Supporting Information

Facile hydrothermal synthesis of CuO@ZnO heterojunction nanostructures for enhanced photocatalytic hydrogen evolution

Characterization

Crystallographic phases were studied on X-ray diffraction (XRD) D8 Advance Bruker with CuKα. The scan range was 2θ= 20^{o} to 70^{o}. Morphological and compositional studies were done with HRTEM (JEOL 2100 LaB6) operating at 200 kV where sample was dispersed in ethanol and a little was dropped on copper grid coated with carbon and dried. It was equipped with a CCD camera. Field emission scanning electron microscopic (FESEM) characterization was done on FEI Nova Nano SEM-450. The Brunauer–Emmett–Teller (BET) measurements by Nitrogen adsorption/ desorption isotherms were performed to investigate the surface characteristics at 77 K using a surface area analyzer (Quantachrome Instrument, USA; Model No. NOVA 1000e). The optical properties were characterized by using UV-vis diffuse reflectance spectroscopy (DRS) Perkin Elmer Lambda 750. XPS analysis was done on a KRATOS AXIS 165 with Mg Kα irradiation. About 10^{-9} Torr pressure was maintained in the spectrometer. Electrochemical Impedance Spectroscopy (EIS) studies were carried out in a computer-controlled potentiostat/galvanostat (CHI 608E, CH Instrument, USA). Linear sweep voltammetry (LSV) and electrochemical impedance studies in a three-electrode photoelectrochemical (PEC) cell were carried out on a scanning potentiostat (Metrohom, Autolab). 2.5 mg of photocatalyst powder was dissolved in 1ml of ethanol and 20 µL of Nafion (5 %) solution by ultrasonication. Indium tin oxide (ITO) coated PET (2 x 5 cm^2 area) was used as substrate on which 500 µL of prepared solution was injected and dried for 6 hrs. For reference, calomel electrode is used and a

platinum wire as the counter electrode. 0.1 M Na_2SO_4 as aqueous electrolyte were used. LSV scan were performed between – 0.6 V to 1.0 V vs saturated calomel electrode (SCE) at scan rate of 2 mV s^{-1}. For photocurrent measurements, the same ITO substrate electrode was used as photoanode. A LED ((model no. HP-FL-20W-F-Hope LED Opto-Electric Co., Ltd.) was used as the incident light source and placed at 10 cm distance from the electrochemical cell. Shimadzu GC-2014 with Molecular Sieve/5Å packed column with thermal conductivity detector using N_2 as carrier gas was employed for Gas analysis.

