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Supporting Information

Synthesis of ZnTPyP/WO_3 nanorod-on-nanorod heterojunctions direct Z-scheme with spatial charge separation ability for enhanced photocatalytic hydrogen generation

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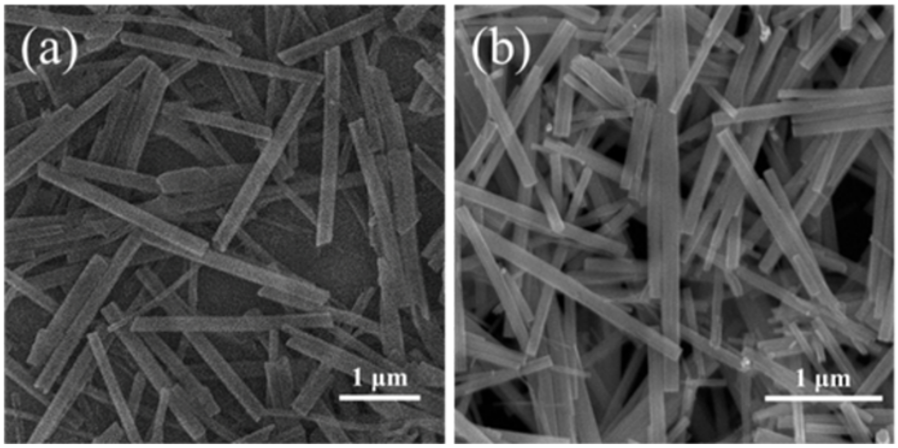

Figure S1. SEM images of (a) pure ZnTPyP nanorods (pH = 8.6) and (b) WO_3 nanorods.

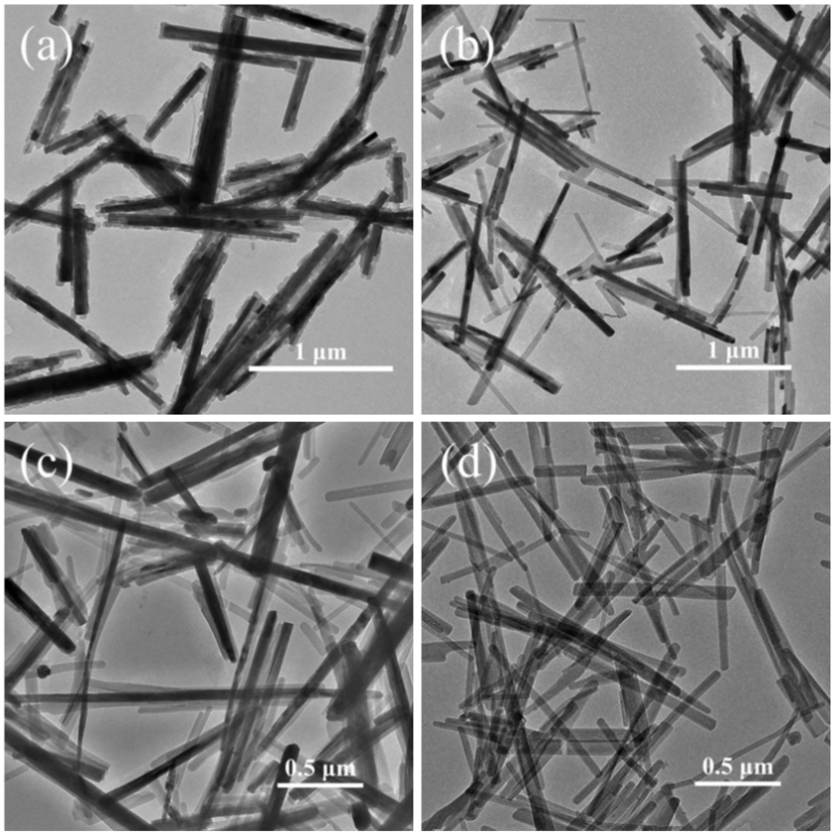

Figure S2. TEM of ZnTPyP/WO_3 were prepared under different pH: (a) pH=3.06, (b) pH=8.83, (c) pH=10.96, (d) pH=11.82.

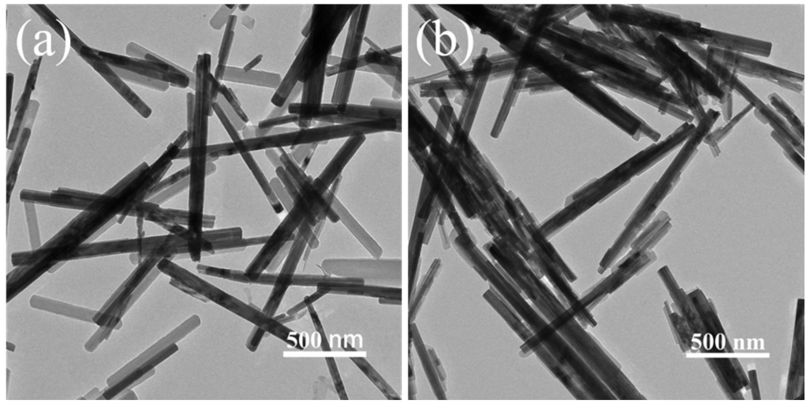

Figure S3. TEM images of ZnTPyP/WO_3 nanorod-on-nanorod heterojunctions prepared in different surfactant type: (a) SDS and (b) MTAB.

