Supplementary Information for

Thermodynamically Driven Self-formation of Ag Nanoparticles in Zn-embedded Carbon Nanofibers for Efficient Electrochemical CO_2 Reduction

Gi-Baek Lee[a], In-Kyoung Ahn[a], Won-Hyo Joo[a], Jae-Chan Lee[a], Ji-Yong Kim[a], Deokgi Hong[a], Hyoung Gyun Kim[a], Jusang Lee[a], Miyoung Kim[a], Dae-Hyun Nam[b,*], and Young-Chang Joo[a,c,d,*]

[a]*Department of Materials Science & Engineering, Seoul National University, Seoul 151-744, Republic of Korea*

[b]*Department of Energy Science & Engineering, Daegu Gyeongbuk Institute of Science & Technology (DGIST), Daegu 42988, Republic of Korea*

[c]*Research Institute of Advanced Materials (RIAM), Seoul National University, Seoul 08826, Republic of Korea*

[d]*Advanced Institute of Convergence Technology, 145 Gwanggyo-ro, Yeongtong-gu, Suwon 16229, Republic of Korea*

*Corresponding author.

E-mail addresses: dhnam@dgist.ac.kr (D. H. Nam), ycjoo@snu.ac.kr (Y. C. Joo).

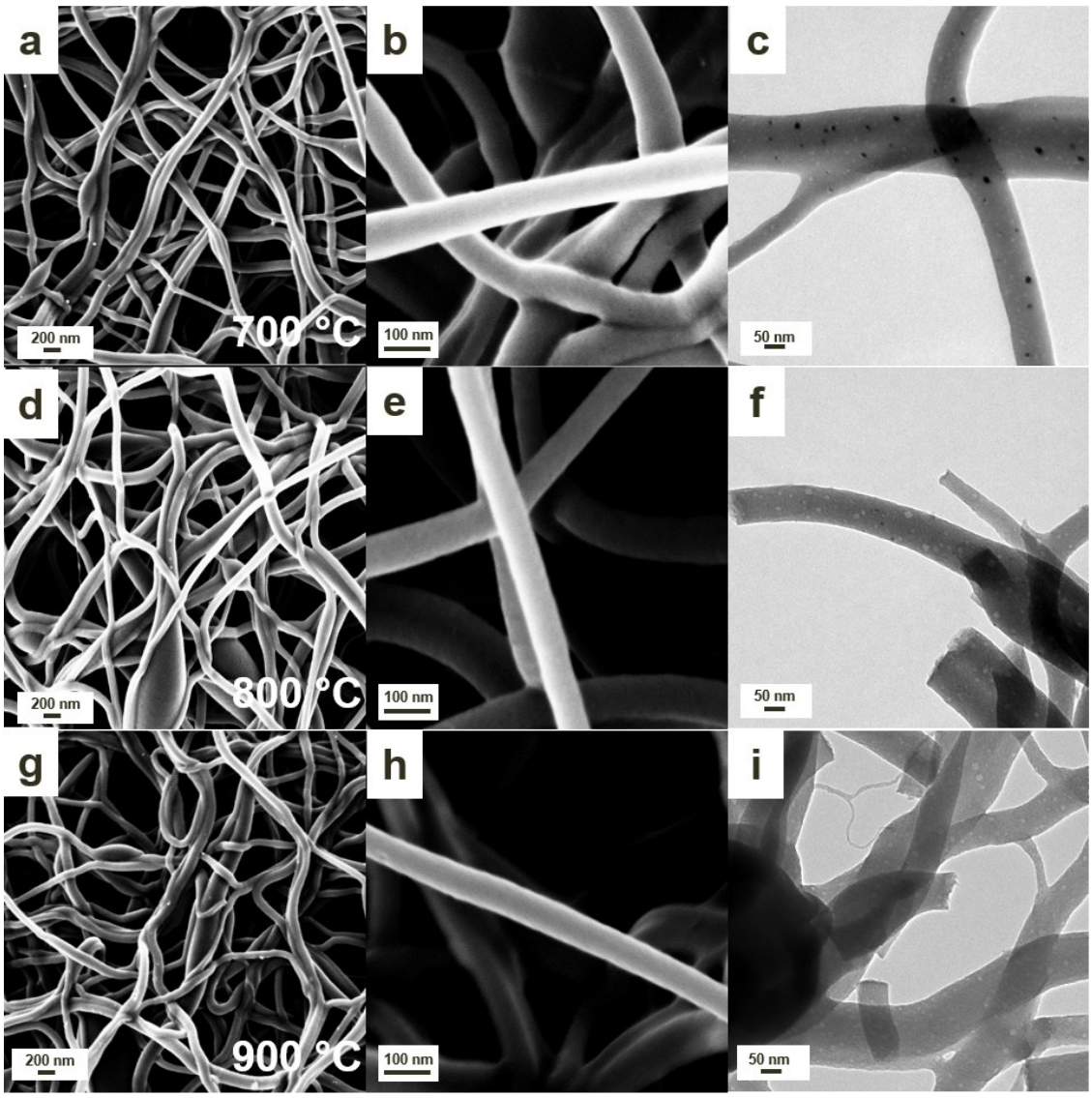


Fig. S1. Temperature dependence of the composition and structure of the catalyst. FESEM image of AgZn-CNF annealed at (a), (b) 700 °C, (d), (e) 800 °C and (g), (h) 900 °C and TEM image of AgZn-CNF annealed at (c) 700 °C, (f) 800 °C and (i) 900 °C.

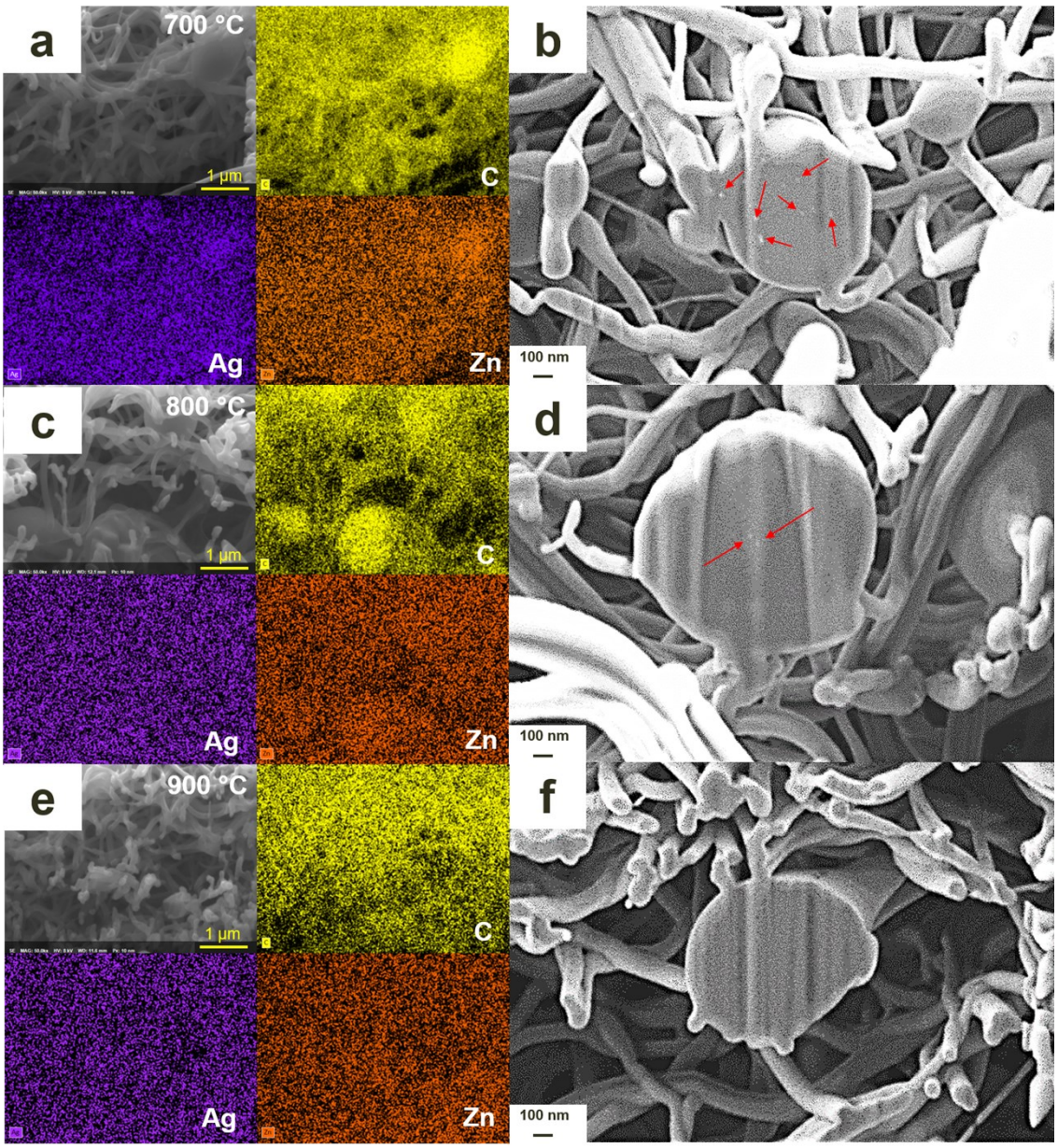
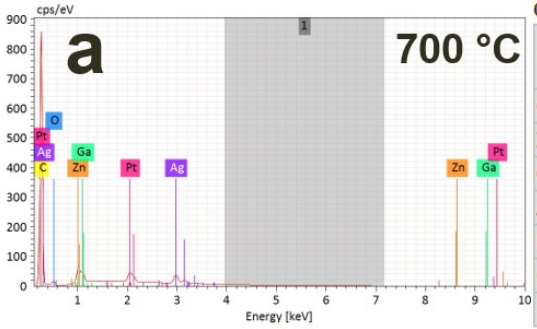


