Supporting Information on

Photocatalytic 4-nitrophenol degradation and oxygen evolution reaction in CuO/g-C_3N_4 composites prepared by deep eutectic solvent assisted chlorine doping

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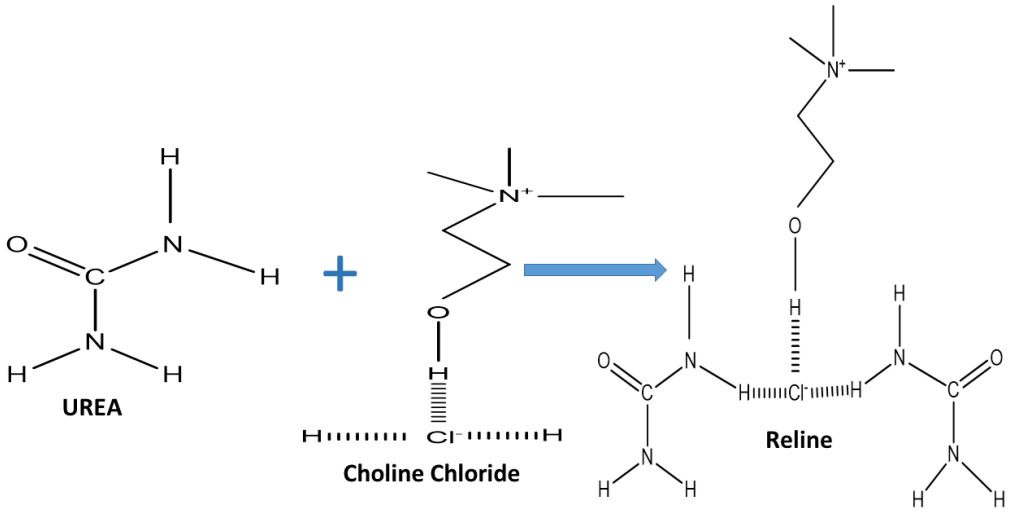

Scheme S1. Molecular structural formation of Reline

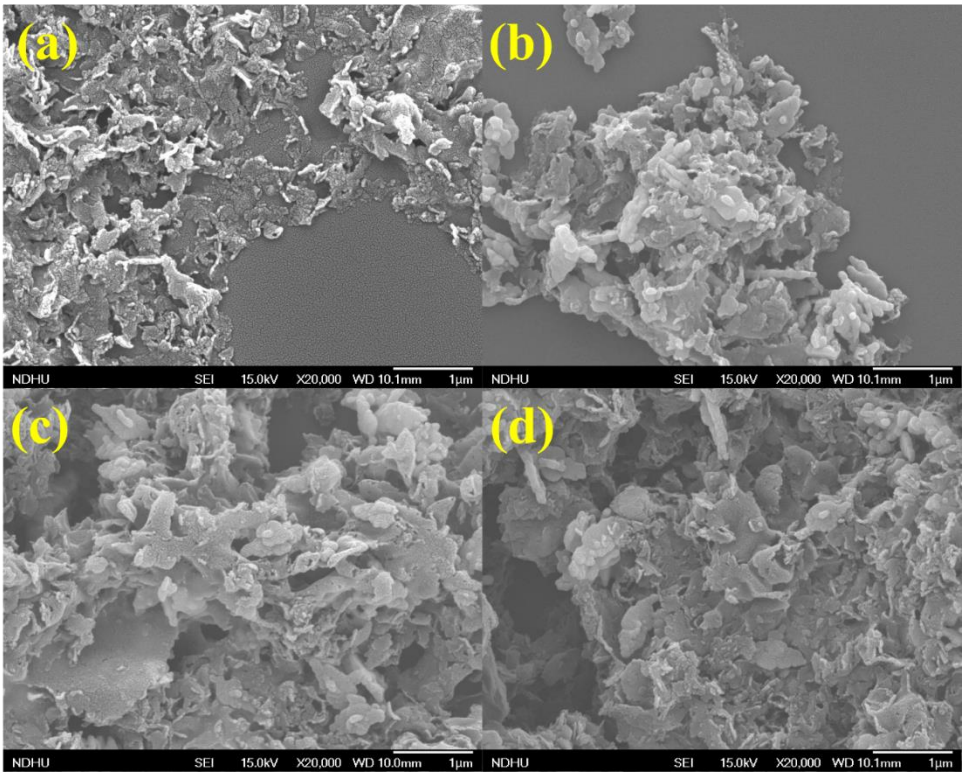

Fig. S1. FESEM images of (a) g-C_3N_4, (b) CuO/gCN 2:1, (c) CuO/gCN 1:1 and (d) CuO/gCN 1:2.

