Supporting Information

Oxygen-incorporated carbon nitride porous nanosheets for highly efficient photoelectrocatalytic CO_2 reduction to formate

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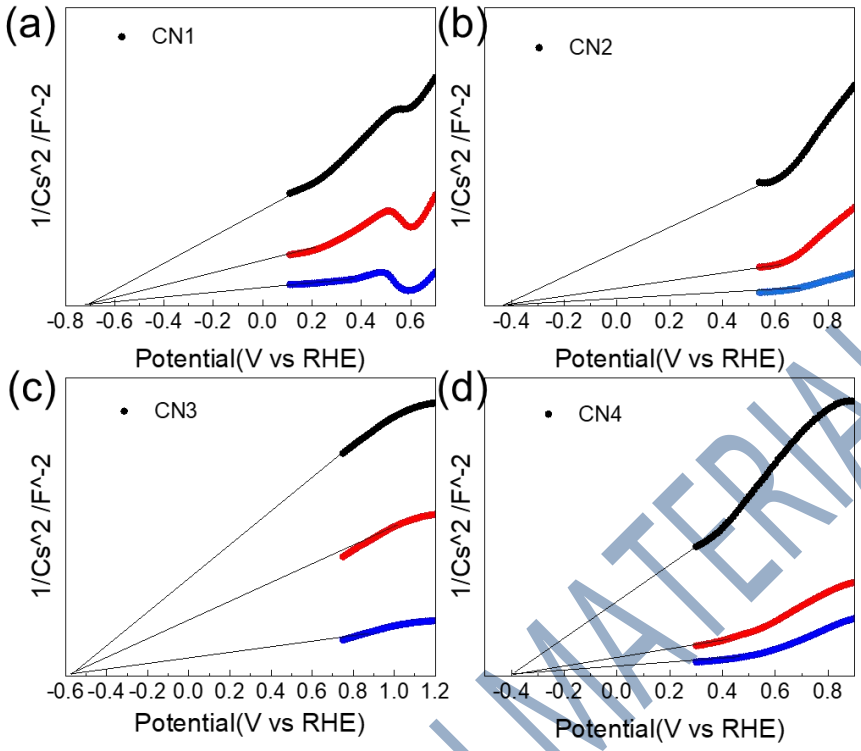

Figure S1. Mott-schottky curves of the CN samples, frequency 1000 Hz, 100 Hz, 10 Hz correspond to black, red, and blue curves, respectively.

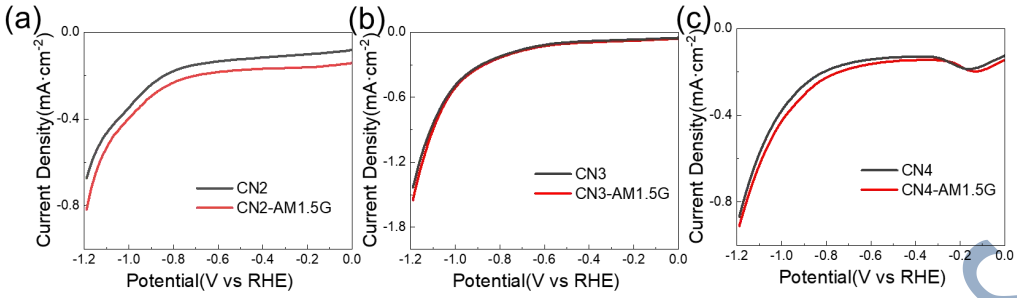

Figure S2. Photocurrent−potential curves of the CN2 (a), CN3 (b), and CN4(c) under dark (black line) and AM 1.5G illumination (red line).

