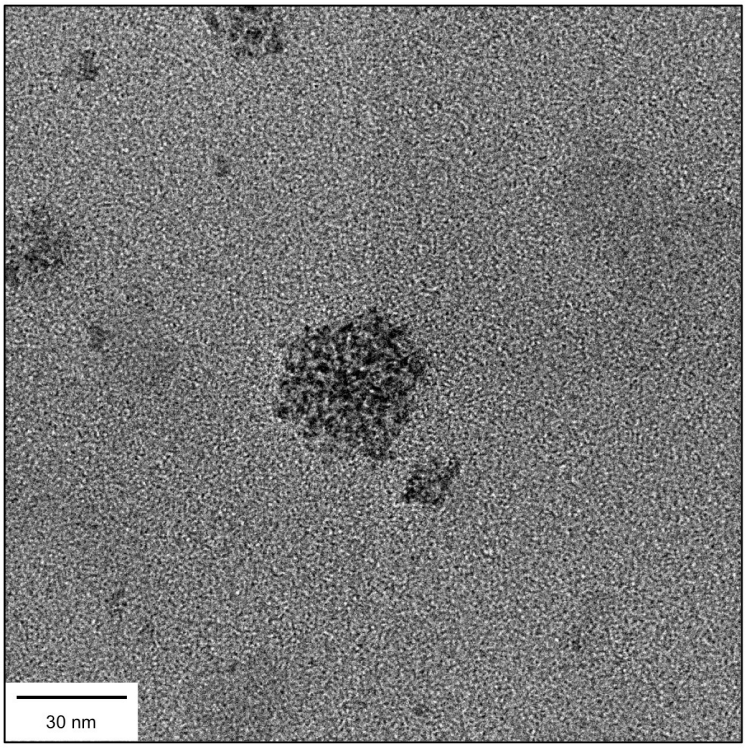

Fig. S2. HRTEM image of fullerodendron/Pt(II) complex.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

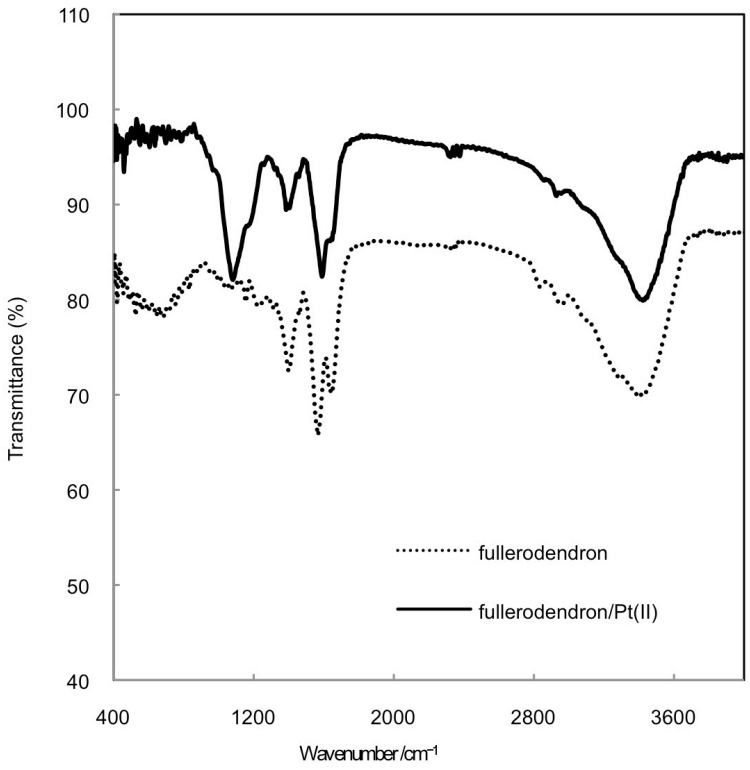

Fig. S3. IR spectra of fullerodendron and fullerodendron/Pt(II) complex.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