Fig. S2. Temperature dependence of the composition of the catalyst. Cross-sectional FESEM image and EDS mapping of AgZn-CNF annealed at (a), (b) 700 °C, (c), (d) 800 °C and (e), (f) 900 °C. Pointed white dots of cross- sectional image represent Ag nanoparticles.



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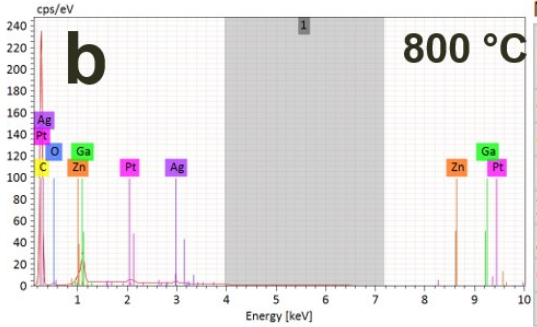
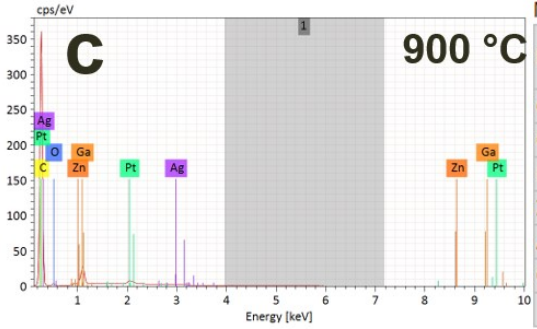
Element	At. No.	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (3 sigma)
C	6	39.77	68.82	85.61	12.15
Zn	30	6.78	11.73	2.68	1.21
Ga	31	0.00	0.00	0.00	0.00
Ag	47	4.69	8.11	1.12	0.51
Pt	78	0.00	0.00	0.00	0.00
O	8	6.55	11.34	10.59	2.24
		57.79	**100.00**	**100.00**	



Map

Element	At. No.	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (3 sigma)
C	6	24.95	79.91	94.38	7.75
O	8	0.80	2.57	2.28	0.33
Pt	78	0.00	0.00	0.00	0.00
Zn	30	3.78	12.12	2.63	0.68
Ag	47	1.69	5.40	0.71	0.19
Ga	31	0.00	0.00	0.00	0.00
		31.23	**100.00**	**100.00**	



Map

Element	At. No.	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (3 sigma)
C	6	95.96	95.96	97.77	29.73
O	8	2.55	2.55	1.95	1.05
Pt	78	0.00	0.00	0.00	0.00
Zn	30	1.48	1.48	0.28	0.27
Ag	47	0.02	0.02	0.00	0.00
Ga	31	0.00	0.00	0.00	0.00
		100.00	**100.00**	**100.00**	

Fig. S3. Spectrum and concentration of EDS mapping annealed at (a) 700 °C, (b) 800 °C and (c) 900 °C.

