Supplementary Information

Hierarchical Microspheres of Mixed Metal Oxide Heterojunction with CuO and Ag/AgCl for Enhanced Photocatalytic Oxidation of Organic Pollutants and Hydrogen Production

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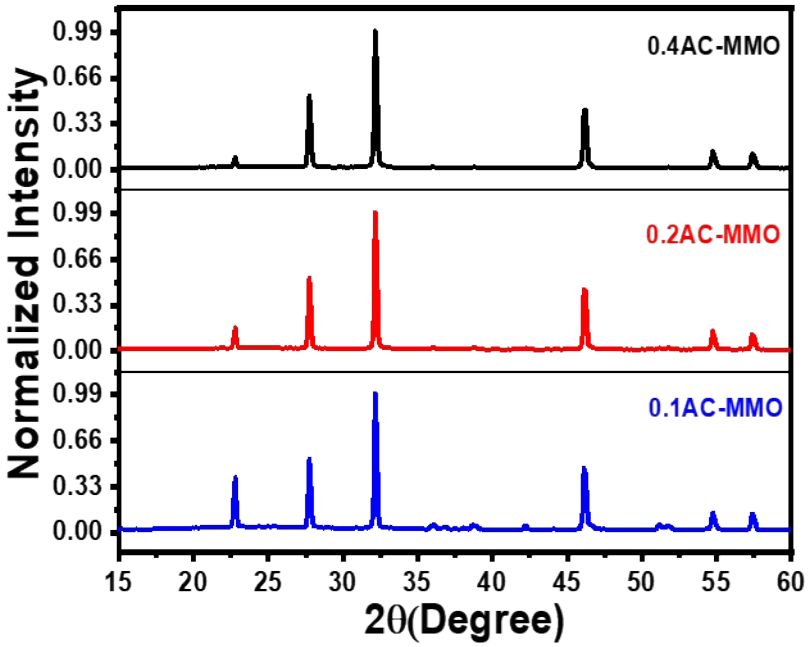


Figure S1. XRD pattern of synthesized AC-MMO using different molar ratios of $AgNO_3$ reaction on CuO/MMO.

