

Exploration of electrocatalytic activity of nonlinear optically active CuWO₄/g-C₃N₄ nanocomposites

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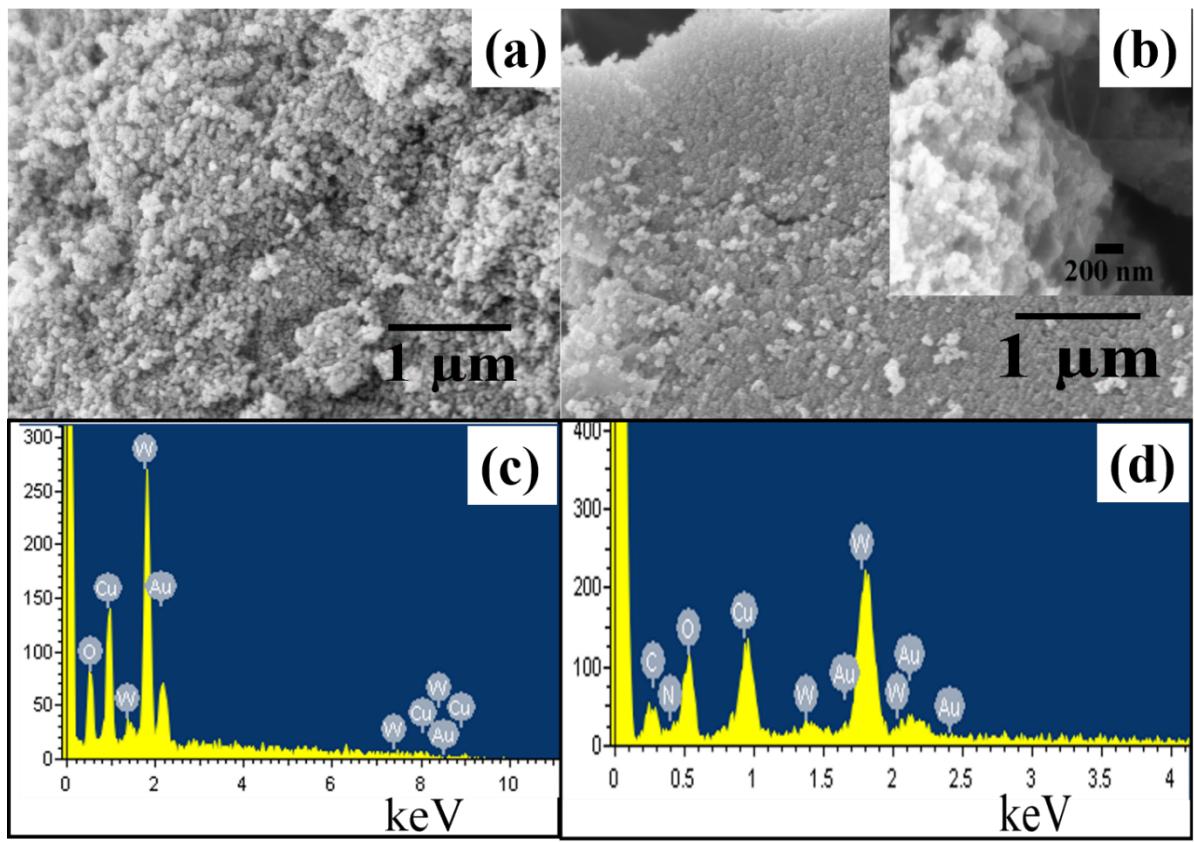


Fig. S1. (a, b) SEM micrographs of CuW and CuW/ gCN respectively (inset: high magnification) (c, d) their respective EDS spectra.