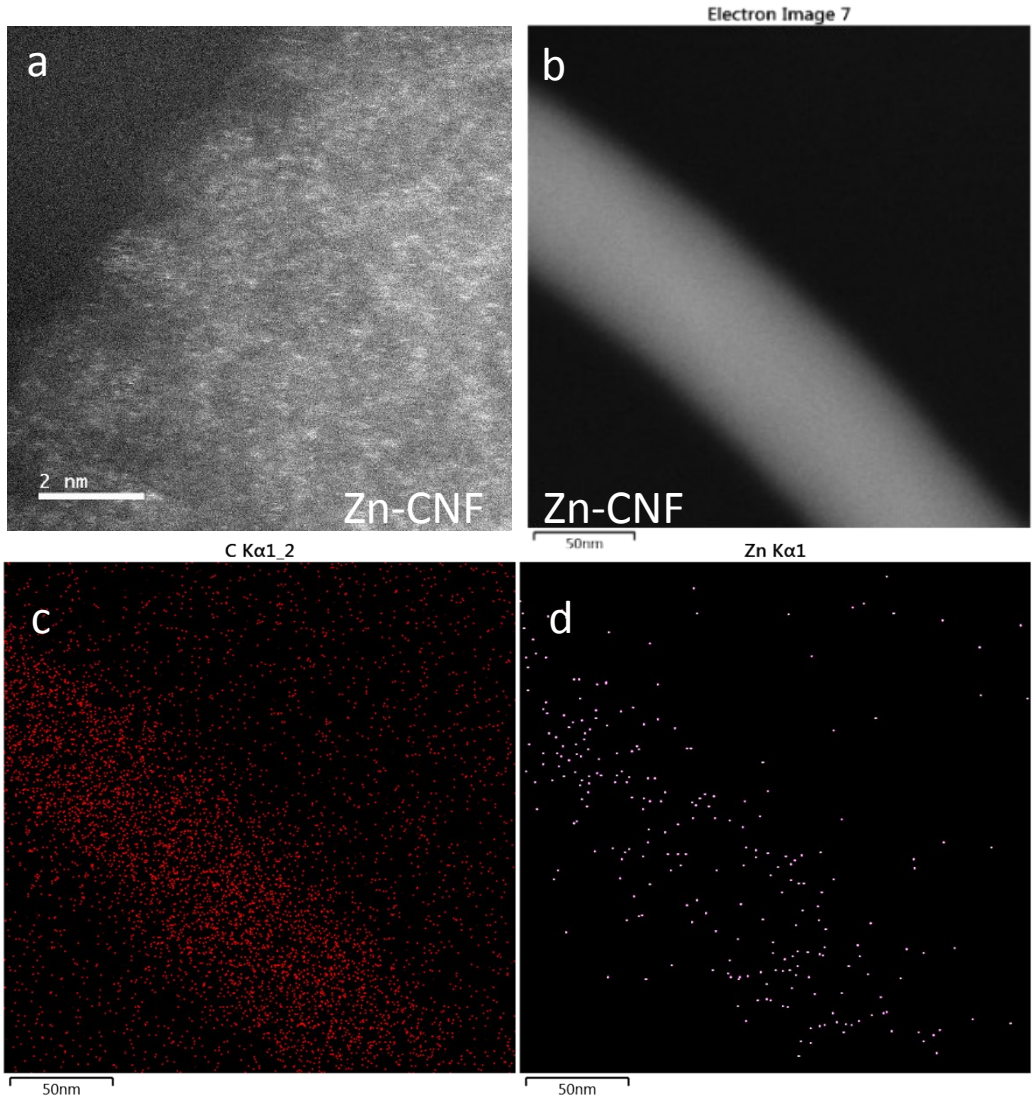


Fig. S4. (a) cs-STEM image of Zn-CNF with white dots representing atomically dispersed Zn, (b) HAADF-STEM image of Zn-CNF and EDS analysis of (c) C (d) Zn.