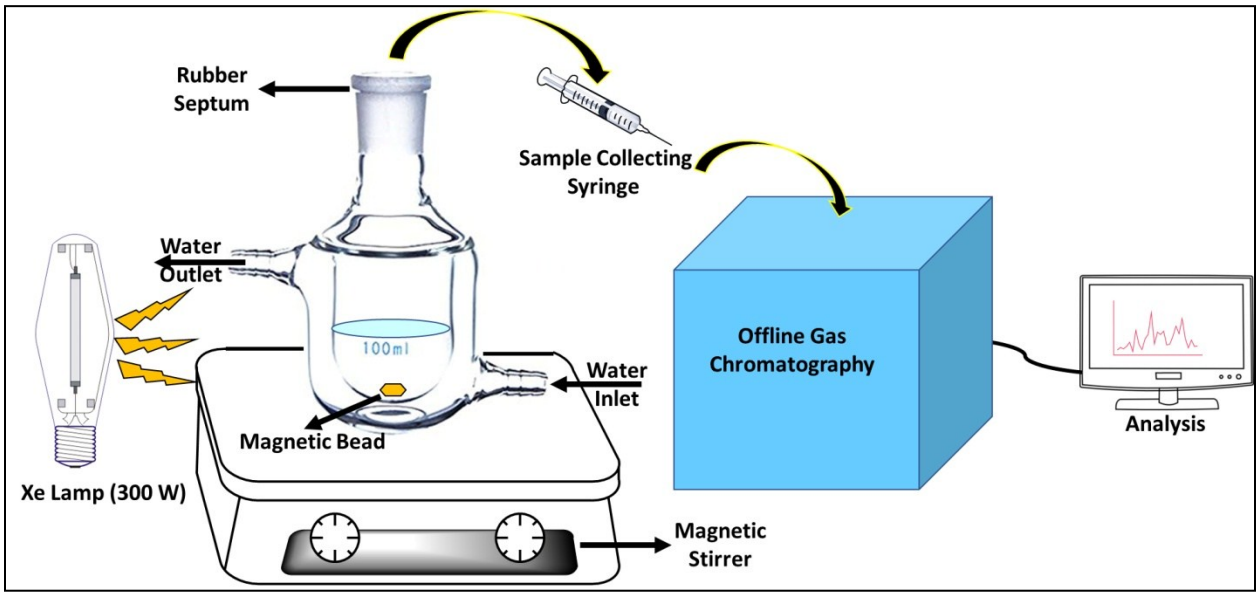

Figure S1. Schematic diagram demonstrating the apparatus for H_2 production.