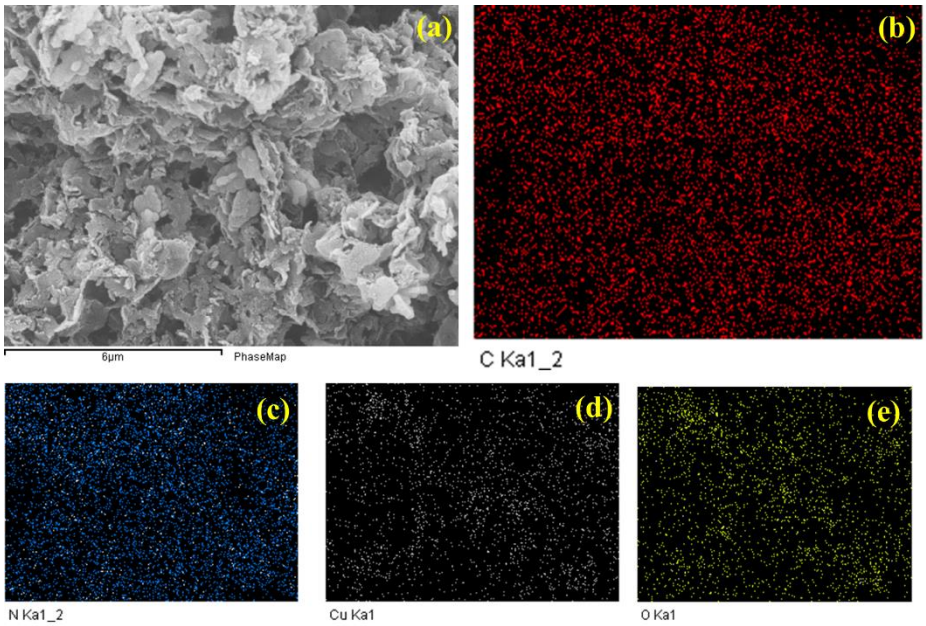

Fig. S2. FE-SEM elemental mapping Cl-CuO/ g-CN(1:2), (a) FE-SEM image, (b) C, (c) N, (d) Cu and (e) O