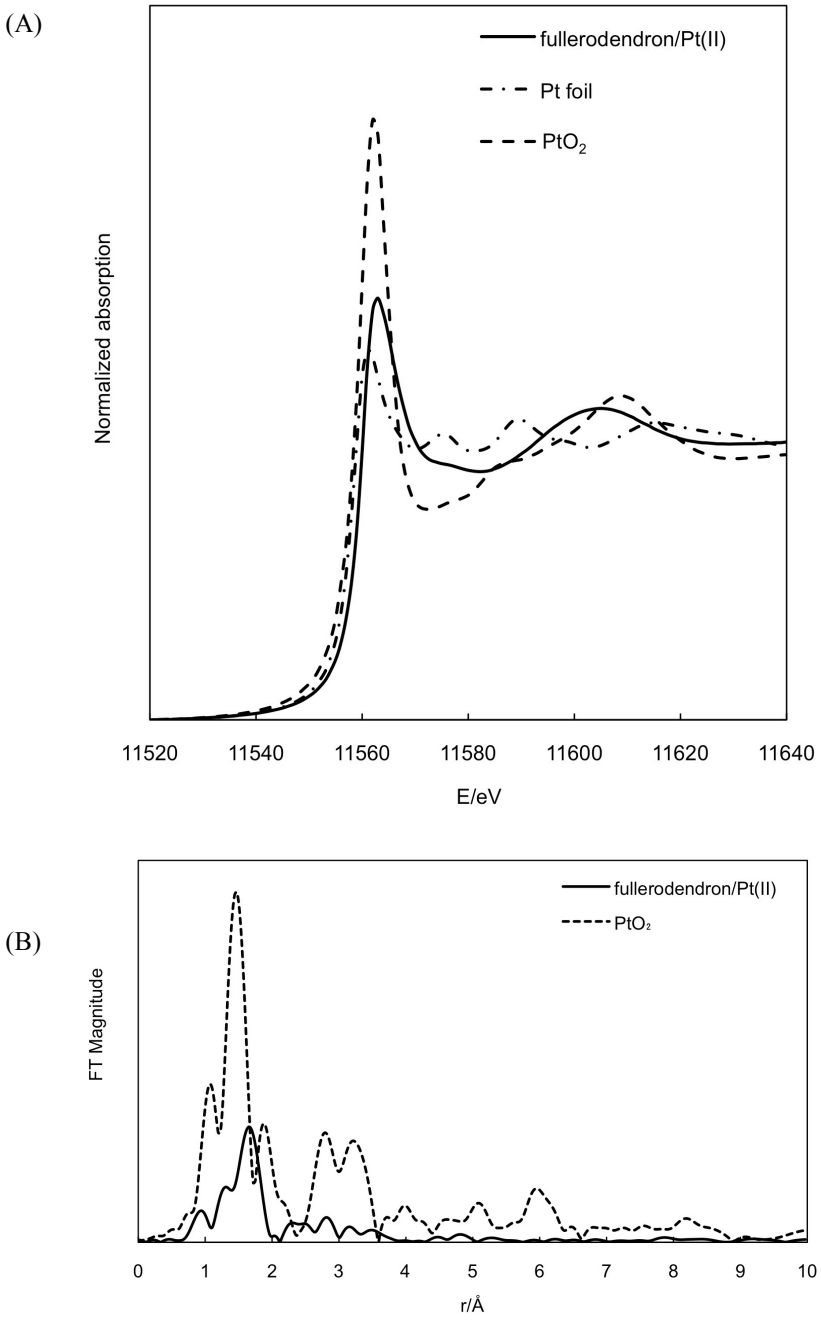

Fig. S4. (A) XANES spectra for fullerodendron/Pt(II) complex and references (Pt foil and PtO_2) and (B) Magnitude of Fourier transform of the EXAFS spectra for fullerodendron/Pt(II) complex.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