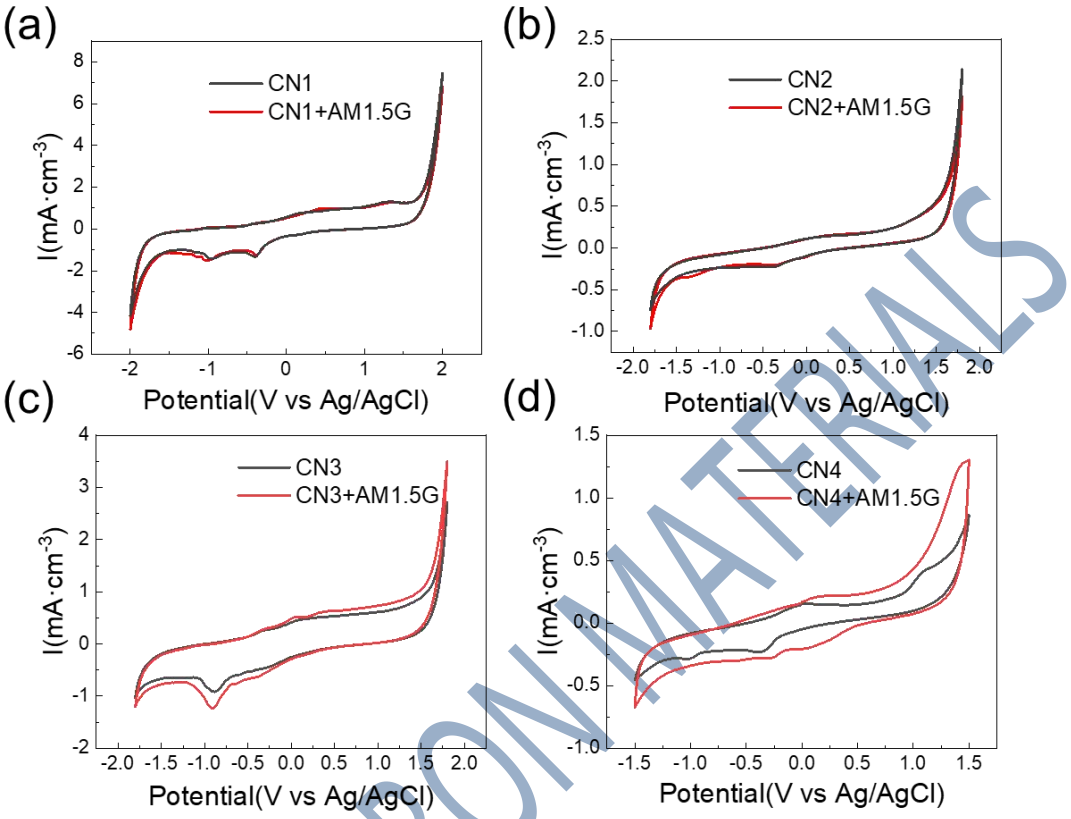

Figure S3. CV curves of the CN1 (a), CN2 (b), CN3 (c), and CN4 (d) under dark (black line) and AM 1.5G illumination (red line).

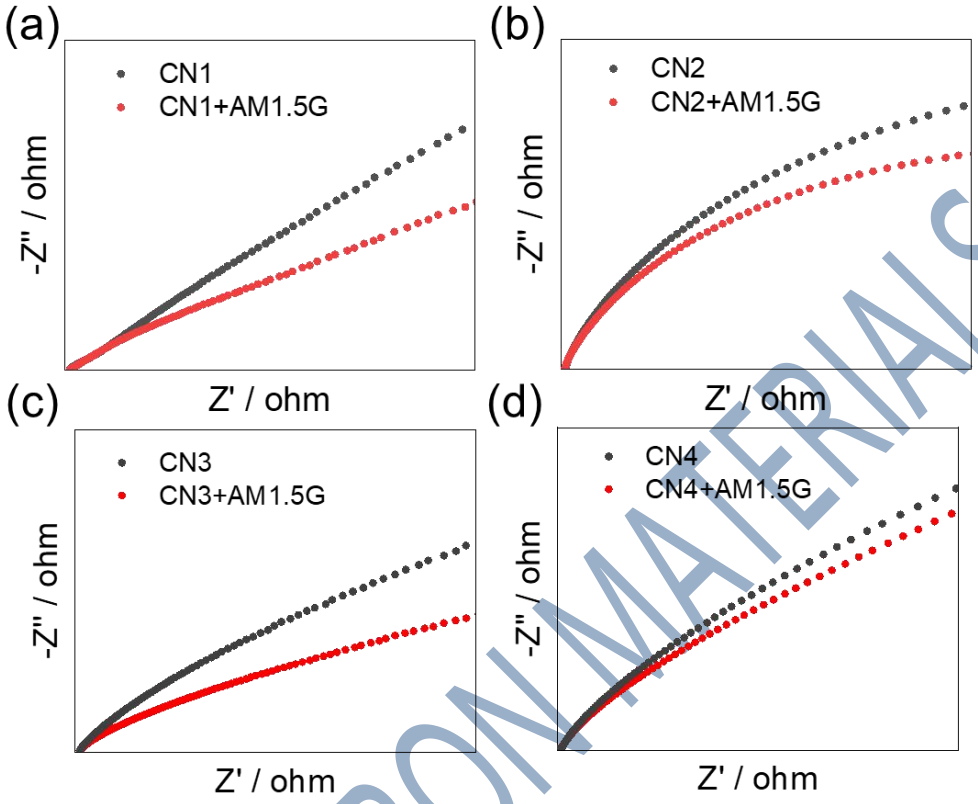

Figure S4. EIS curves of the CN1 (a), CN2 (b), CN3 (c), and CN4 (d) under dark (black line) and AM 1.5G illumination (red line).