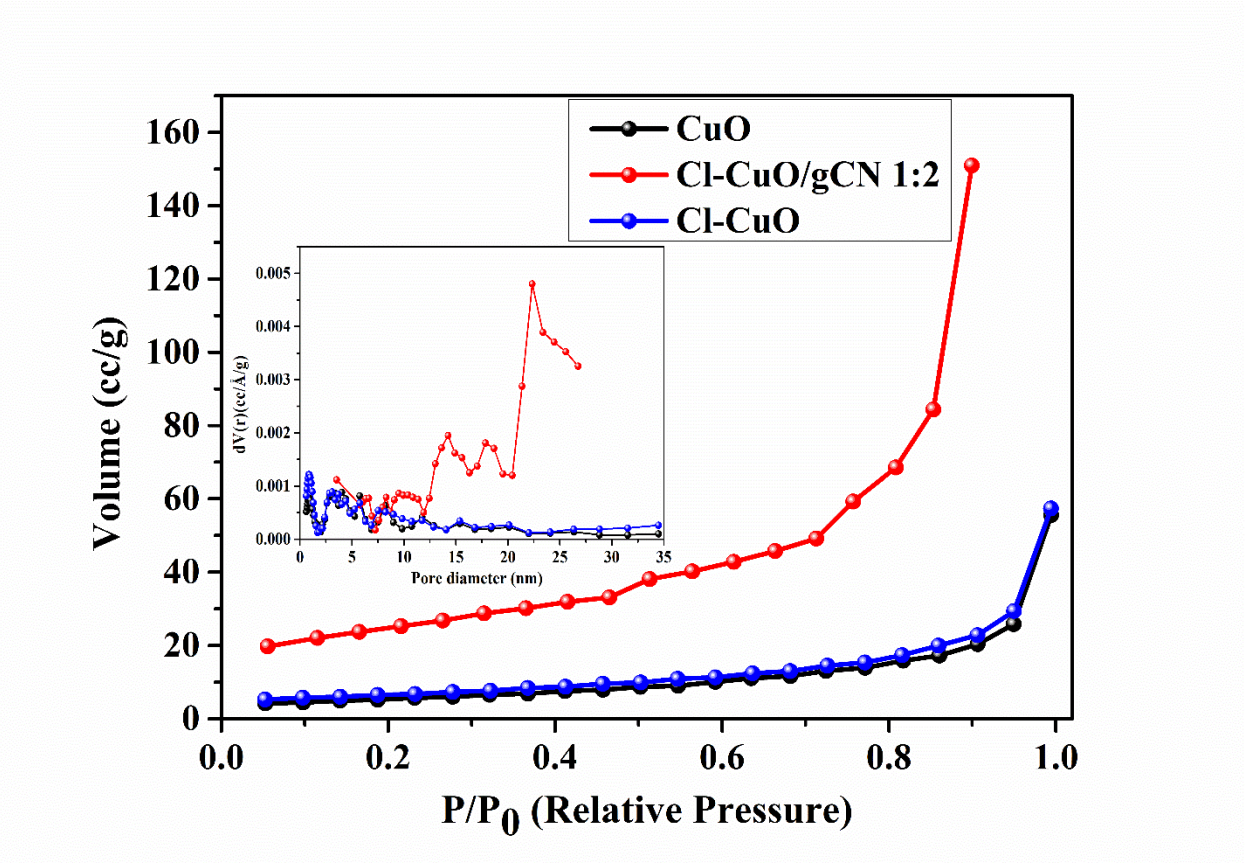

Fig. S3. BET and pore size distribution of CuO. Cl-CuO and Cl-CuO/g-CN (1:2)

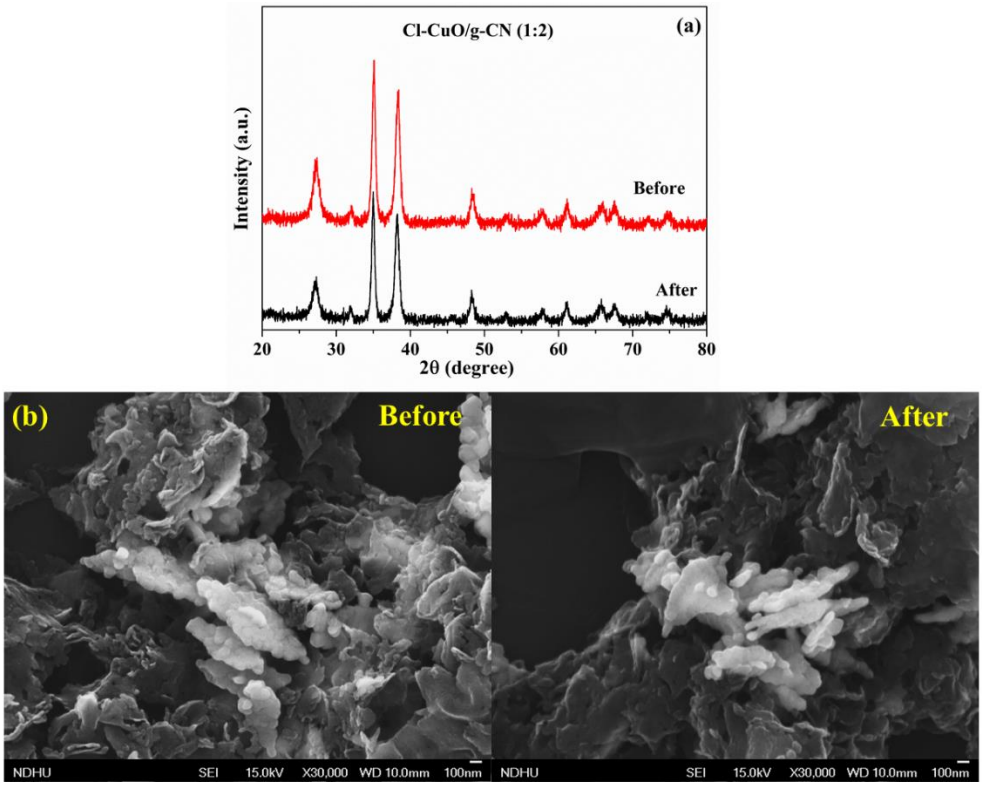

Fig. S4. XRD spectra of Cl-CuO/g-CN (1:2) before and after recycle test of 4-NP degradation (a), FE-SEM images before and after recycle test (b)