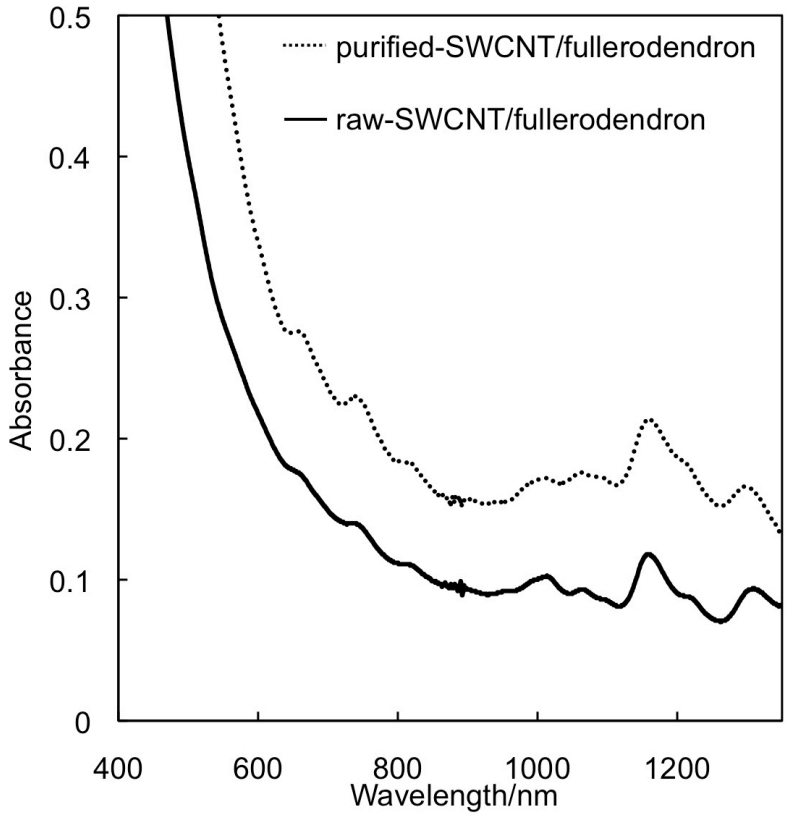

Fig. S5. Vis-NIR spectra of raw−SWCNT/fullerodendron and purified−SWCNT/fullerodendron.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

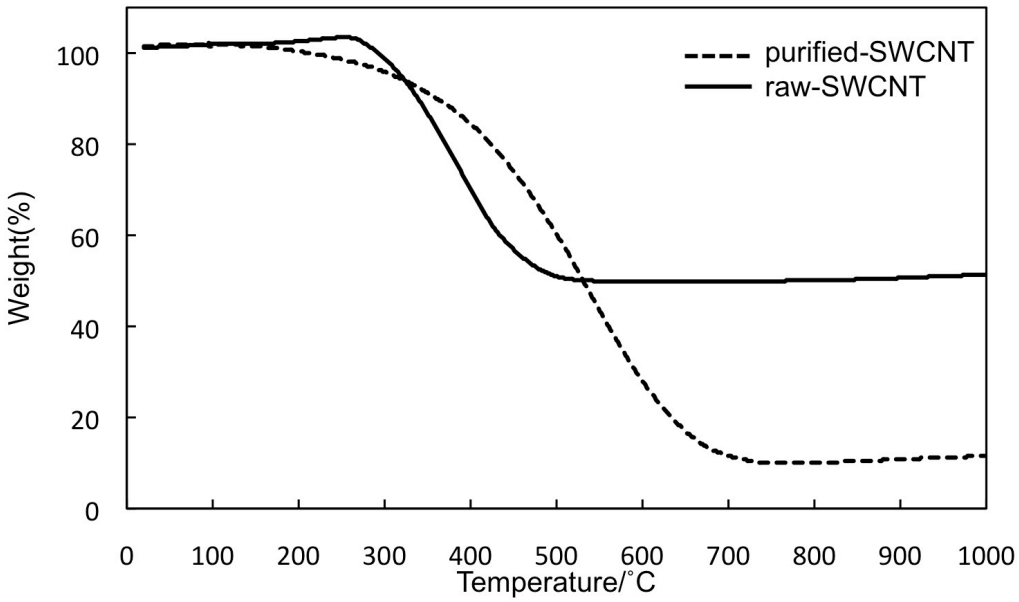

Fig. S6. TGA of raw−SWCNTs and purified−SWCNTs.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