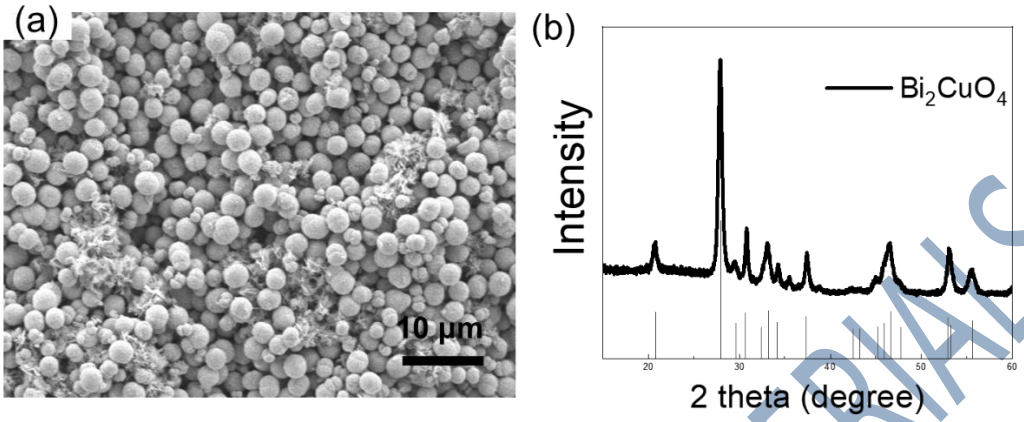

Figure S5. SEM image (a) and XRD pattern (b) of Bi_2CuO_4.

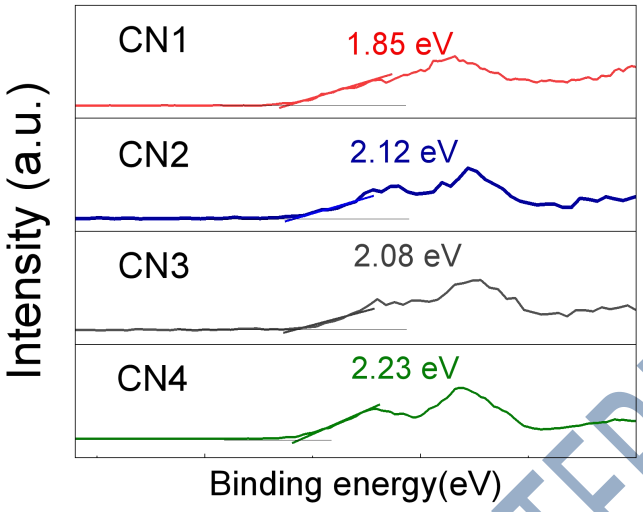

Figure S6. VB of XPS survey spectrum, the VB maximum values are according the photoelectric effect equation.

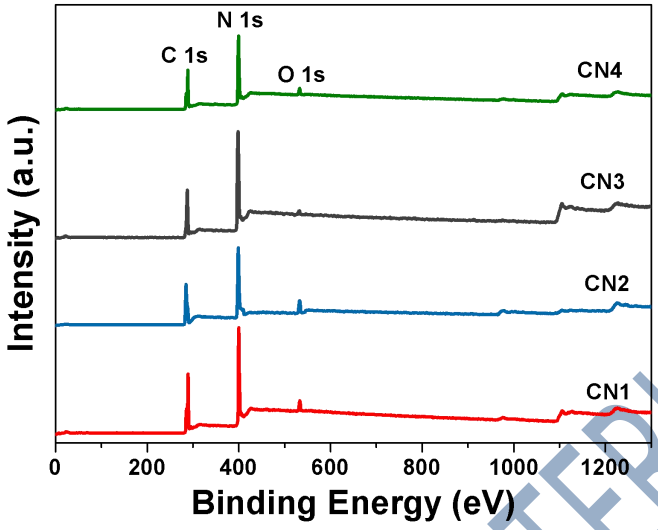

Figure S7. XPS spectra of CNs.