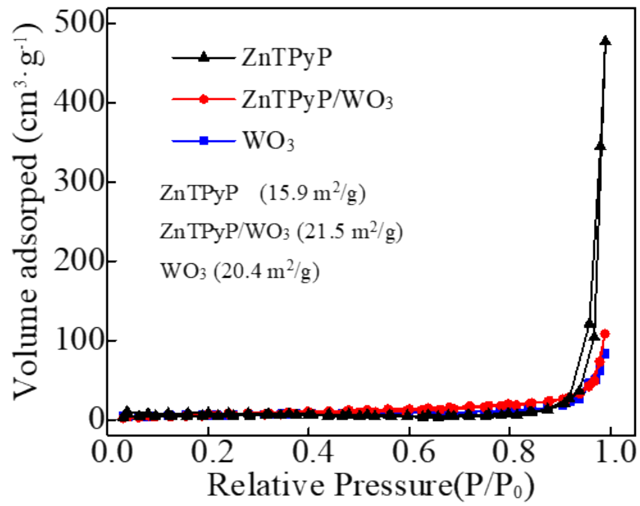

Figure S4. Nitrogen adsorption-desorption isotherm curve of the ZnTPyP nanorod, WO_3 nanorod and ZnTPyP/WO_3 nanorod-on-nanorod heterojunctions.

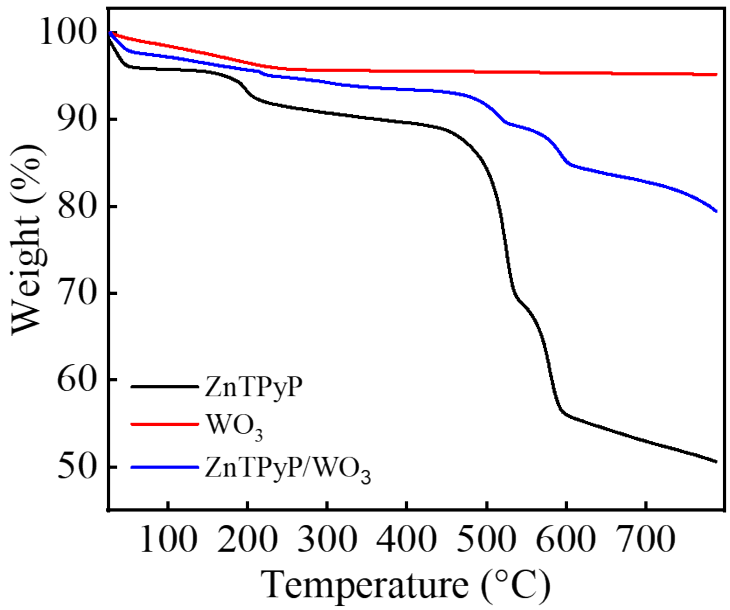

Figure S5. Thermogravimetric analysis (TGA) curve for the ZnTPyP nanorod, WO_3 nanorod and $ZnTPyP/WO_3$ nanorod-on-nanorod heterojunctions.

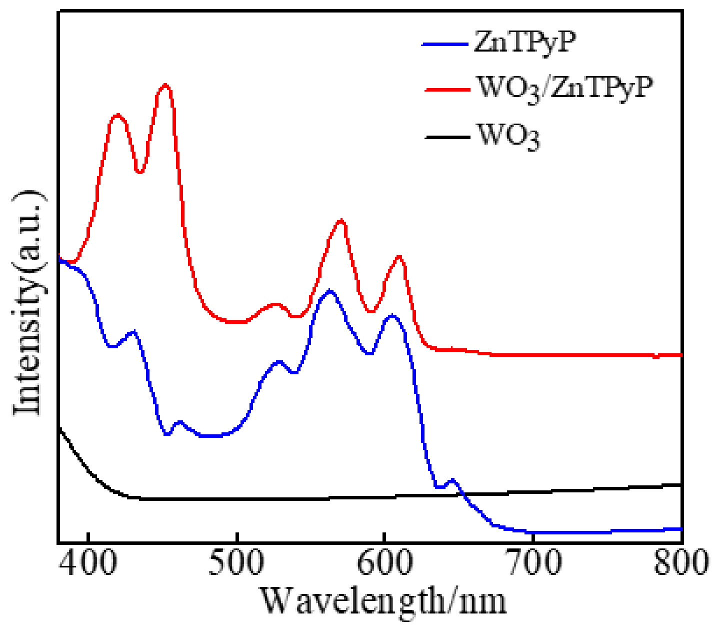

Figure S6. UV-vis diffuse reflectance spectra (DRS) of pure WO_3 nanorods, ZnTPyP nanorods, and ZnTPyP/WO_3 (26.1 wt %).