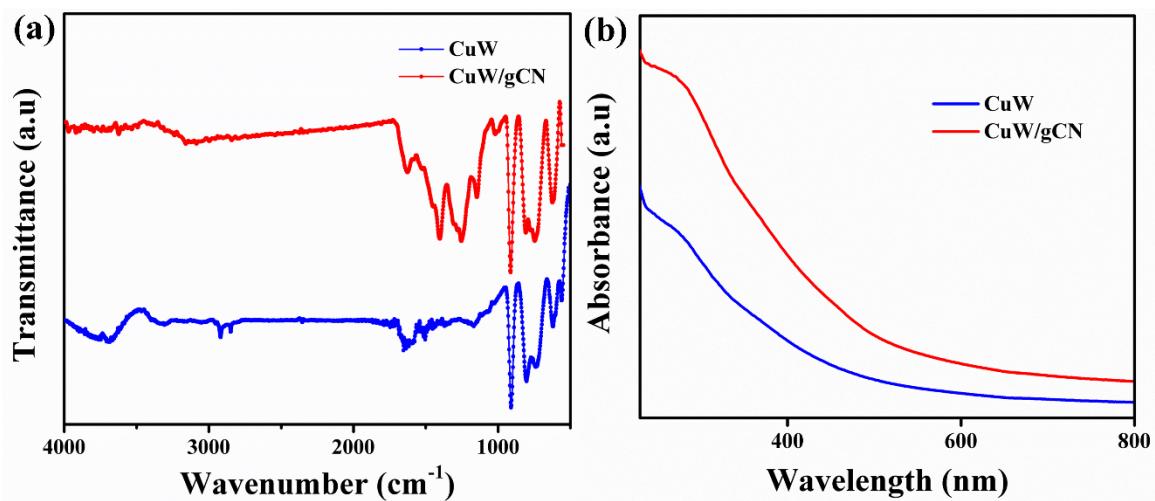


Fig. S2. (a) FTIR transmittance (4000-500 cm⁻¹) and (b) UV-Visible absorption spectra of CuWO₄ and CuW/gCN samples.