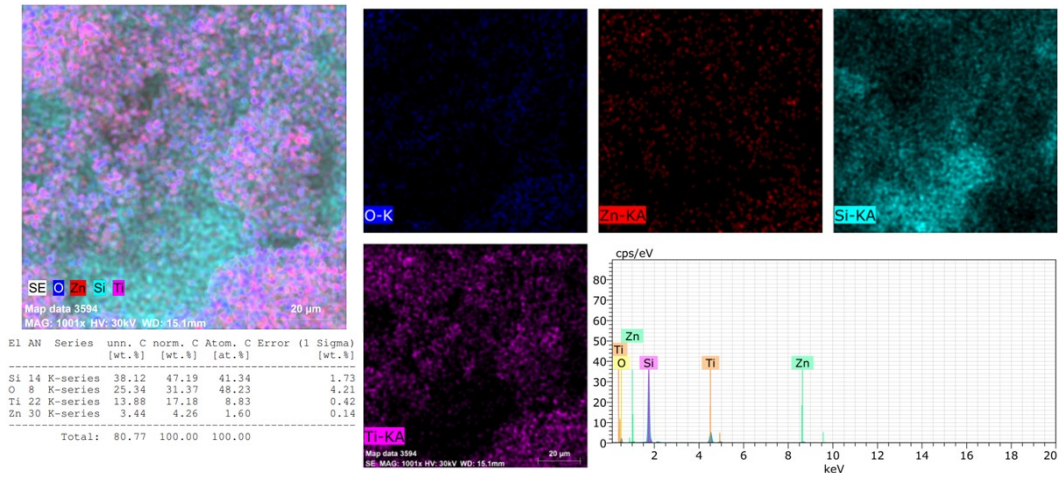


Figure S2. EDS and elemental mapping for MMO

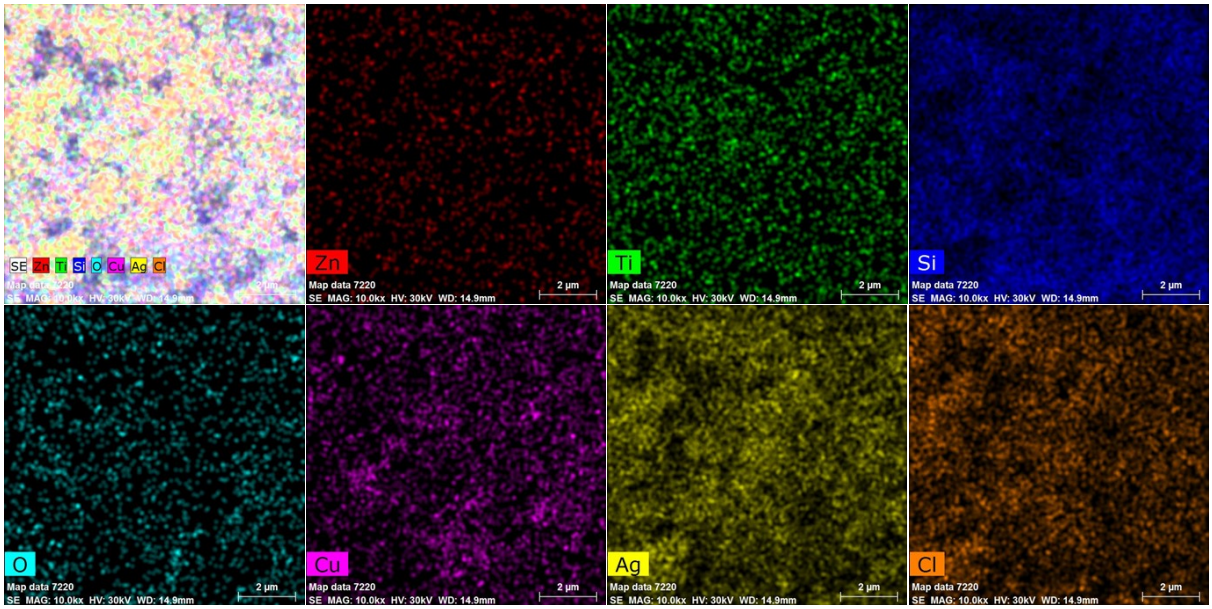


