Electronic Supplementary Material (ESI) for Nanoscale.

Electronic supplementary information (ESI)

Polarons and bipolarons induced charge carrier transportation for enhanced photocatalytic H_2 production.

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# Equal contribution

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Synthesis of PPy-C_3N_4 composite.

g-C_3N_4/ PPy composite was synthesized by wet impregnation method. In detail, 15 mg of PPy was added to 500 mg of g-C_3N_4 in 1:1 ratio of water and methanol and stirred for 5 h at RT. The obtained PPy/g-C_3N_4 was washed with DI water and dried at oven at 60 °C for 10 h.

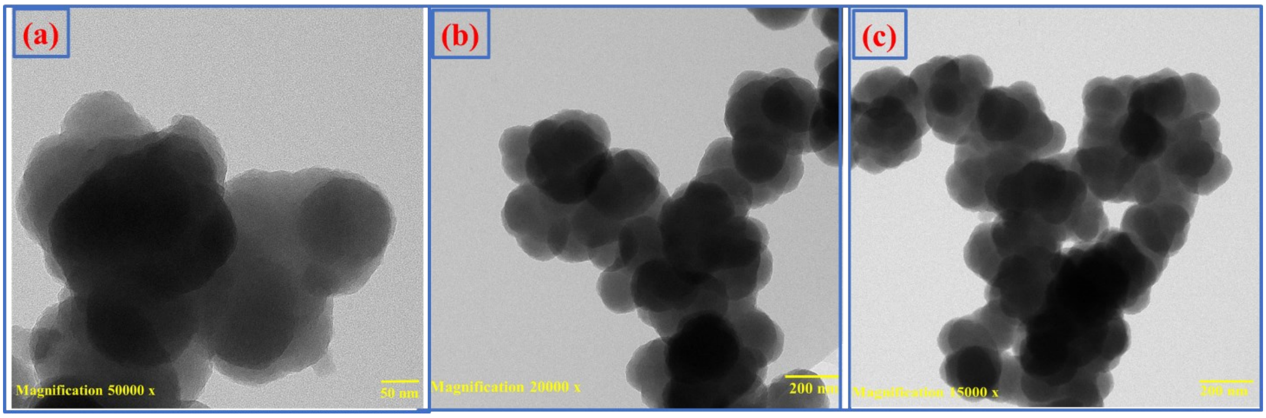

Figure S1: a-c) TEM images of PPy-6 with different magnification.

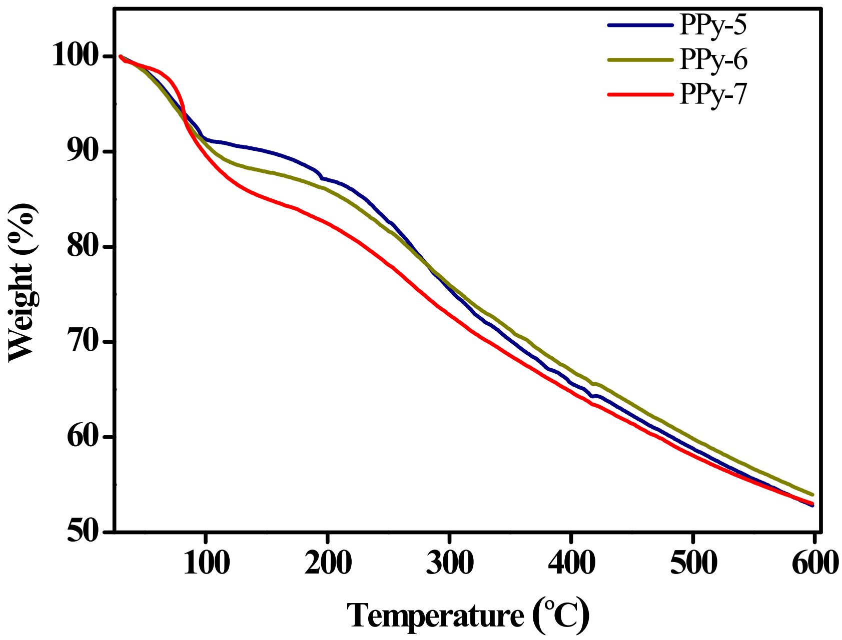

Figure S2: TGA spectra of PPy-5, 6 and 7.

