Supporting Information

Vertically aligned two-dimensional graphene-metal hydroxide hybrid arrays for Li-O_2 batteries

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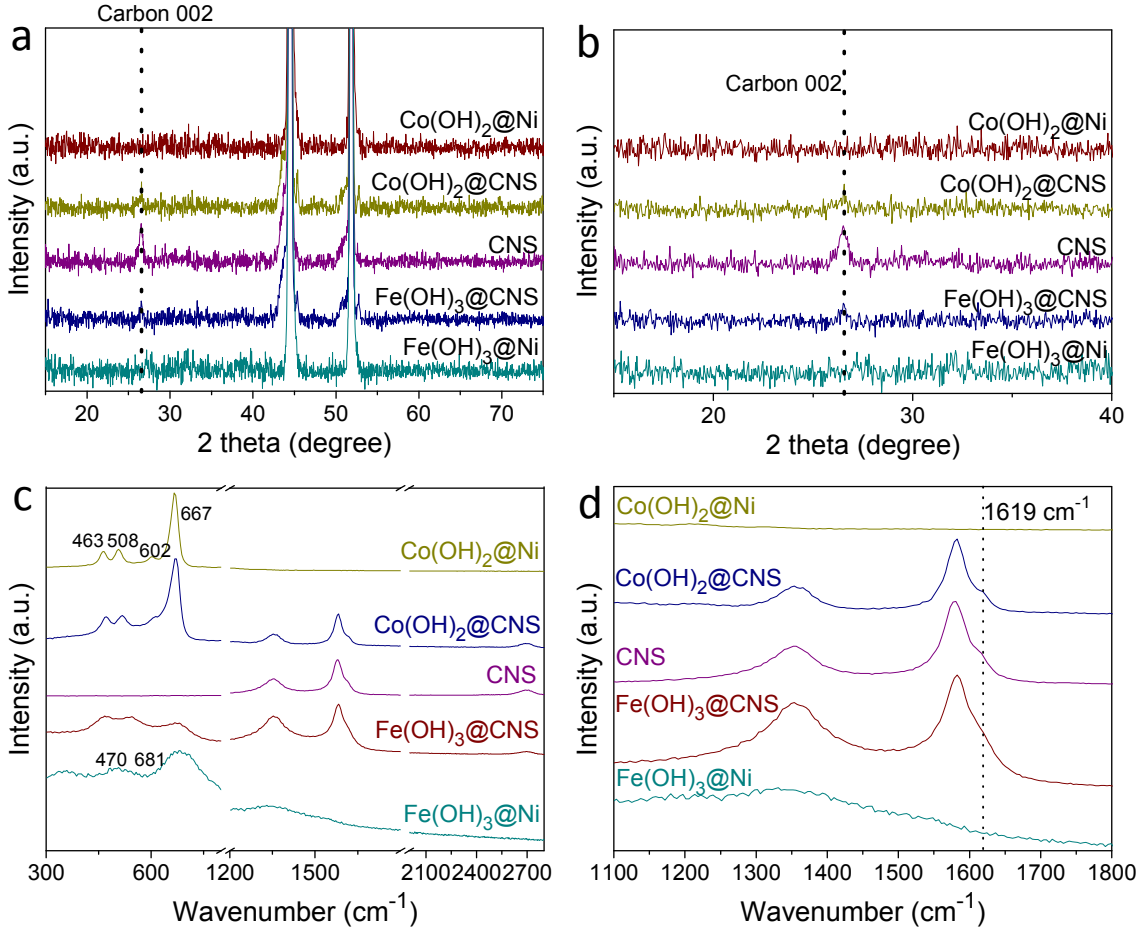

Figure S1 X-ray diffraction (XRD) patterns of CNS, $Fe(OH)_3$@CNS, $Co(OH)_2$@CNS and Ni@$Fe(OH)_3$, Ni@$Co(OH)_2$ (a), as well as magnification of the 15 < 2 theta < 40 region (b) and Raman spectra of CNS, $Fe(OH)_3$@CNS, $Co(OH)_2$@CNS and $Fe(OH)_3$@Ni, $Co(OH)_2$@ Ni (c), as well as magnification of the 1100 - 1800 cm^{-1} region (d).