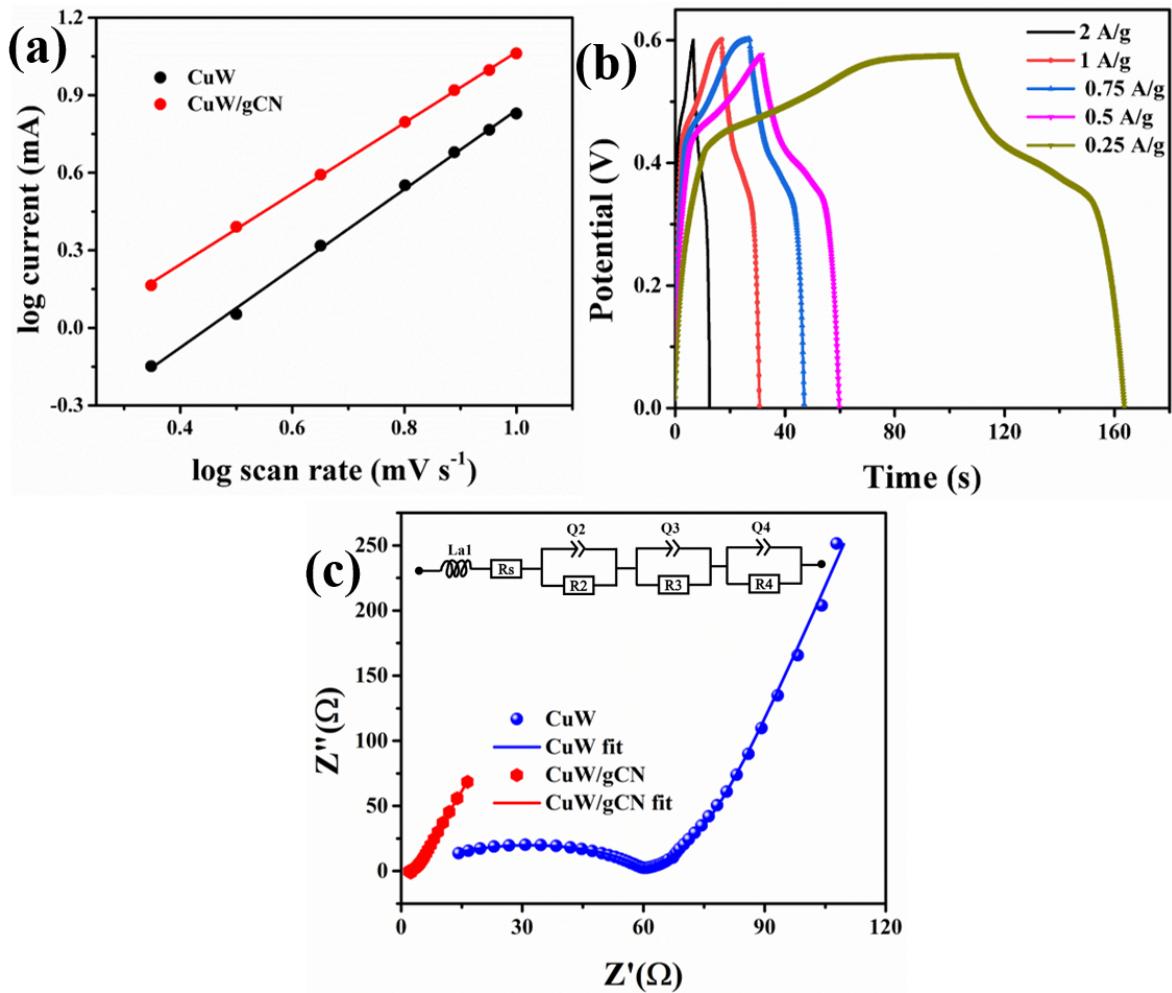


Fig. S3. (a) Dependence of cathodic peak current with scan rate (log v – log i plot) (b) GCD curves of CuW at different current densities (c) EIS Nyquist plots of CuWO₄ and CuW/gCN samples.

Table S1. Supercapacitive parameters of CuWO₄/g-C₃N₄ compared with tungstate materials.

Material	Synthesis	Capacitance (F/g)	Capacity Retention (%)	References
ZnWO ₄	Microwave irradiation	72	70 (10000 cycles)	[1]
CuWO ₄	Microwave irradiation	10.06	—	[2]
ZnFe ₂ O ₄ /rGO	Hydrothermal	33.6	—	[3]
CuWO ₄ /rGO	Hydrothermal	35.71	100 (1000 cycles)	[4]
CuW/gCN	Microwave irradiation	111	85 (10000 cycles)	Present work

Table S2. Comparison of few recently reported HER electrocatalysts.

Material	Synthesis	Electrolyte	Overpotential (mV)	Tafel (mV/dec)	References
NiWO ₄ /NWS	Hydrothermal	1M KOH	400	66	[5]
CoMn ₂ O ₄ /NNF	Hydrothermal	1M KOH	318	135.19	[6]
CoNi _x O ₄	Hydrothermal	1M KOH	259	131.6	[7]
W ₁₈ O ₄₉ /NiWO ₄	Hydrothermal	1M KOH	280	101	[8]
MoS ₂ /COF/C ₄ N	Hydrothermal	1M KOH	358	-	[9]
CuW/ppy	Hydrothermal	1M KOH	250	50	[10]
PPy/ZnWO ₄	Hydrothermal	0.5 M H ₂ SO ₄	543	76	[11]
CuWO ₄	Hydrothermal	0.5 M H ₂ SO ₄	574	-	[12]
CuW/gCN	Microwave irradiation	0.5 M H ₂ SO ₄	143	46	Present Work

Table S3. Electrocatalytic OER performance of recently reported tungstate materials.