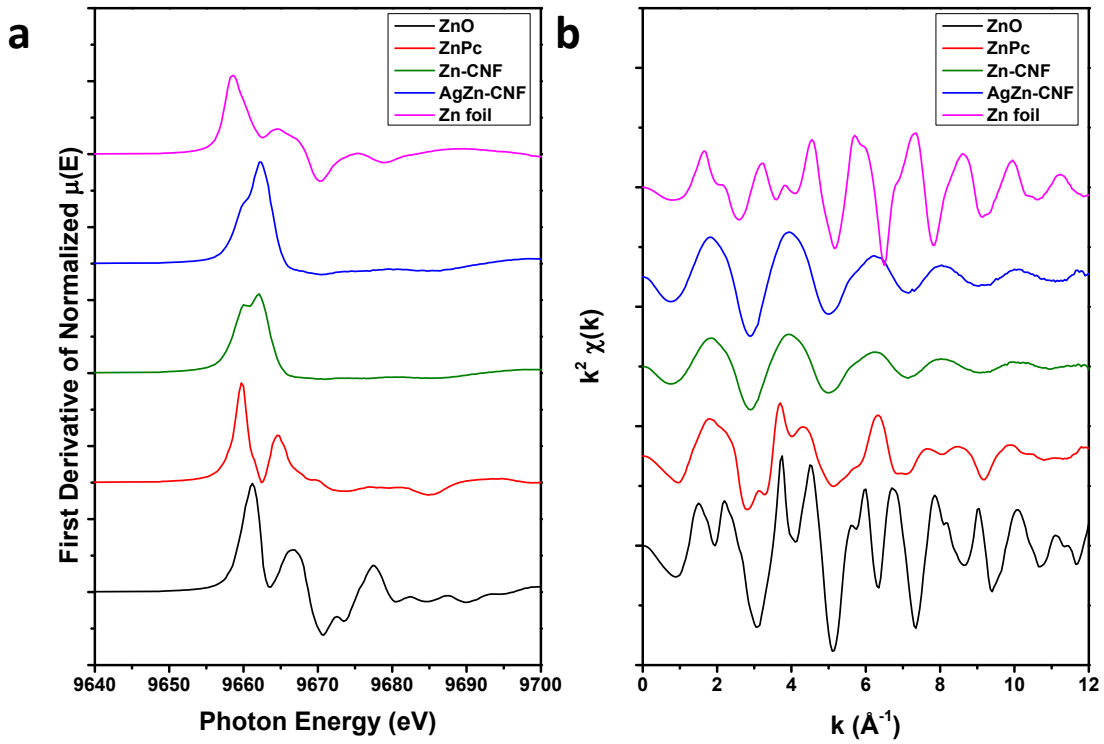


Fig. S5. (a) first derivative of XANES data to investigate the oxidation states of Zn according to the materials, (b) EXAFS in k spaces of Zn *K*-edge.