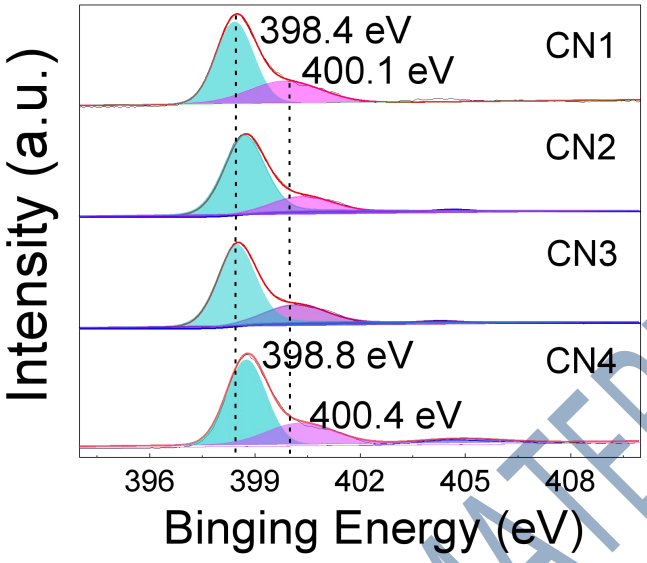

Figure S8. High-resolution N 1s XPS spectrum of CN samples.

Table S1. Comparison of the activities of CN samples with the reported photoelectrocatalysts for CO_2 reduction.

Catalysts	Electrolyte/Solvent	Activity	J(mA/cm^2)	Light source	Ref.
Ru-BNAH/TiO_2/Cu_2O	KCl (0.1 M)	51.2 μmol h^{-1} (8 mg)	-0.07 at -0.8 V_{SCE}	AM 1.5G (100 mW cm^{-2})	3
Ru($H_4P_2O_6$-C_2H_4-bpy)(CO)$_2$Cl$_2$/g-C_3N_4	acetonitrile and TEOA (4 : 1, v/v)	3.8 μmol h^{-1} (8 mg)		λ > 400 nm (30 mW cm^{-2})	4
g-C_3N_4/[Ru(bpy)$_2$(CO)$_2$Cl$_2$]	DMA and TEOA (4:1, v/v;)	8.5 μmol h^{-1} (4 mg)		λ > 400 nm	5
RuRu binuclear catalyst/Au/g-C_3N_4	DMA and TEOA (4:1, v/v;)	8.8 μmol g^{-1} h^{-1}		λ > 400 nm	6
p-n+ Si /GaN NWs	$KHCO_3$ (0.1 M)		−7.07 at −1.0 V_{RHE}	100 mW cm^{-2}	7
p$^+$-p-n$^+$ Si /GaN NWs/NiO	$NaHCO_3$ (0.05 M)		−1.18 at −0.25 V_{RHE}	AM 1.5G (100 mW cm^{-2})	8
2,2′-bipyridine Cu PCN films on TiO_2 NRs	$KHCO_3$ (0.5 M)	110±10 μmol h^{-1} at -1.2 V_{RHE}	15 at -1.2 V_{RHE}	50 W LED light	9
Cu_2O-Cu (GLD) CuO/NtTiO_2	$KHCO_3$ (0.5 M)		0.2 at -0.9 V_{RHE}	AM 1.5G	10
p-type SiNWs	$KHCO_3$ (0.1 M)	58 μmol h^{-1} cm^{-2} at -1.2 V_{RHE}	−3.6 at -1.2 V_{RHE}	AM 1.5G (100 mW cm^{-2})	11
Ti_3C_2/g-C_3N_4	$KHCO_3$ (0.1 M)	50.2 μmol h^{-1} cm^{-2} at -0.85 V_{RHE}	0.85	200 mW cm^{-2}	12
7%-(Cu, N)-SnO_x	$NaHCO_3$ (0.5 M)		0.002	λ > 420 nm	13
CoTPP/ g-C_3N_4 Pt	KCl (0.1 M)	154.4 μmol h^{-1}	0.026	AM 1.5G (100 mW cm^{-2})	14
Cu–Co_3O_4 NTs Pt	Na_2SO_4 (0.1 M)	84.4 μmol h^{-1}	0.122 at -0.9 $V_{Ag/AgCl}$	λ > 420 nm (10 mW cm^{-2})	15
TiO_2/ 2D Ti_3C_2 BiVO4	$KHCO_3$ (0.5 M)	73.6 μM cm^{-2} h^{-1}	1 at − 0.7 V V_{SCE}	300 UV (200 mW cm^{-2})	16
Bi_2CuO_3 g-C_3N_4	$KHCO_3$ (0.5 M)	273.56 μM cm^{-2} h^{-1}	0.587 at -0.9 V_{RHE}	AM 1.5G (100 mW cm^{-2})	This work

Table S2. The element contents of C, N and O in the four catalysts.

Catalysts	C	N	O
CN1	47.04	49.60	3.36
CN2	45.74	43.93	10.33
CN3	47.41	48.74	3.85
CN4	47.82	48.10	4.08

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