Material	Synthesis	Electrolyte	Overpotential (mV)	Tafel (mV/dec)	References
ZnWO ₄ Nbs	Hydrothermal	1M KOH	475	140	[13]
ZnWO ₄	Hydrothermal	1M KOH	636	155	[11]
CoMoO ₄	Hydrothermal	1M KOH	765	110	[14]
CoWO ₄			810	107	
W ₁₈ O ₄₉ /NiWO ₄	Hydrothermal	1M KOH	250	85	[8]
MoS ₂ /COF/C ₄ N	Hydrothermal	1M KOH	349	-	[9]
CuWO ₄ /rGO	Hydrothermal	0.5M KOH	270	110	[15]
CuW/gCN	Microwave irradiation	1M KOH	430	104	Present Work

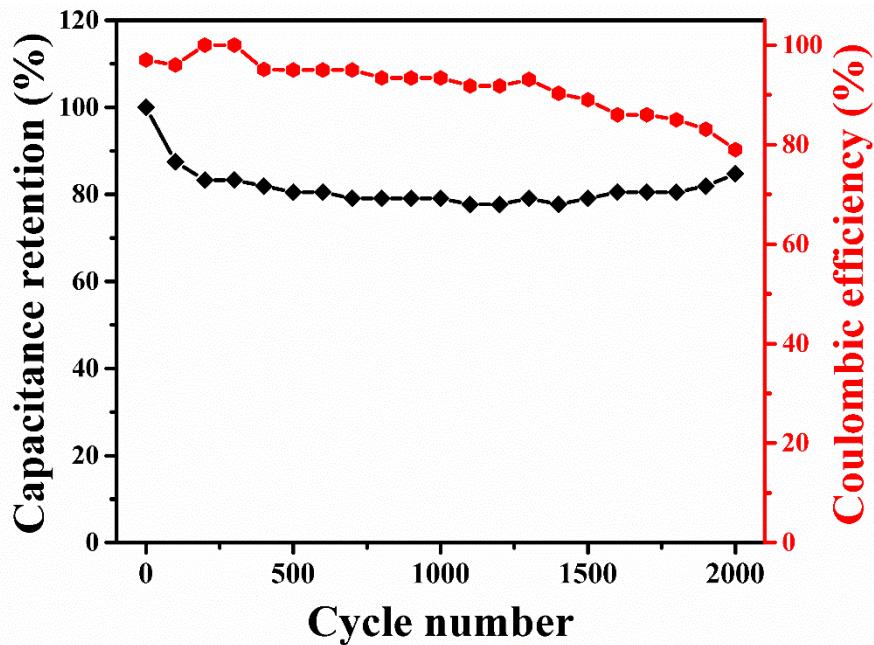


Fig. S4. Capacitance retention (black diamonds) and Coulombic efficiency (red hexagons) of the CuW/gCN electrode.