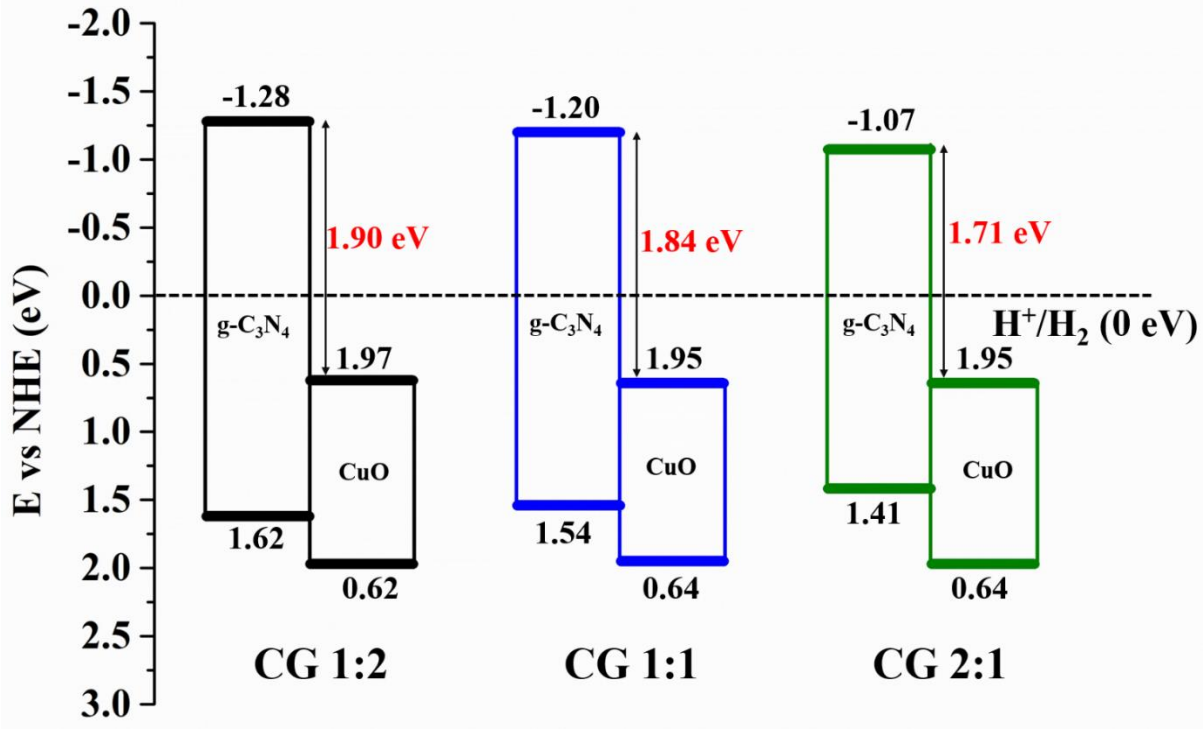

Fig. S5. Comparison of band edge potentials (E vs NHE) among various ratio of Cl-CuO/g-C_3N_4 composite (CG = Cl-CuO/g-CN)