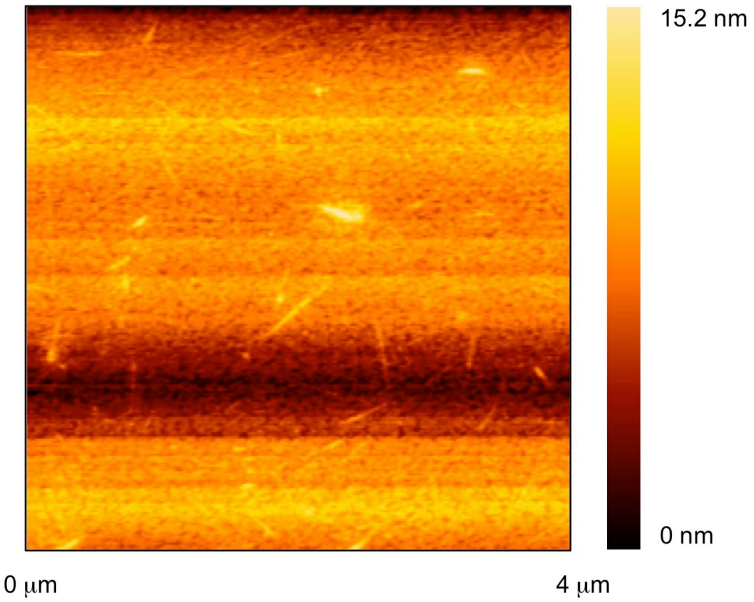

Fig. S7. AFM image of purified-SWCNT/fullerodendron.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