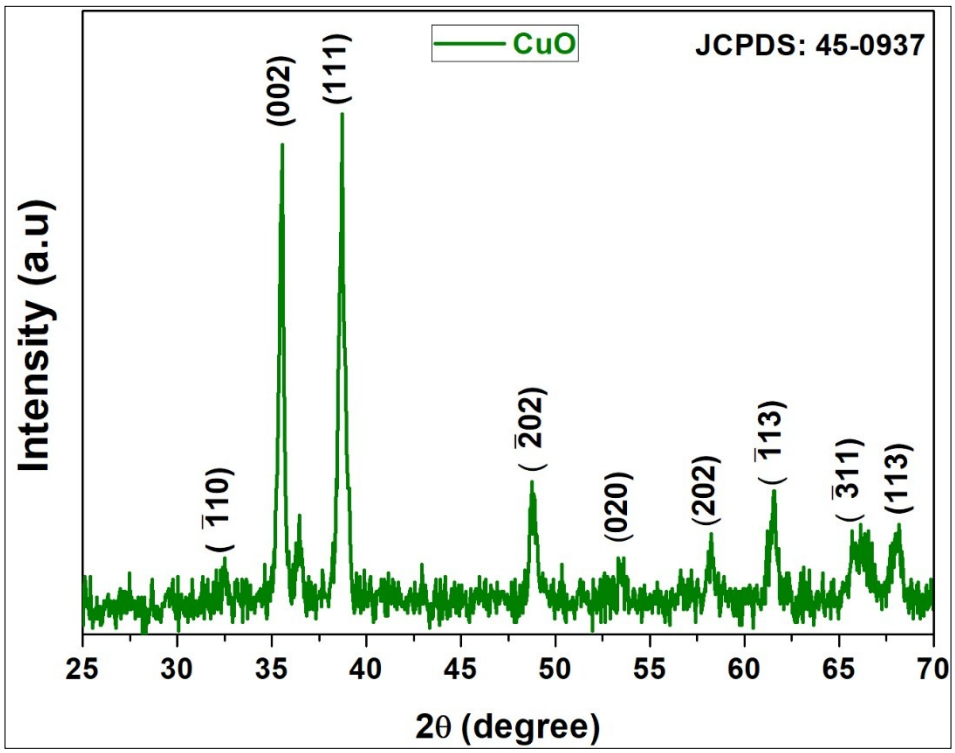

Figure S2. XRD pattern of CuO

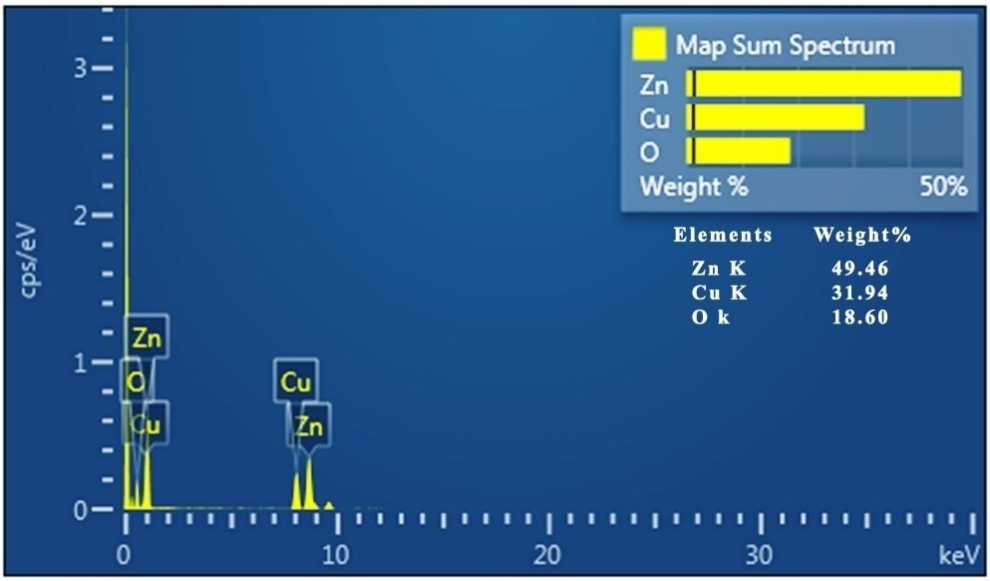

Figure S3. EDXS pattern for CuO@ZnO composite

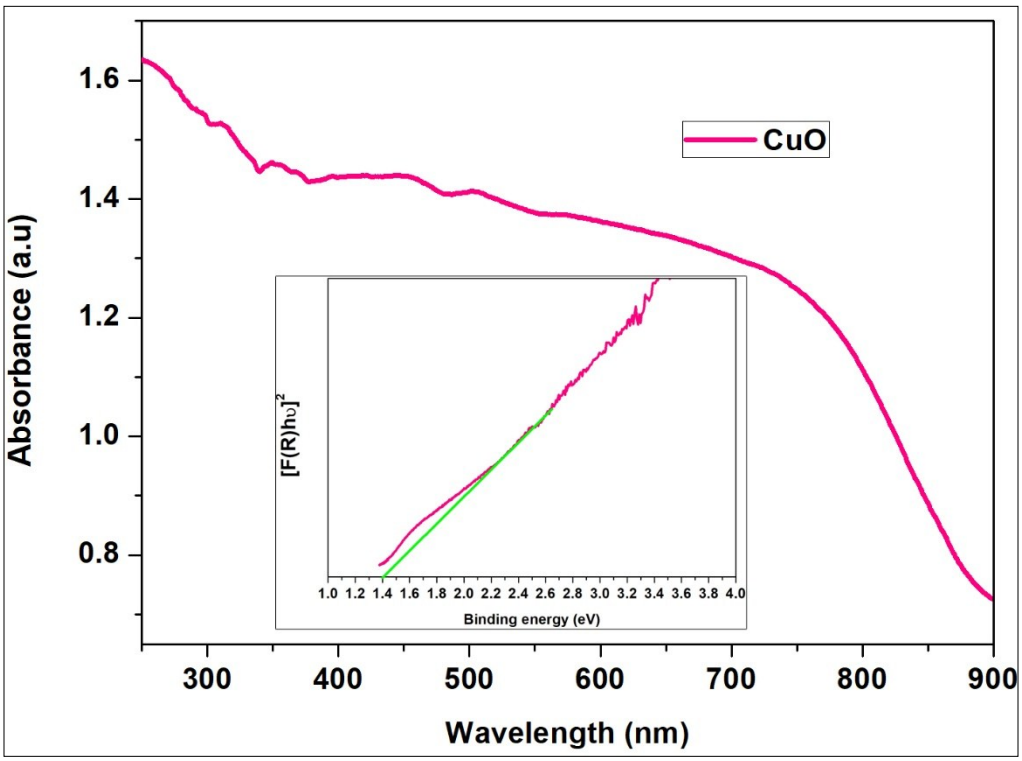

Figure S4. UV-DRS and Kubelka-Munk transformed reflectance spectra of CuO.