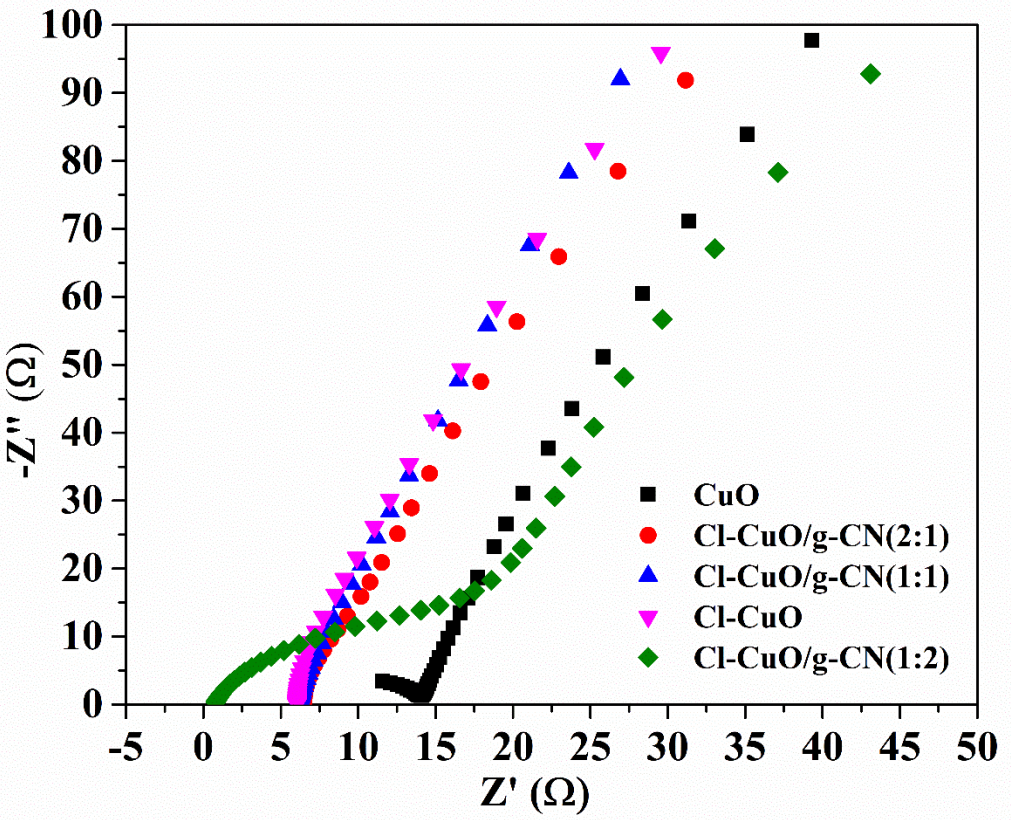

Fig. S6 Electrochemical impedance spectra of Cl-CuO/g-CN composites and CuO

Table S1. Band gap energy calculations of prepared composites

Photocatalysts	**$(\alpha h\nu)^2$ vs hν Band gap (eV)**		**$(\alpha h\nu)^{1/2}$ vs hν Band gap (eV)**		**Absorbance vs wavelength Band gap (eV)**	
	g-CN	Cl-CuO	g-CN	Cl-CuO	g-CN	Cl-CuO
Cl-CuO/g-CN (1:2)	2.90	1.35	2.24	0.85	2.57	1.16
Cl-CuO/g-CN (1:1)	2.74	1.31	-	0.73	2.33	1.15
Cl-CuO/g-CN (2:1)	2.49	1.31	-	0.77	-	1.15
Cl-CuO	-	1.30	-	0.66	-	1.14
g-C_3N_4	2.98	-	2.62	-	2.81	-

Table S2. Calculated relative contribution percentages of lifetimes t_1 and t_2 and their values.

Sample	**A_1 (rel. %)**	**t_1 (ns)**	**A_2(rel. %)**	**t_2 (ns)**	**t_{av} (ns)**
CuO/gCN 1:2	99.3	1.78	0.66	8.14	1.82
g-C_3N_4	97.9	3.28	2.0	16.38	3.54

Table S3. Calculated rate constant values of the prepared photocatalytic composites

Photocatalysts	**Rate Constant k ($\times 10^{-2}$ min^{-1})**
Cl-CuO/g-CN (1:2)	2.74
Cl-CuO/g-CN (1:1)	1.76
Cl-CuO/g-CN (2:1)	1.65
Cl-CuO	1.74
g-C_3N_4	0.53
H_2O_2+light	0.53

Table S4. Calculated values of activation energy, enthalpy, entropy and Gibbs free energy by photodegradation at different temperatures

Temperature (°C)	**E_a (KJ mol^{-1})**	**ΔH (KJ mol^{-1})**	**ΔS (KJ $mol^{-1}K^{-1}$)**	**ΔG (KJ mol^{-1})**
30	**37.87**	**35.26**	**-0.236**	**106.8**
40				**109.1**
50				**111.5**

Table. S5 Comparison of photo-oxidation of 4-Nitrophenol with previous reports.

Photo Catalyst	**Catalyst amount (mg)**	**4-NP concentration**	**Light source**	**Degradation % & Time (min)**	**Recycle test**	**Reference**
GO/TiO2	100 mg	10 ppm	150 W Hg Lamp	59.5% & 120 min	---	[1]
TNTs: $CoFe_2O_4$/TCF	100 mg	10 ppm	4 Sylvania TLD 15 W/08 UV-A lamps	100% & 35 min	5 cycles	[2]
Ag–OMS-C	10 mg in 20 µL	0.10 mM in 2 mL	------	96% & 120 s	5 cycles	[3]
Ag@TPHH-COF	4 mg	0.4 mM	----	100% & 150 s	6 cycles	[4]
MCNF@$NiCo_2O_4$	2 mg	0.01 M in 25 µL	----	100% & 45 min	20 cycles	[5]
Pt@Ag NPs	1.0 mg mL^{-1}	0.10 mM)	----	100% & 8 min	5 cycles	[6]
Cl-CuO/g-C_3N_4	10 mg	20 ppm (50 ml)	35 W Xe	100 min & 92.8%	5 cycles	This work

Table S6 Calculated values of Current density, onset potential and over potential

Photocatalysts	**Onset potential (V)**	**Over potential (V)**	**Current density (mA cm^{-2})**
Cl-CuO/g-CN (1:2)	2	0.77	33.11
Cl-CuO/g-CN (1:1)	2.20	0.97	24.29
Cl-CuO/g-CN (2:1)	2.22	0.99	19.29
Cl-CuO	2.12	0.89	30
CuO	2.28	1.05	9.7

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