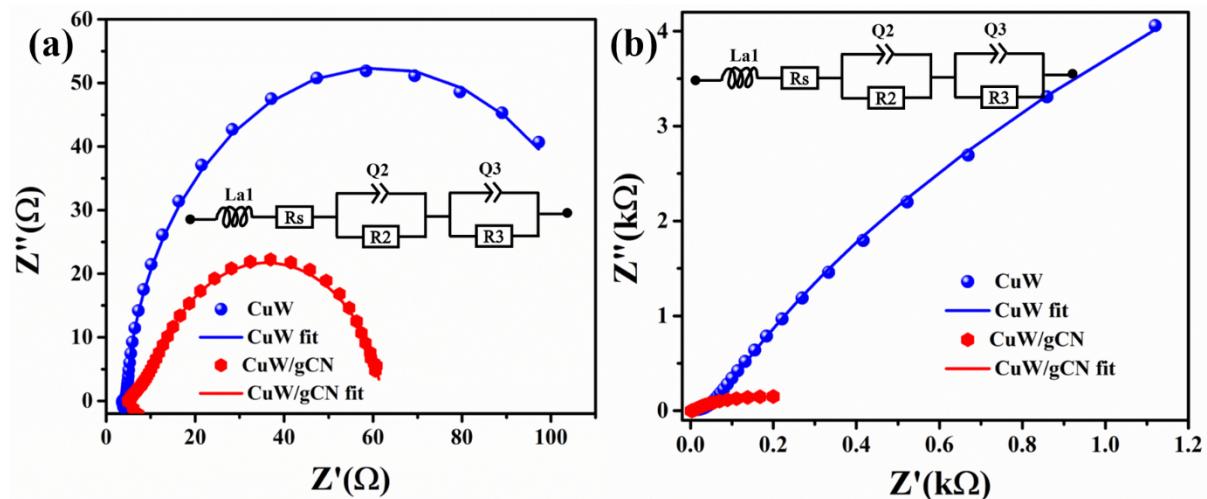


Fig. S5. EIS Nyquist plots of the electrodes in the frequency range 0.01 Hz to 100 kHz. (a) in $0.5\text{M H}_2\text{SO}_4$ (b) in 1M KOH .

