Supporting Information

Photo-driven Synthesis of Polymer-coated Platinized ZnO Nanoparticles with Enhanced Photoelectrochemical Charge Transportation

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Experimental Details of solid state NMR:

The solid-state ¹³C NMR experiments were carried out on Bruker AVANCE III 700 spectrometer with a 16.4 Tesla superconducting magnet operating at frequencies of 700 MHz and 175 MHz for the ¹H and ¹³C nuclei respectively. Prior to measurement, due to the low carbon content of the material, the sample was treated overnight with 10 v/v% nitride acid (Premium Grade, RCI Labscan) to dissolve away the ZnO nanoparticles. The residue was finely ground and packed into a 4 mm zirconia rotor fitted with a Kel-F cap. ¹³C Cross-Polarization with Magic Angle Spinning (¹³C CPMAS) NMR spectra of the material was acquired at 8 kHz MAS with 2 ms of ramped cross-polarization time to transfer the coherence from the ¹H to the ¹³C nuclear spins and 80 kHz ¹H SPINAL64 decoupling during acquisition. The TOtal Suppression of Spinning Sidebands (TOSS) with ¹³C 180° pulse length of 7.2 µs scheme was implemented prior to acquisition to prevent any overlap of the isotropic peaks with the spinning sideband peaks. 2 s recycle delays were used for the measurements and 72 k transients were co-added for sufficient signal to noise yielding a total experimental time of 41 h for each spectrum. Selective suppression of the protonated carbon species was achieved by inserting a 40 µs gated decoupling (gade) period in the TOSS sequence during which the ¹H decoupling is switched off. During the 40 µs gade period the dipolar coupling of the ¹H with the ¹³C spins causes the dephasing of the ¹³C signal of motionaly rigid CH and CH_2 species to <10% of their original intensity. On the other hand the non-protonated (quaternary) carbon species retail > 90% of their original intensity. For the CH₃ species which have a fast rotation about the C-C bond, signal is only partially reduced (typically 30 %-50 %) due to motionally reduced strength of the ¹H-¹³C dipolar coupling. The chemical shifts were referenced to the C=O peak of glycine at 176 ppm.



Figure S1: Hydrogen evolution during the photocatalytic synthesis of Pt/ZnO and Poly/Pt/ZnO.



Figure S2: (a) (a) Color difference between bare ZnO and Poly/ZnO, (b) Raman spectra of all the samples and (c) TEM images of Poly/ZnO showing the crystalline regions with 0.28nm lattice spacing which is characteristic of ZnO.



Figure S3: (a) TGA curves of Poly/Pt/ZnO after 5 h of illumination, (b) TGA and DTA curves of Poly/Pt(20) and (c) TGA curve of Poly/Pt/ZnO after 20 h of illumination.



Figure S4: (a) TEM image of Poly/Pt(20) echibiting a wave-like sheet structure and (b) HR-TEM of Poly/Pt(20) depicting the lattice spacing (~0.23nm) of the platinum deposits.



Figure S5: PEC profile depicting the stable photocurrent of Poly/Pt/ZnO during three hours of illumination under an applied bias of 0.75V.



Figure S6: PEC hydrogen evolution utilizing Poly/Pt/ZnO as the photoanode.



Figure S7: Emission spectra of a coumarin suspension prior to illumination and following three hours of illumination in the presence of Poly/Pt/ZnO.