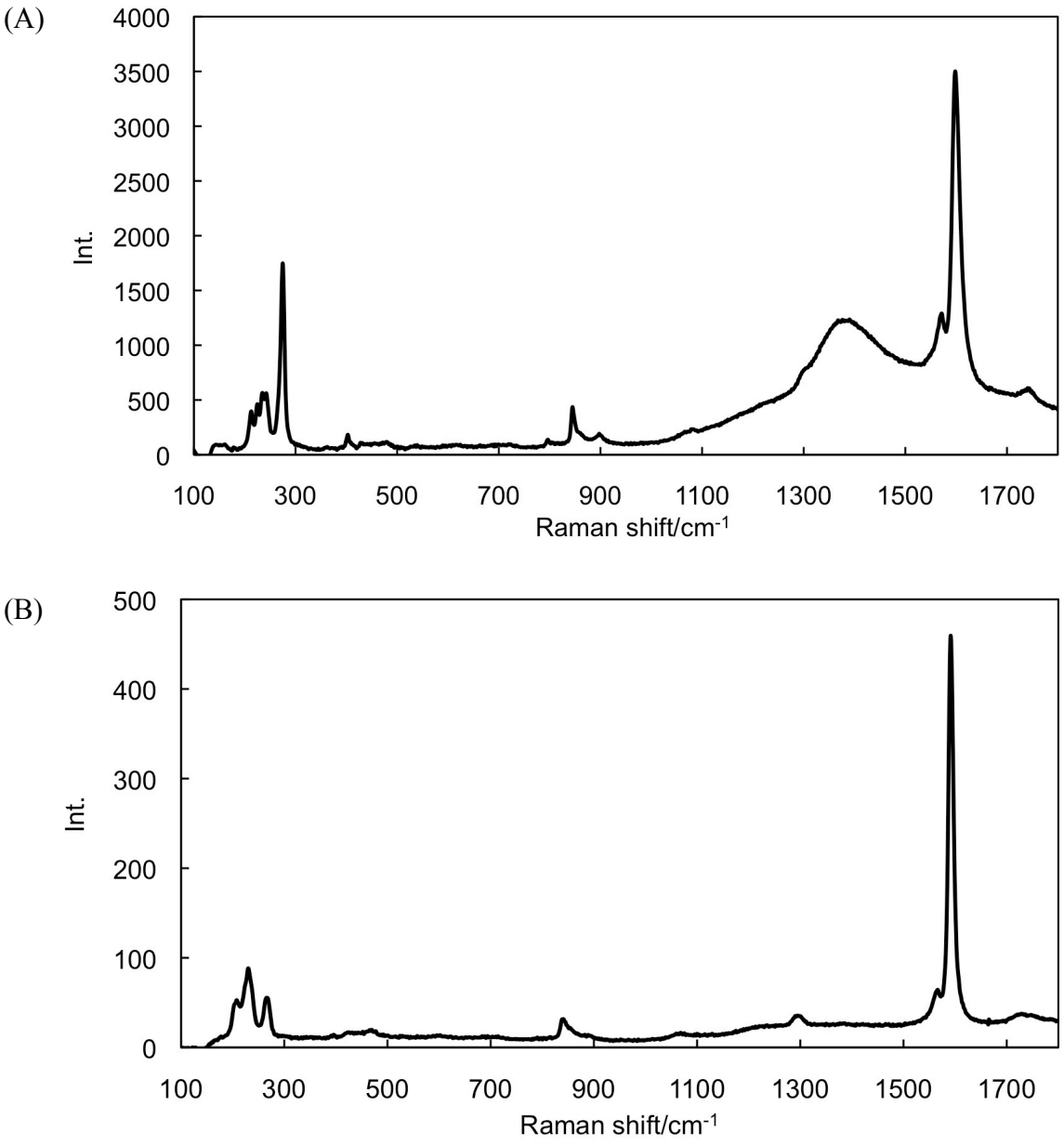

Fig. S8. Raman spectra of (A) SWCNT/fullerodendron/Pt(II) coaxial nanohybrids and (B) SWCNT/fullerodendron supramolecular nanocomposites.

This journal is © The Royal Society of Chemistry and The Centre National de la Recherche Scientifique 2013

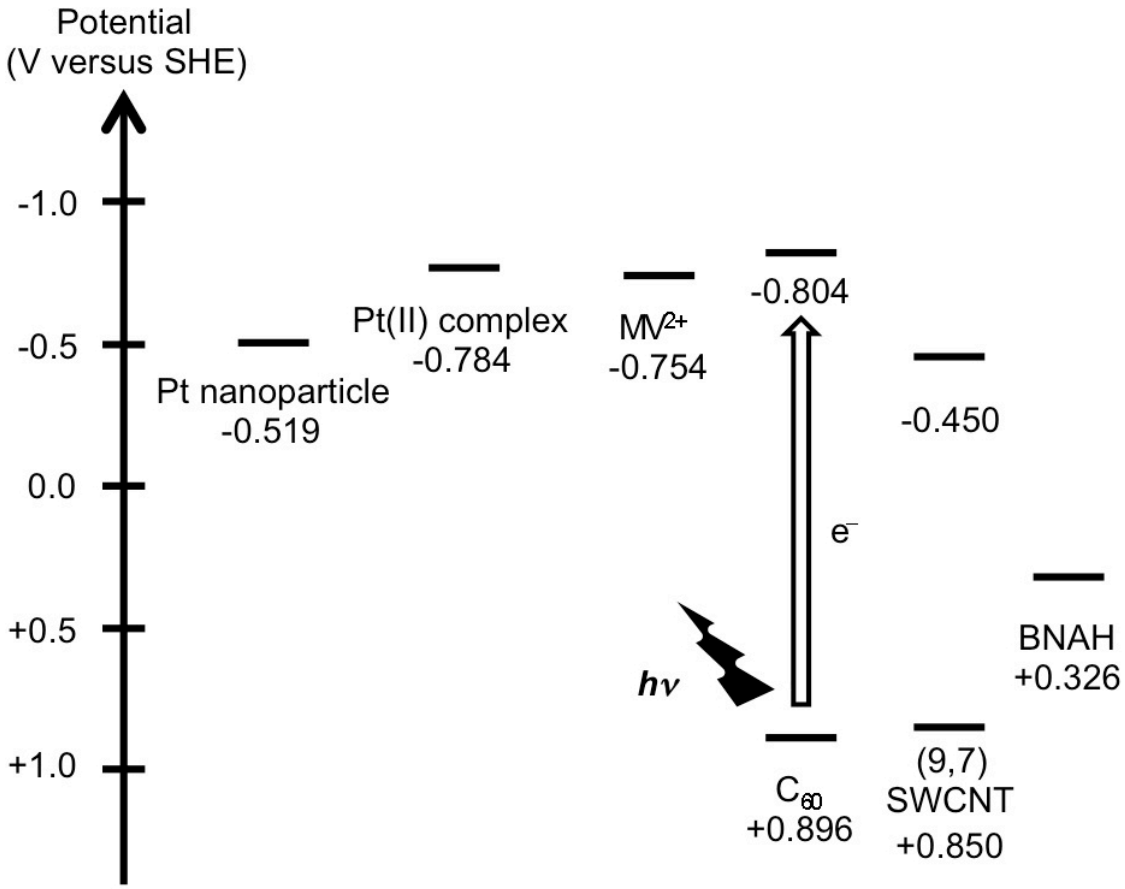

Fig. S9. Schematic energy diagram for hydrogen evolution systems using SWCNT/fullerodendron nanohybrid, of which SWNT is (9,7) SWCNT.