Figure S3. Elemental mapping of 0.2AC-MMO

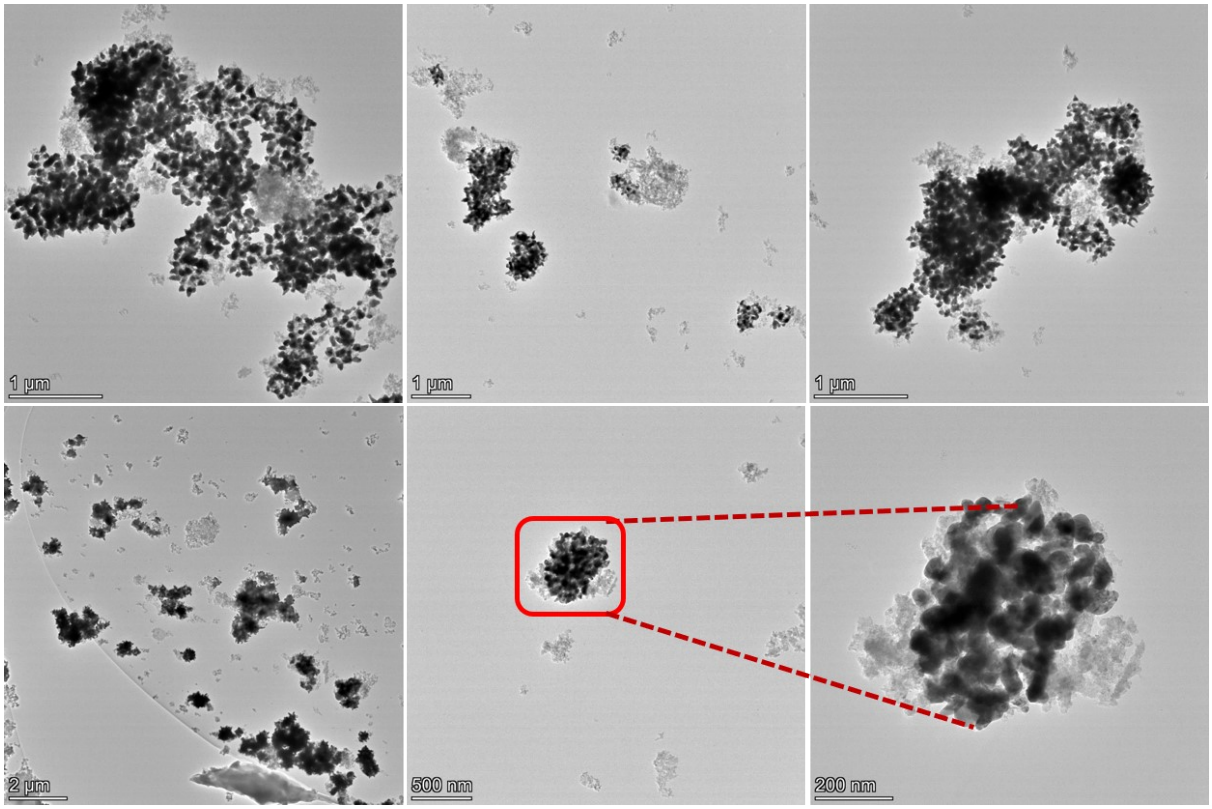
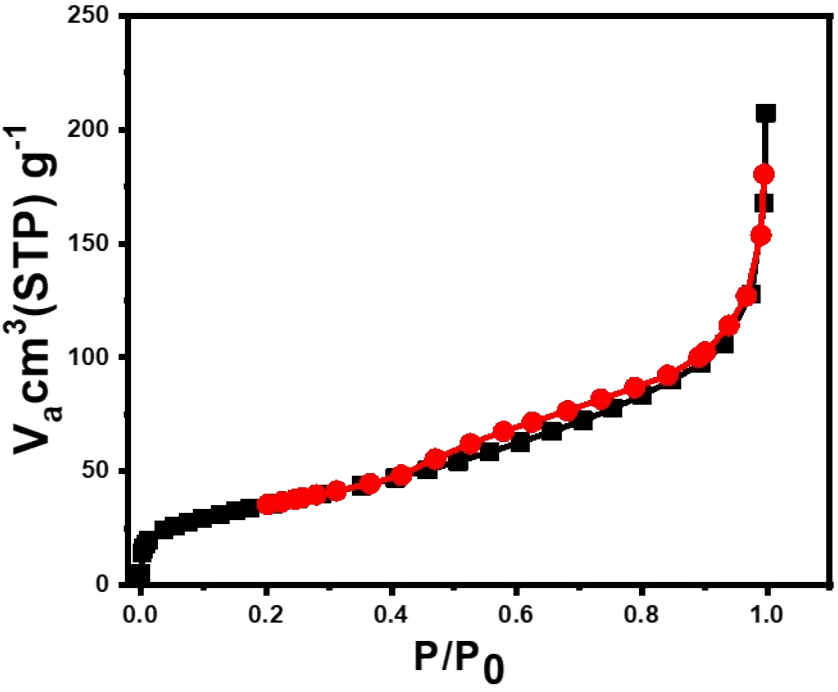