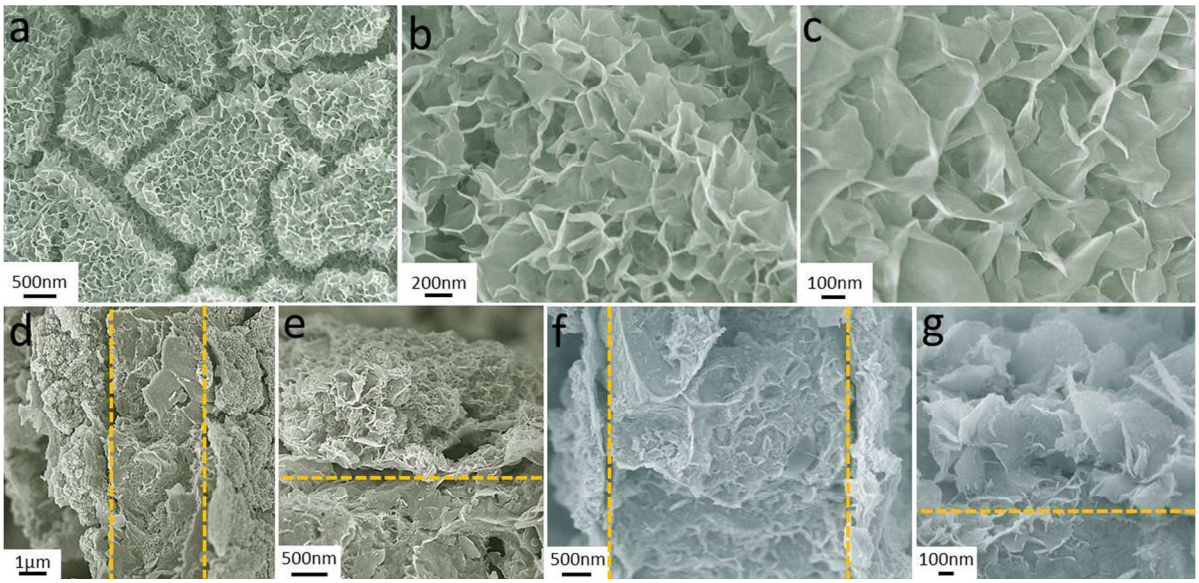

Figure S2 (a-c) FESEM images of $Co(OH)_2$@CNS with 120 s deposition time; (d-e) the cross-section FESEM images of $Co(OH)_2$@CNS with 30 s deposition time; (f-g) the cross-section FESEM images of $Fe(OH)_3$@CNS with 30 s deposition time.