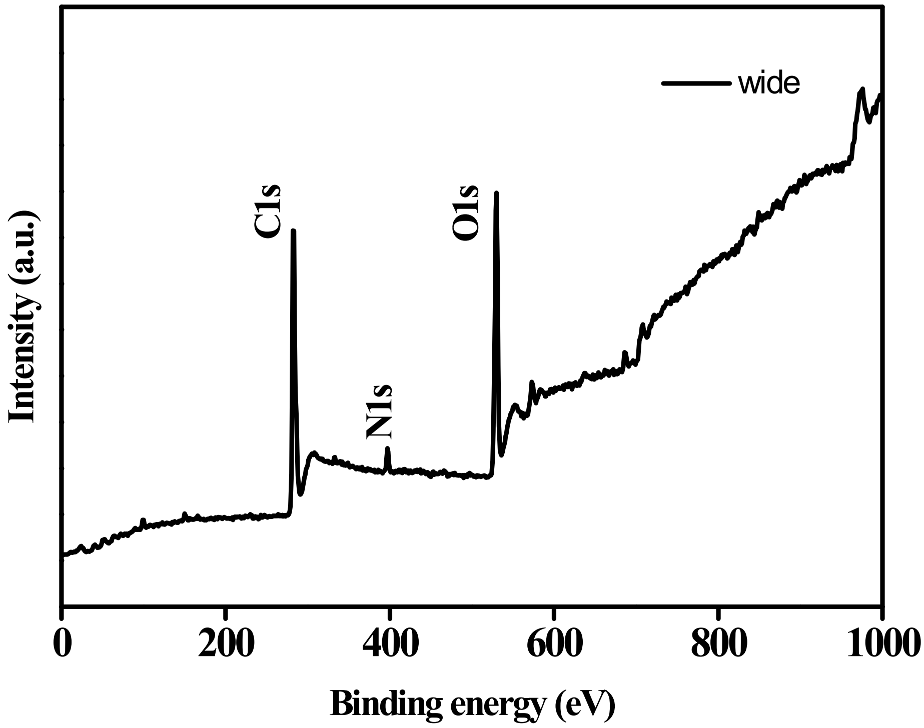

Figure S3: XPS wide angle spectra of Polypyrrole

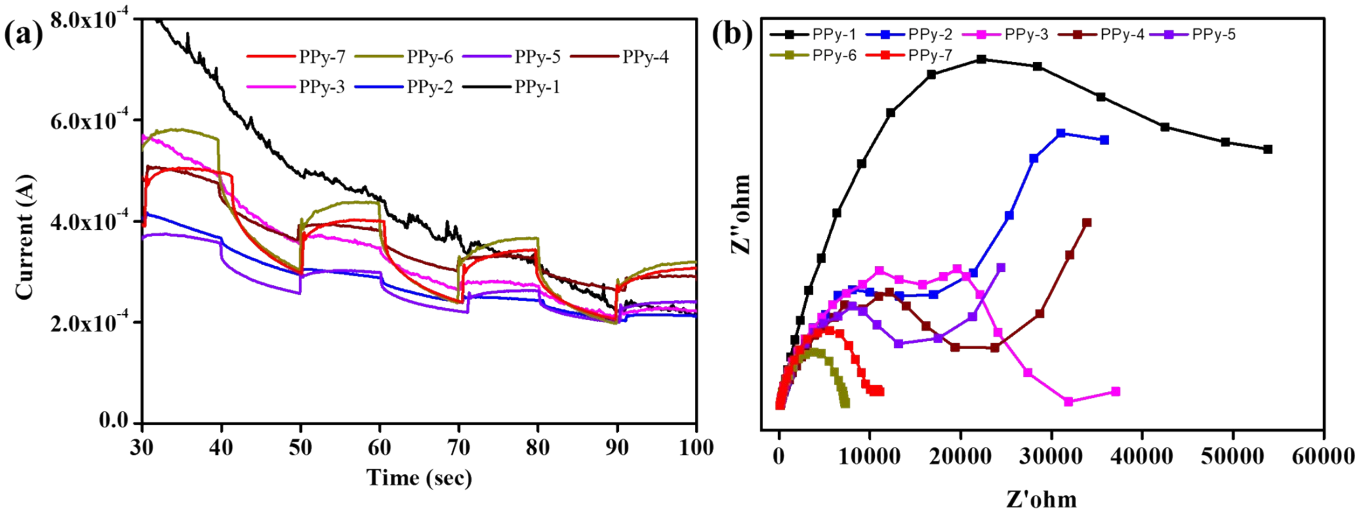

Figure S4: a) Transient photocurrent measurement b) Nyquist plot for different concentrations of oxidizing agent in polypyrrole.