Figure S4. Additional TEM images of 0.2AC-MMO



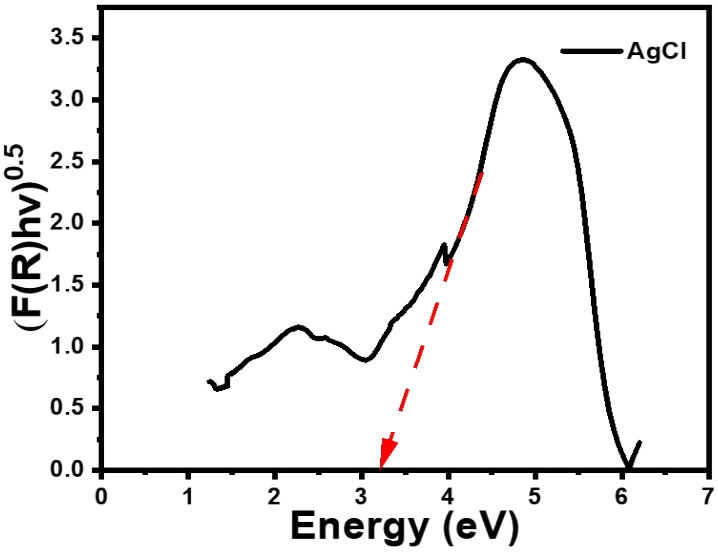


Figure S5. N_2 adsorption-desorption isotherms and pore size distributions of 0.2AC-MMO.

Figure S6. Tauc plots of $(\alpha h\upsilon)^{1/2}$ vs. $(h\upsilon)$ of AgCl.

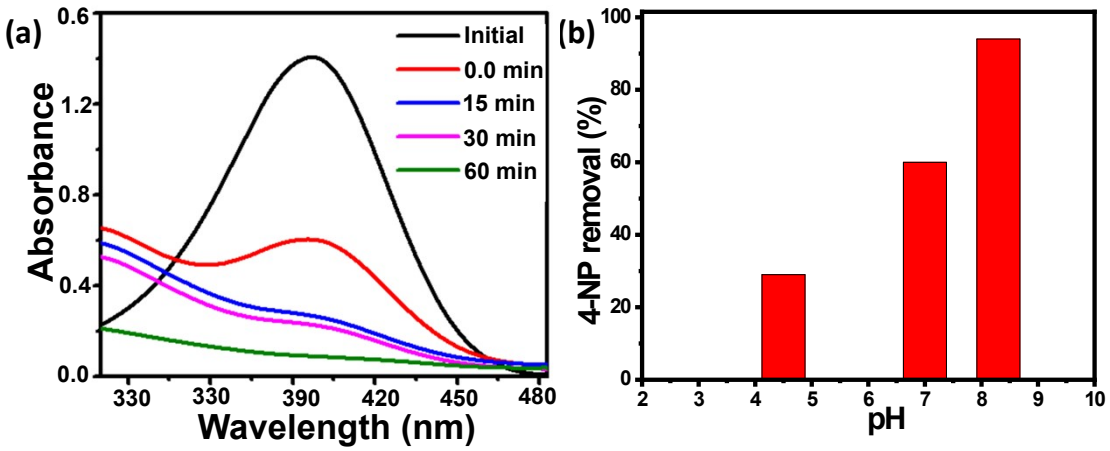


Figure S7. (a) UV–vis spectra for photodegradation of 20 ppm 4-NP in aqueous medium of pH 8.3 using catalyst 0.2 AC-MMO under Xe lamp irradiation, (b) Histogram of degradation of 4-NP under various pH conditions. (Note: The pH of 4-NP solution is varied by the addition of HCl and NaOH.)