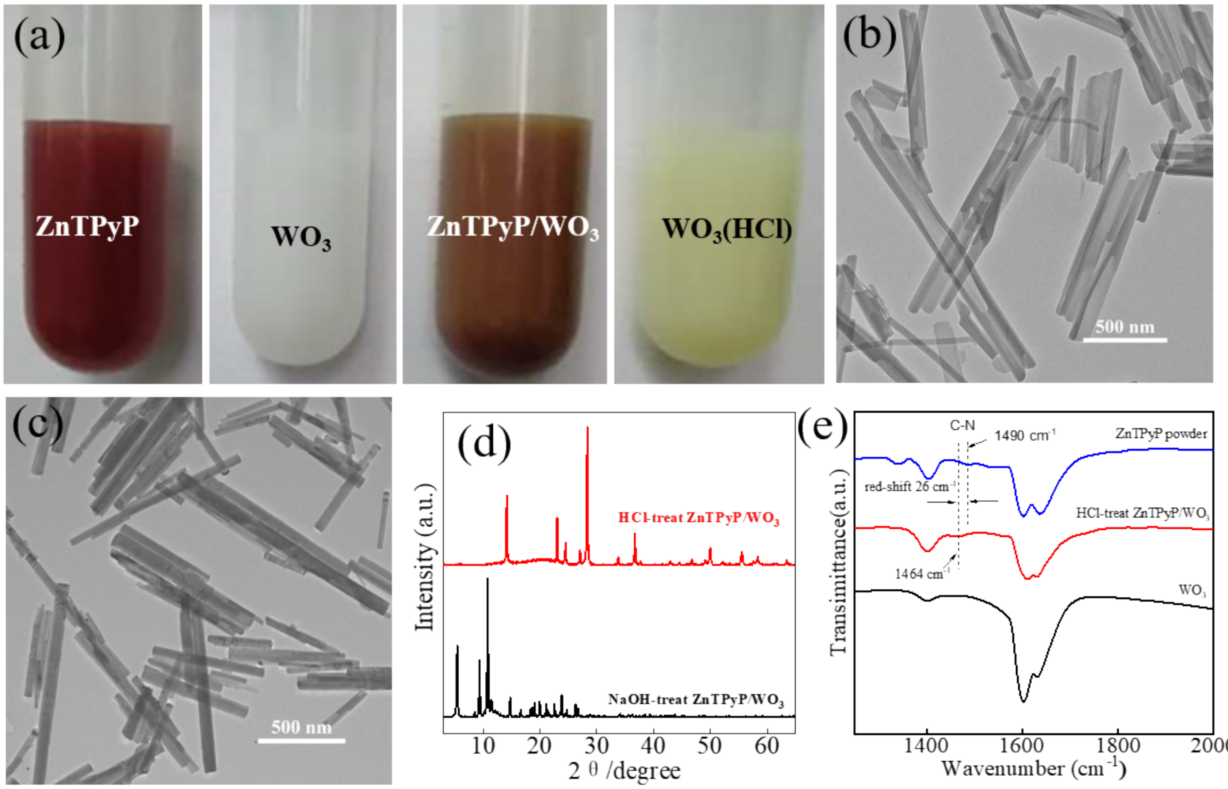

Figure S7. (a) Photograph of pure WO_3 nanorods, ZnTPyP nanorods, ZnTPyP/WO_3 (26 wt %), and ZnTPyP/WO_3 treated with HCl aqueous solution. (b) TEM of WO_3@ZnTPyP core-shell treated with NaOH. (c) TEM of ZnTPyP/WO_3 treated with HCl. (d) XRD of ZnTPyP/WO_3 treated with HCl (red) and NaOH (black). (e) Corresponding FT-IR of ZnTPyP powder, ZnTPyP nanorods, and HCl-treated ZnTPyP/WO_3.