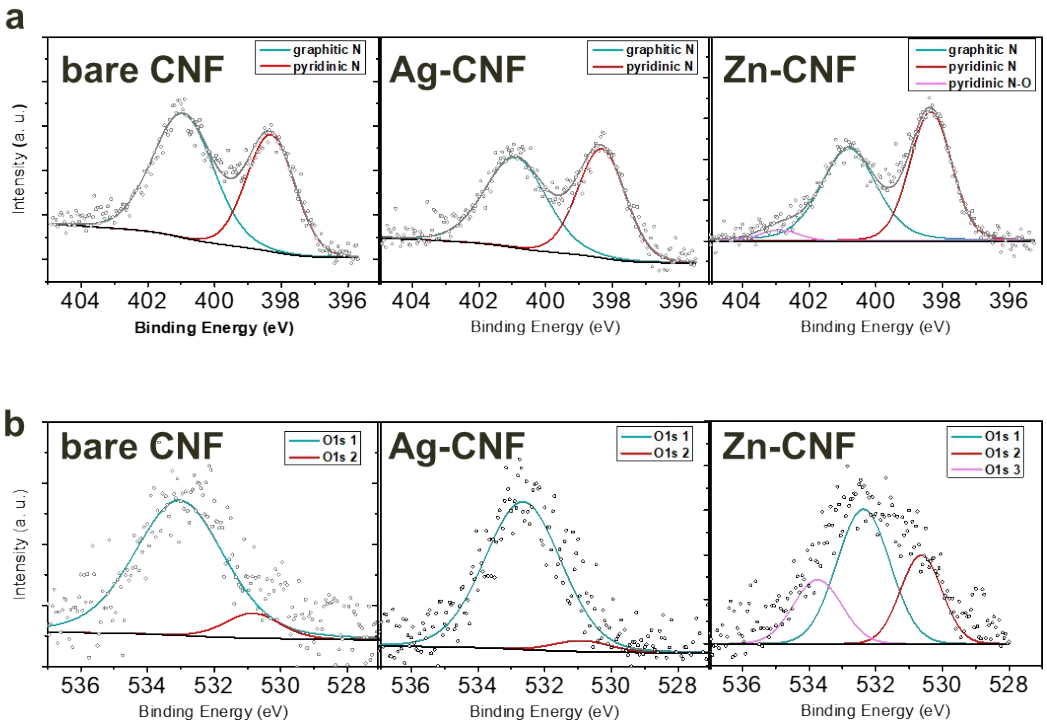


Fig. S6. XPS analysis (a) deconvolution result of N 1s of w/o metal, Ag-CNF and Zn-CNF (b) deconvolution result of N 1s of w/o metal, Ag-CNF and Zn-CNF.