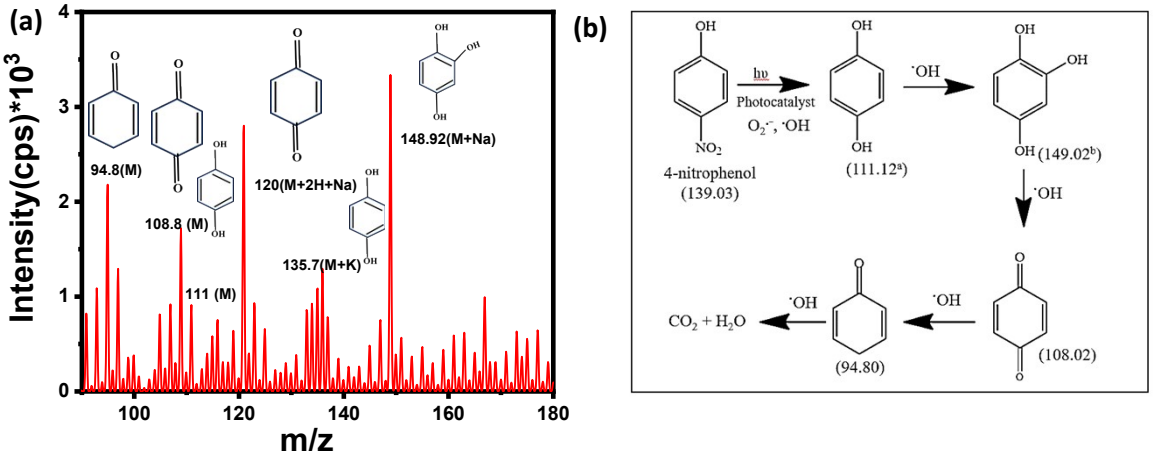


Figure S8. (a) LC-MS analysis of 4-NP degradation after 1h light irradiation (broad-spectrum), (b) Schematic depiction of the process involved in the degradation of 4-NP. The proposed degradation pathways via photogenerated species of photodegraded 4-nitrophenol (the corresponding m/z value of different intermediates identified by LC-MS.