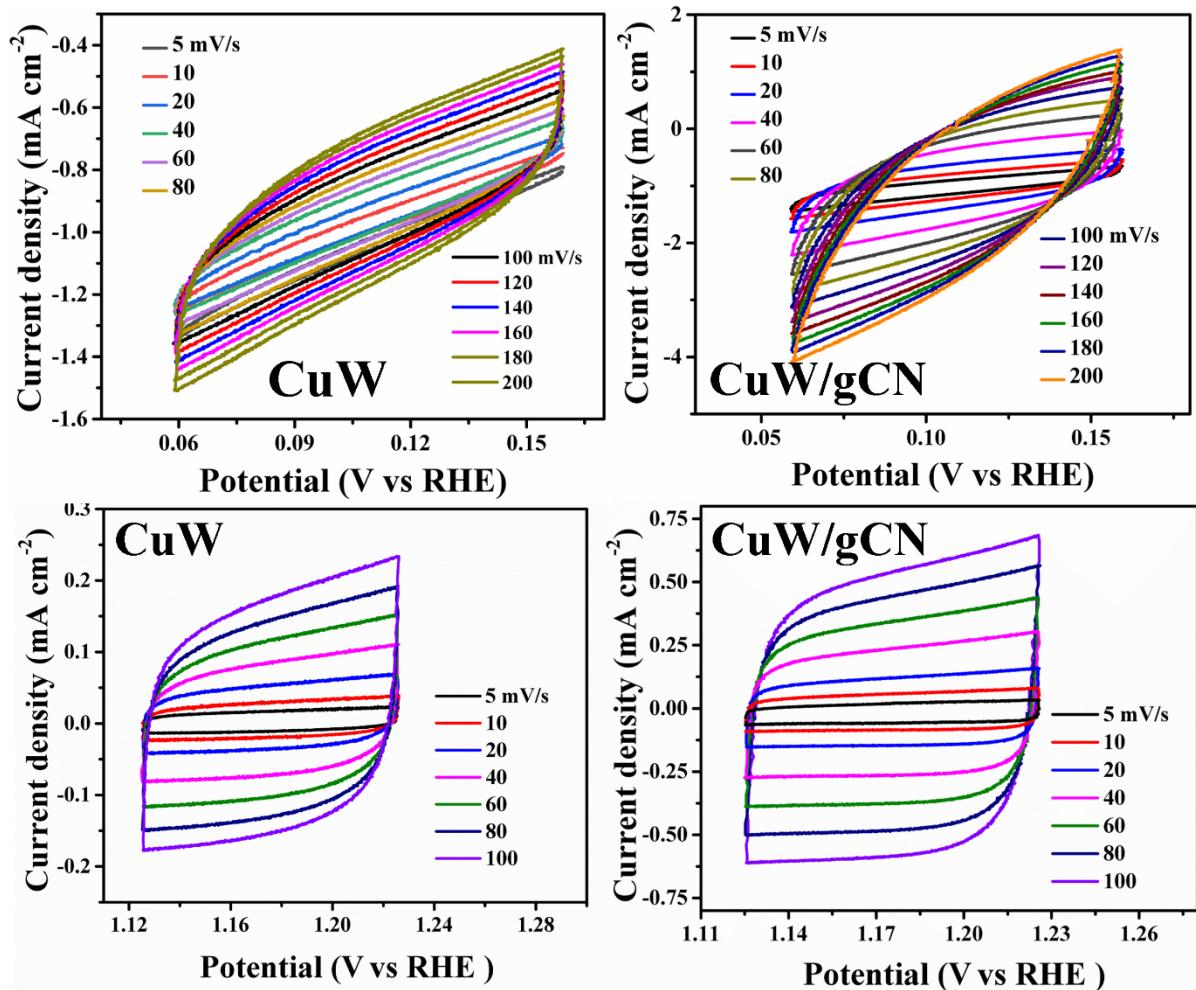


Fig. S6. CV curves of CuW and CuW/gCN electrodes in the non-Faradaic region at different scan rates. Upper layer: HER (in 0.5M H_2SO_4) and lower layer: OER (in 1M KOH).

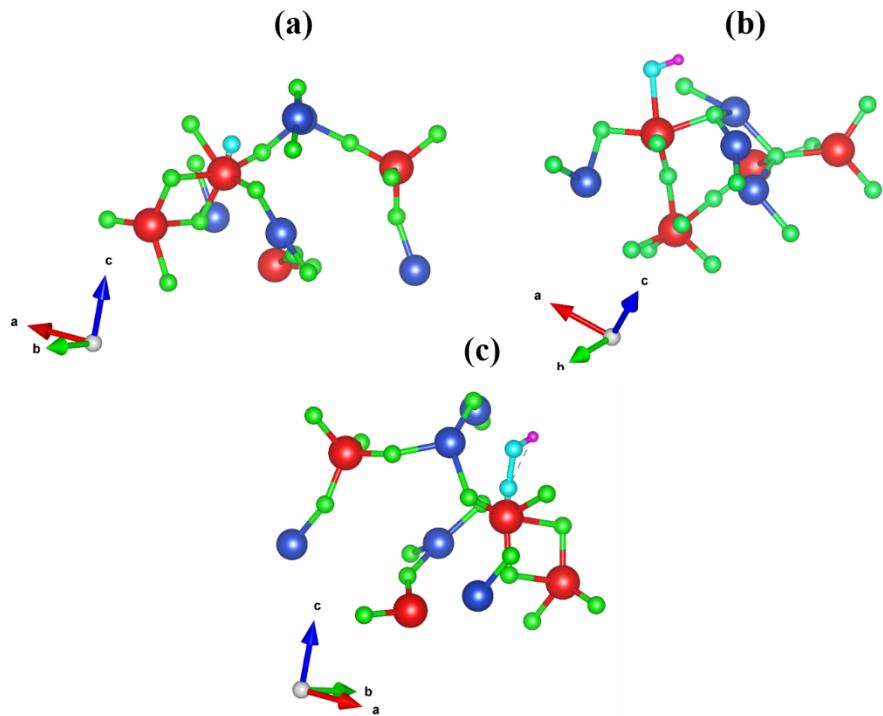


Fig. S7 DFT relaxed configuration for adsorbed species of (a) O, (b) OH, and (c) OOH on the CuW. Blue, red, green, sky blue and magenta color represent the Cu, W, O, O (adsorbed species) and H atom respectively.