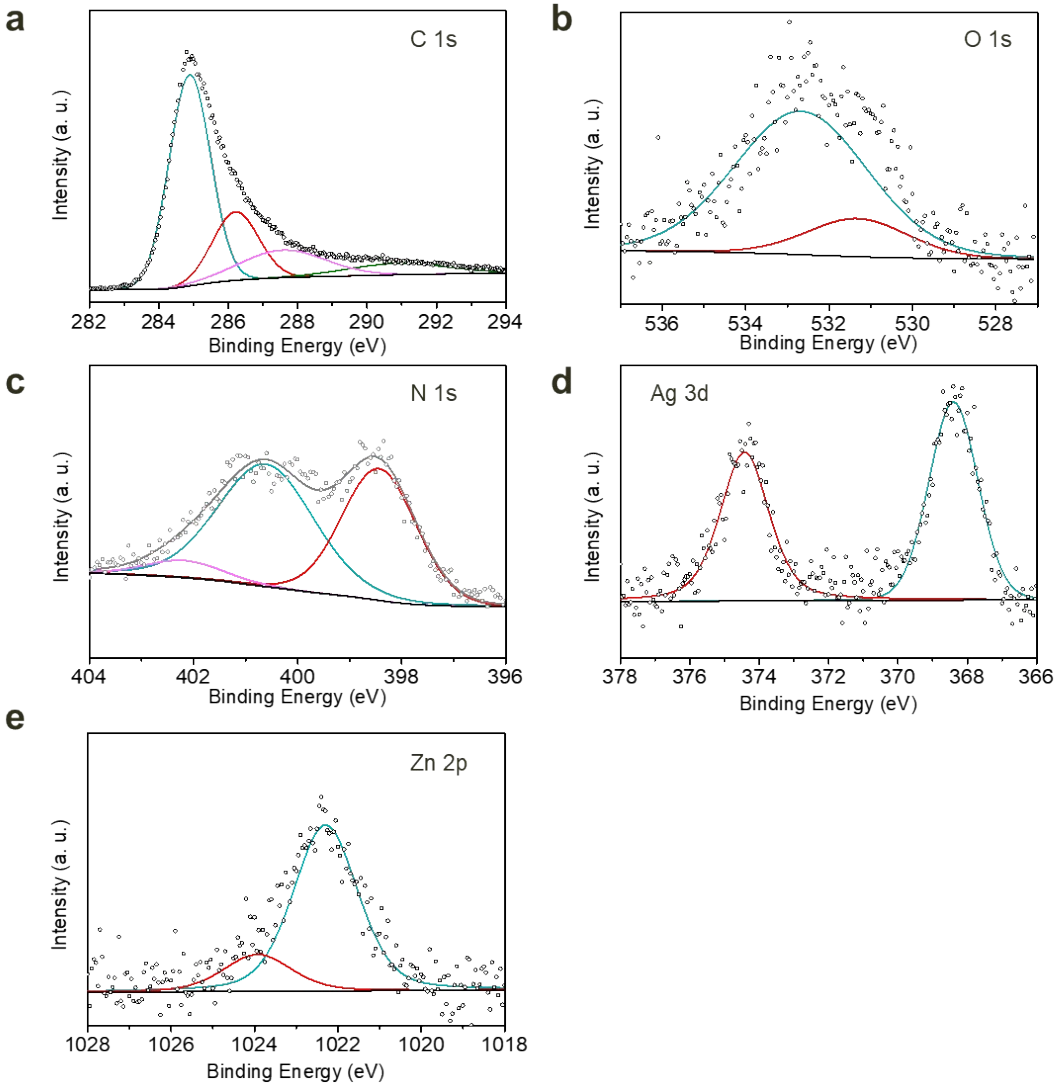


Fig. S7. XPS deconvolution analysis of AgZn-CNF (a) C 1s (b) O 1s (c) N 1s (d) Ag 3d (e) Zn 2p.

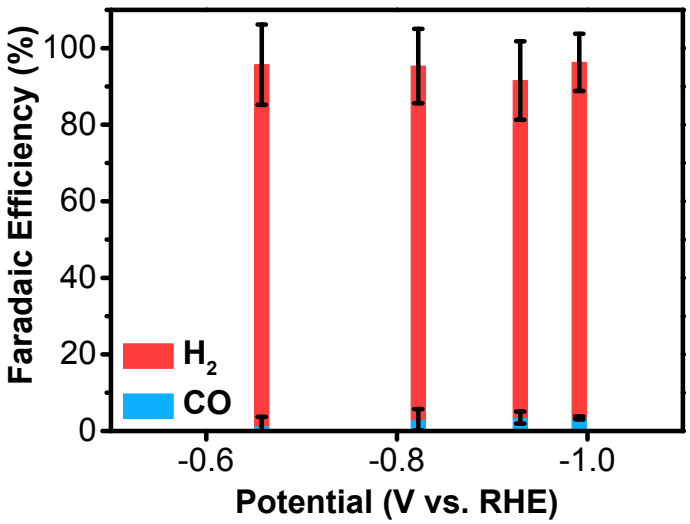


Fig. S8. Faradaic efficiency of electrocatalytic CO_2 reduction of bare CNF.

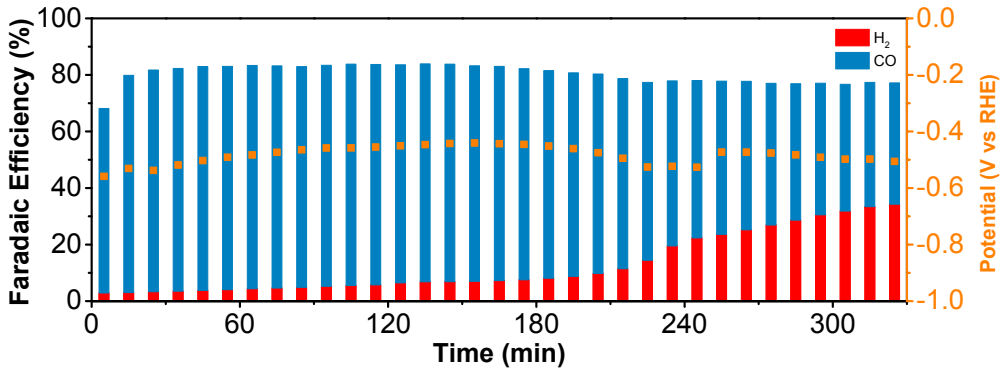


Fig. S9. Stability analysis of AgZn-CNF in 1 M KOH at -150 mA/cm^2.

Table S1. Temperature dependence of atomic composition of AgZn-CNF based on FESEM EDS.

AgZn-CNF	C (at%)	Ag (at%)	Zn (at%)	O (at%)	Total (at%)
700 °C	85.61	1.12	2.68	10.59	100
800 °C	94.38	0.71	2.63	2.28	100
900 °C	97.77	0	0.28	1.95	100

Table S2. XPS analysis for verification of chemical composition.

Sample	C (at%)	N (at%)	Ag (at%)	Zn (at%)	O (at%)	Total(at%)
Ag-CNF	87.1	9.7	0.7	0	2.6	100.1
Zn-CNF	86.4	9.3	0	0.7	3.5	99.9
AgZn-CNF	86.9	9.3	0.4	0.9	2.6	100.1