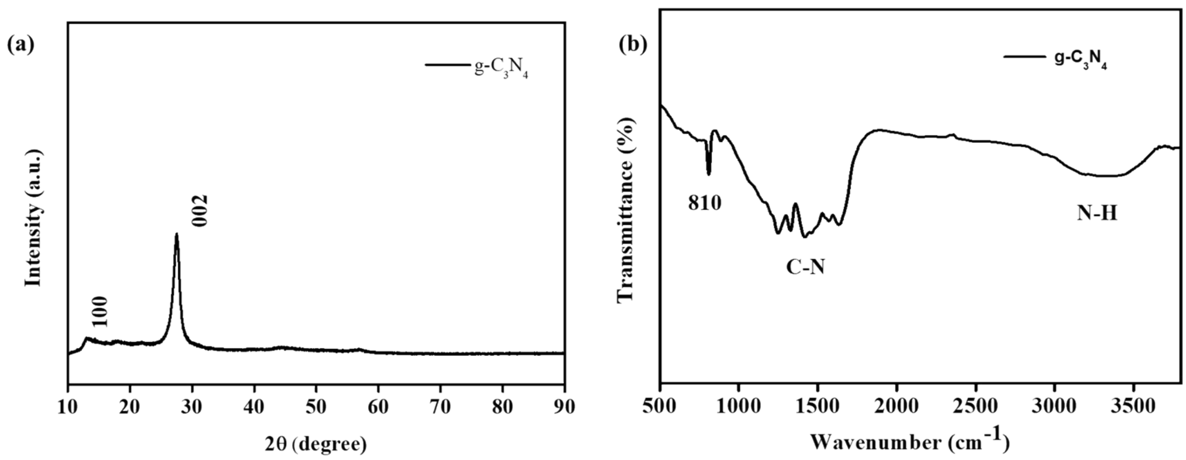

Figure S5: a) XRD b) FT-IR spectra of g-C_3N_4

Table S1: Comparison table.

Catalysts	Cocatalysts	Light Source	Sacrificial agents	H_2 Evolution Rate (μmol g^{-1} h^{-1})	Ref
g-C_3N_4-P3HT	Pt	300 W xenon lamp λ > 420 nm	TEOA	609.9	1
g-C_3N_4/Ti_2C	-	300 W xenon lamp λ > 420 nm	TEOA	950	2
g-C_3N_4/CuO/Co	-	300 W xenon lamp λ > 420 nm	TEOA	93.8	3
g-C_3N_4/InVo4	Pt	300 W xenon lamp λ > 420 nm	Methyl Alcohol	212	4
g-C_3N_4/P25	Au	300 W xenon lamp λ > 420 nm	Methanol	219	5

g-C_3N_4/MoS_2	Pt	300 W xenon lamp λ > 420 nm	Methanol	231	6
g-C_3N_4/TiO_2	Pt	300 W xenon lamp λ > 420 nm	TEOA	329	7
g-C_3N_4/$SrTiO_3$	Pt	250 W iron doped metal halide (λ ≥ 420 nm)	oxalic acid	440	8
WO_3/g-C_3N_4/$Ni(OH)_x$	-	300 W xenon lamp λ > 420 nm	TEOA	576	9
g-C_3N_4/$Cu(OH)_2$	-	300 W xenon lamp λ > 420 nm	Methanol	48.7	10
g-C_3N_4/Ag quantum dots	-	300 W xenon lamp λ > 420 nm	Methanol	200	11
g-C_3N_4 /Fe_2O_3	Pt	350 W xenon lamp λ > 420 nm	TEOA	398	12
g-C_3N_4/PPy	Pt	300 W xenon lamp λ > 420 nm	TEOA	1851.8	This Work

AC conductivity (s) and dielectric constant was calculated using equation 1 and 2

$$\tan\delta(\omega) = \frac{\varepsilon''(\omega)}{\varepsilon'(\omega)}$$

$$\varepsilon'(\omega) = \frac{Cd}{\varepsilon_o A} \text{--------}(1)$$

$$\sigma = \varepsilon_0 \varepsilon' \omega \tan\delta \text{--------}(2)$$

Where, C is the measured capacitance in Farad, Thickness and cross-sectional area of the PPy pellet was represented as d and A, respectively. ε_o is defined as permittivity of free space ($8.85*10^{-12}$ F m^{-1}). ε' are the real parts of dielectric constant. ω=2πf is the angular frequency and f is the applied frequency

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