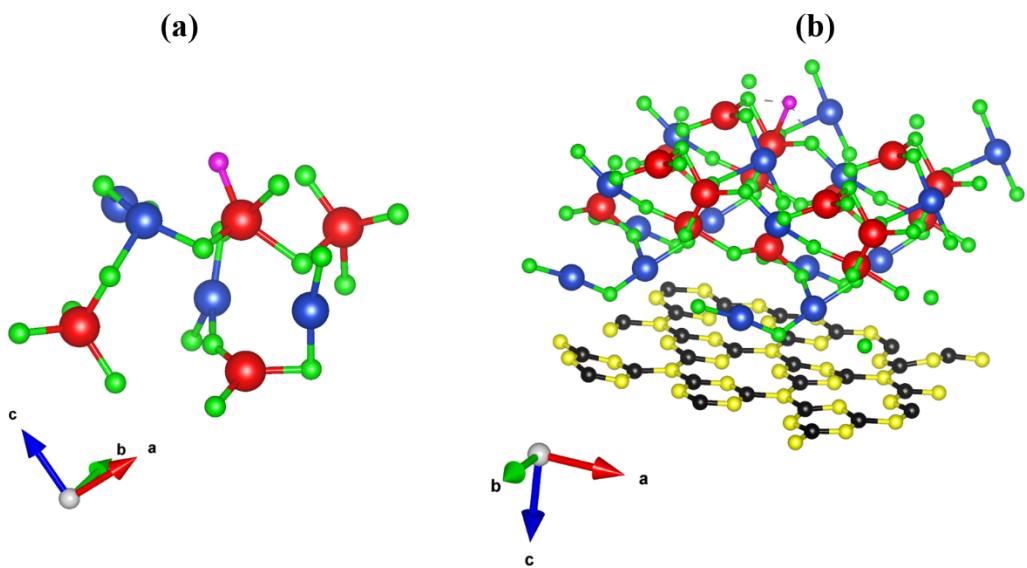


Fig. S8. H adsorption on the surface of (a) CuW and (b) CuW/gCN. Blue, red, green, yellow, black, and magenta color represent Cu, W, O, N, C and H atom, respectively.

Table S4. Comparison of experimental and computed values of overpotential for OER

System	Overpotential (mV)	
	Experimental	Computed
CuW	530	587.25
CuW/gCN	430	493.68

Table S5. Comparison of experimental and computed values of overpotential for HER

System	Overpotential (mV)	
	Experimental	Computed
CuW	325	383.62
CuW/gCN	143	205.34