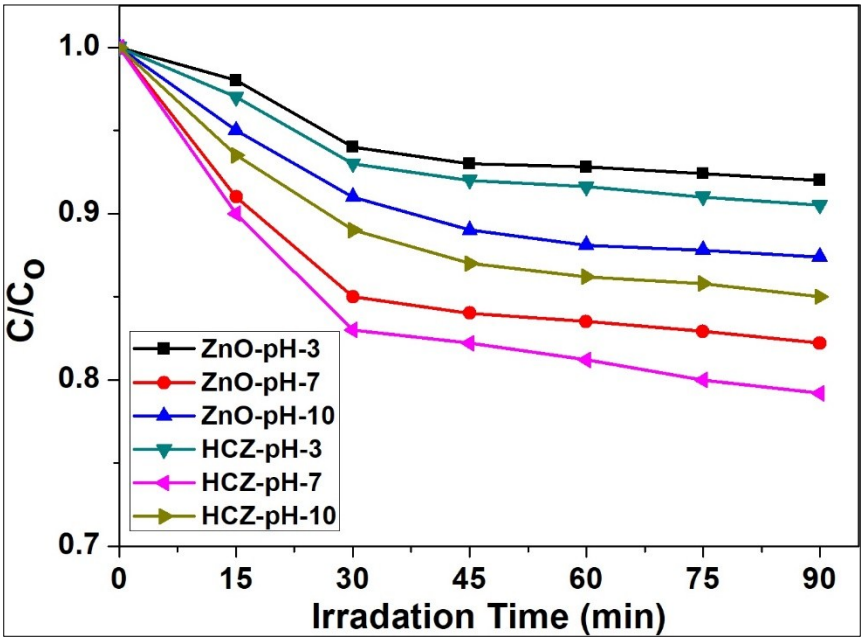

Figure S5. Adsorption–desorption equilibrium rate of MB under dark conditions versus time in the presence of various photocatalysts.

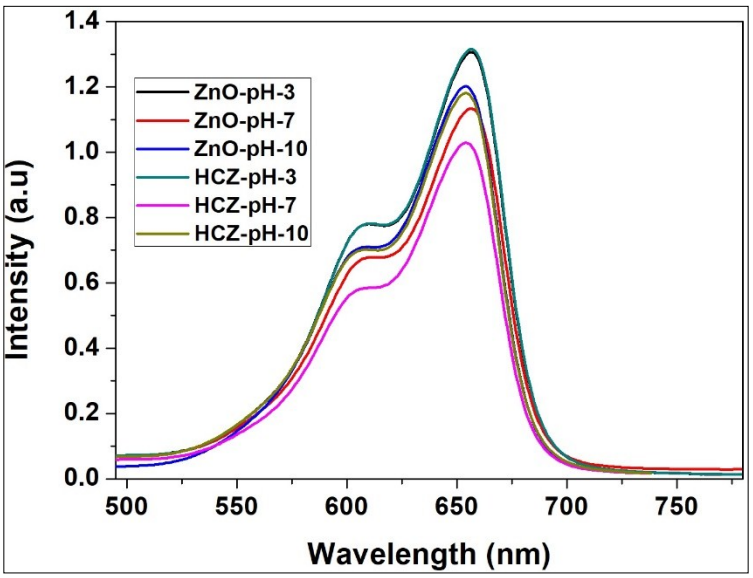

Figure S6. UV–vis absorption spectra of MB aqueous solution at 90-min dark adsorption–desorption equilibrium.

Table S1. Comparison table for the photocatalytic activity of different state of art photocatalyst with the CuO@ZnO photocatalyst.					
Photocatalyst	Sacrificial agent	Light Source	Catalyst (mg/mL)	Amount of H_2 ($\mu mol\ h^{-1}\ g^{-1}$ cat)	Ref
ZnO	$Na_2S + Na_2SO_3$	400 W Xe	20/75	341.9	1
ZnS/CdS	Triethylamine + ethanol	300 W Xe	25/100	375	2
ZnS/ZnO	$Na_2S + Na_2SO_3$	Sunlight	10/10	374	3
Cu-ZnO	Methanol	500 W Xe	20/30	33	4
CuO/ZnO "corn-like"	Methanol+ H_2O	400W High Pressure Hg	10/10	1700	5
CuO@ZnO	$Na_2S + Na_2SO_3$	300 W Xe	20/50	4604	Present Work

References

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