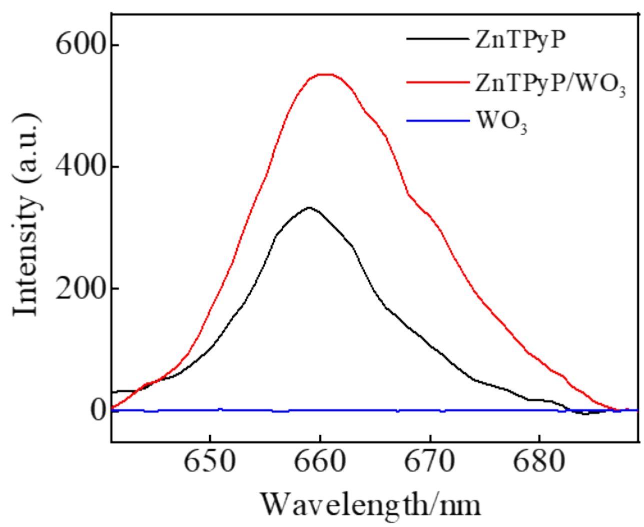

Figure S8. Fluorescence spectra of pure WO_3 nanorods, ZnTPyP nanorods, and ZnTPyP/WO_3 (26.1 wt %), E_x: 420 nm.

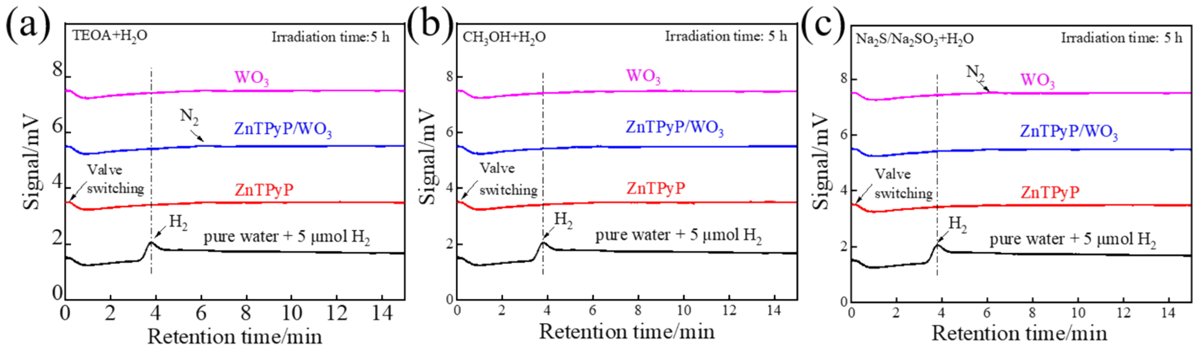

Figure S9. Representative gas chromatograph (GC) results of 1 mg photocatalysis using 50 mL different sacrificial electron donor solution with 1 wt% Pt loading: (a) 10 vol% triethanolamine (TEOA) aqueous solution, (b) 10 vol% of CH_3OH aqueous solution and (c) 0.35 M Na_2S/0.25 M Na_2SO_3 aqueous solution.

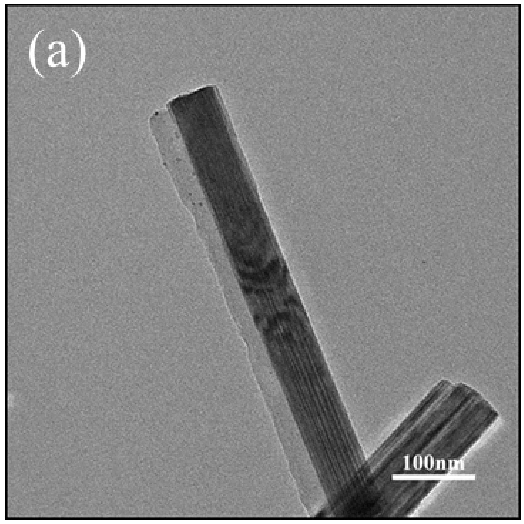

Figure S10. TEM of ZnTPyP/WO_3 nanorod-to-nanorod nanostructures with 1 wt.% Pt co-catalyst loading.

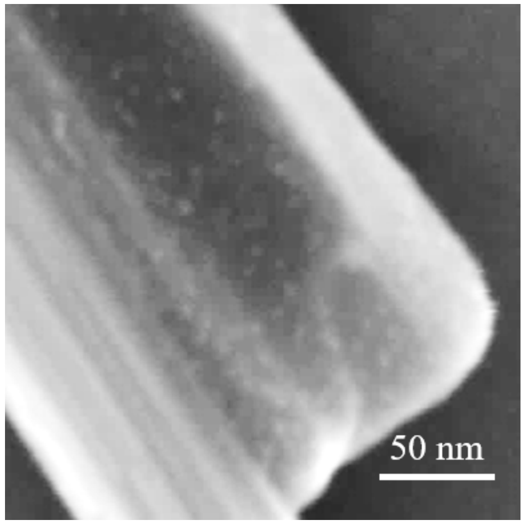

Figure S11. STEM of ZnTPyP/WO_3 nanorod-to-nanorod nanostructures with 5 wt.% Pt co-catalyst loading.