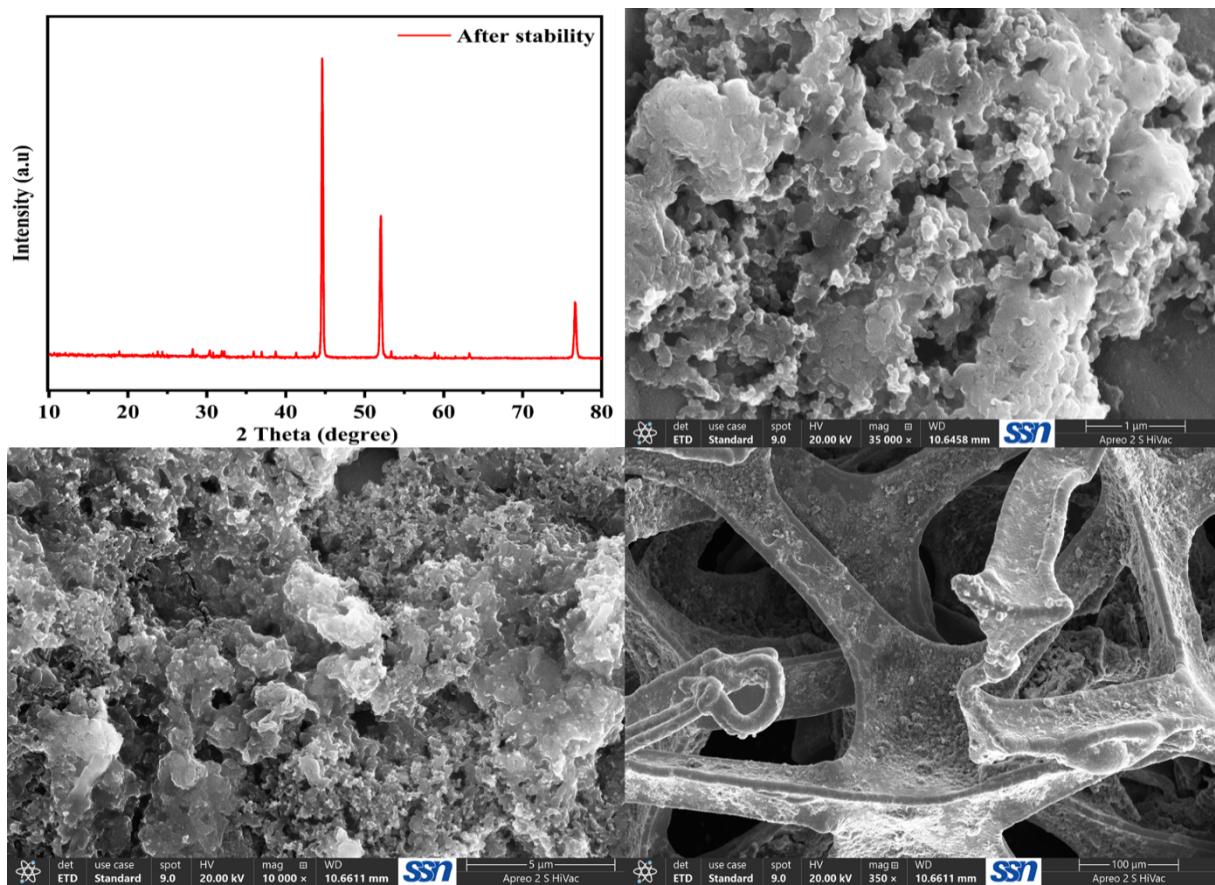


Fig. S9. (a) Xrd graph of post- stability CuW/gCN electrode. (b, c, d) SEM micrographs of post stability CuW/ gCN respectively (low to high magnifications).

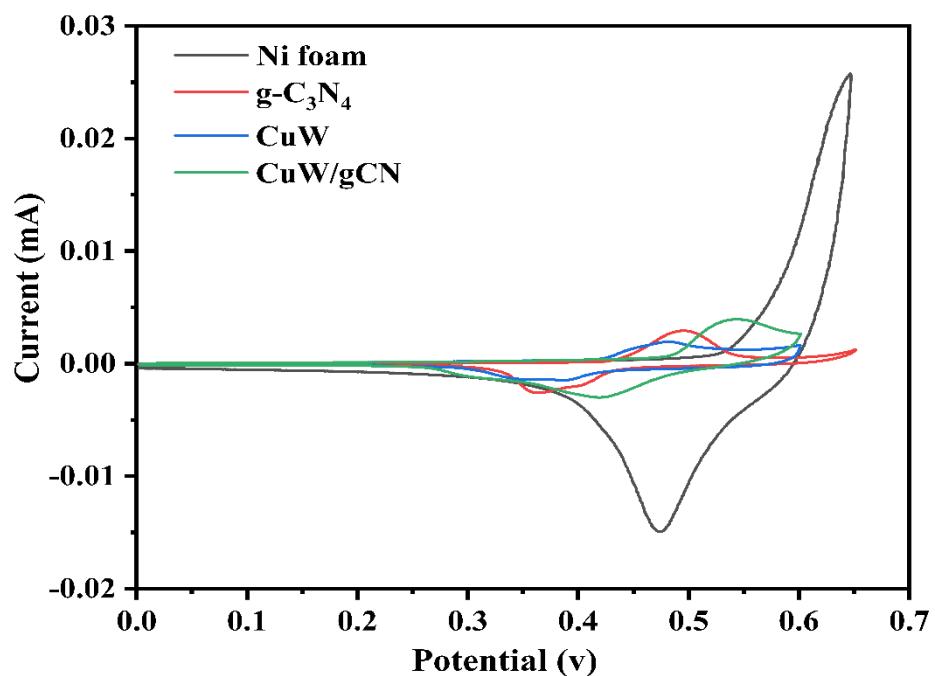


Fig. S10. (a) Comparative CV graphs at scan rate of 20mV/s

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