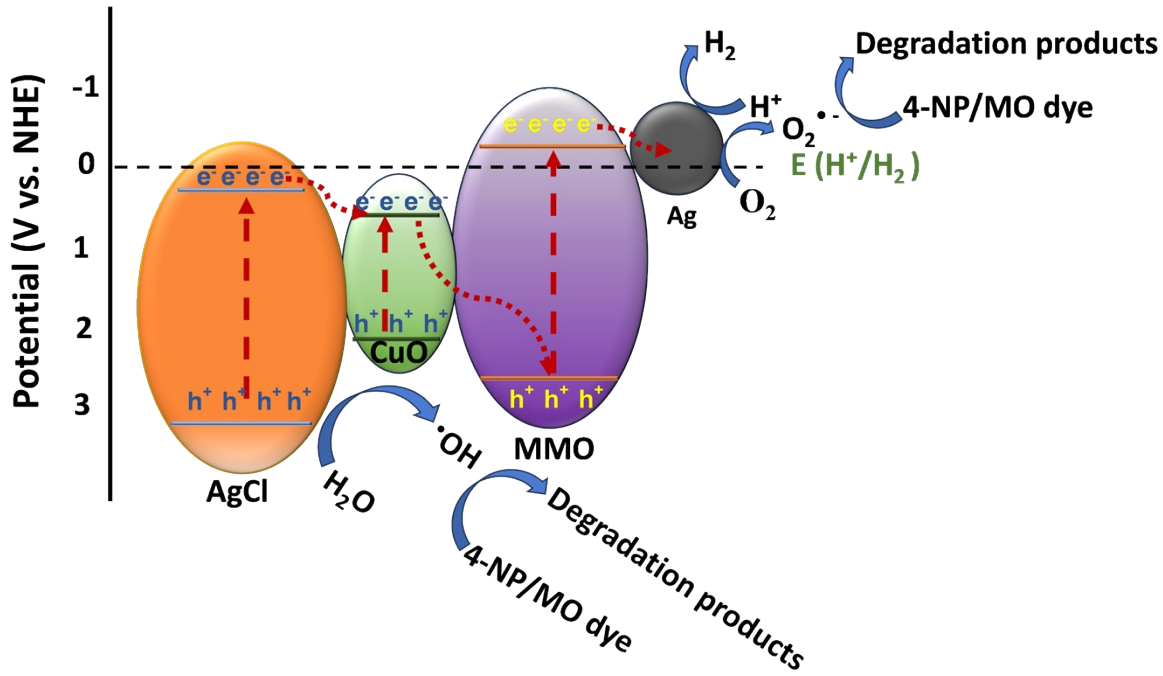


Figure S9. Proposed mechanism for UV-visible-light-induced photocatalytic reaction over the 0.2AC-MMO photocatalyst.

Table S1. Summary of different heterojunction photocatalysts reported for the removal of pollutants/hydrogen production under UV-visible irradiation.

S.No.	Catalyst	Irradiation source	Conditions/hole Scavengers	Removal (%)	H_2 Yield	Ref. #
1	Ternary metal oxide (ZnO:NiO: CuO) nanocomposite heterojunctions	Sunlight irradiation	MO dye Conc. 10 ppm Catalyst dose: 0.1 g L^{-1}	92 % removal in 90 min	----------	1
2	Ternary metal oxide CdO:TiO_2:ZnO	Visible light (>420 nm)	MO dye Conc. 10 ppm Catalyst dose: 5 g L^{-1}	99.6% removal	----------	2
3	Mn_3O_4/ZnO/Eu_2O_3	Sunlight	MO dye Conc. 5 ppm Catalyst dose: 0.2 g L^{-1}	96 % removal in 150 min	----------	3
4	Fe_3O_4/ZnO/Si_3N_4	Xe lamp visible light (>420 nm)	MO dye Conc. 50 ppm Catalyst dose: 20 mg	96 % removal in 90 min	----------	4
5	ZnO-Al_2O_3-CeO_2-Ce_2O_3 mixed oxide	UV irradiation	MO dye Conc. 40 ppm Catalyst dose: 0.02 g L^{-1}	98 % removal in 300 min	----------	5
6	In_2S_3/MoS_2/CdS heterostructures	300 W Xe Lamp (λ > 420 nm).	10 vol% lactic acid	----------	31.29 µmol g^{-1} h^{-1}	6
7	In_2S_3/Nb_2O_5/Nb_2C	1.5 AM filter (300 W Xe lamp)	10 vol % TEOA	----------	68.8 µmol g^{-1} h^{-1}	7
8	Ternary Ni-MOF-74/Ni_2P/MoS_x	5 W white light	15 vol % TEOA	----------	286.16 µmol within 5 h	8
9	Heterojunction CuO/WO_3/ CdS	300 W xenon lamp (λ > 420 nm)	MB dye Conc. 10 ppm Catalyst dose: 0.05 gL^{-1}	87.7 % removal in 4h	178 µmol/g in 4 h	9
10	$ZnIn_2S_4$/$BiVO_4$/MWCNTs nanocomposites	300 W Xenon lamp cutoff filter (λ > 400 nm	MB solution (10 ppm) Catalyst dose: 1 gL^{-1} /10 vol% CH_3OH	98% removal in 50 min	1621 µmol g^{-1} in 5 h	10

11	α-Fe_2O_3/CdS/g-C_3N_4 ternary photocatalyst	1000 W xenon lamp with solar light irradiation	MB solution Conc. 10 ppm Catalyst dose: 1 g L^{-1}/ 0.1 M Na_2S / 0.02 M Na_2SO_3	99.4% removal in 120 min	165 µmol g^{-1} in 2 h	11
12	0.2AC-MMO	Xe lamp Full spectrum	Photocatalytic degradation of MO dye. Conc. 20 ppm Catalyst dose: 1 g L^{-1}/ 10 vol% CH_3OH	90 % removal in 60 min	283 µmol $h^{-1}g^{-1}$	This work

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