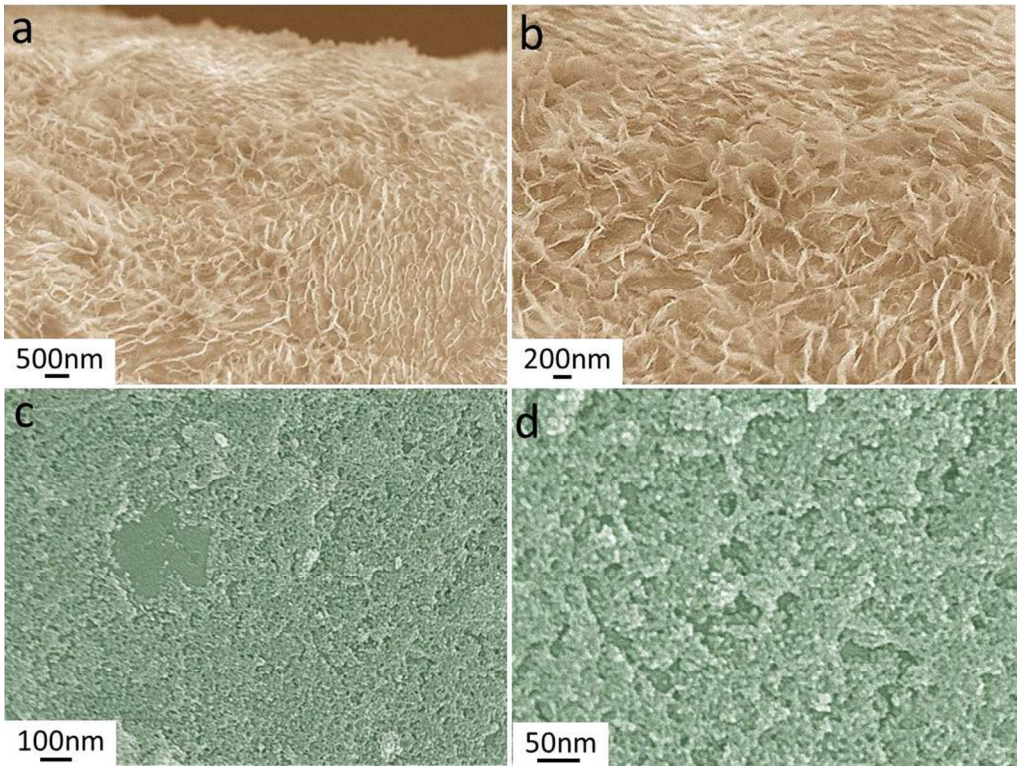

Figure S3 (a-b) FESEM images of $Co(OH)_2$ deposited on nickel foam ($Co(OH)_2$@Ni); (c-d) the cross-section FESEM images of $Fe(OH)_3$ deposited on nickel foam ($Fe(OH)_3$@Ni).

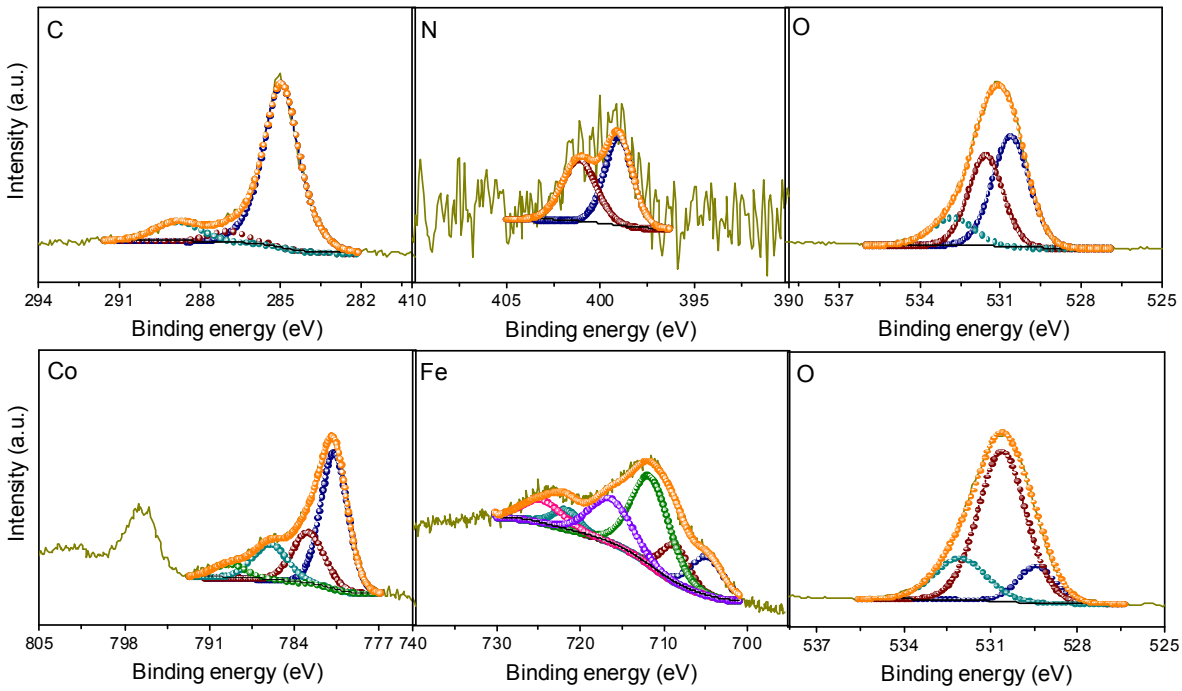

Figure S4 XPS spectra of the elements: C, N, O, Co and Fe in the $Fe(OH)_3$@CNS and $Co(OH)_2$@CNS samples.

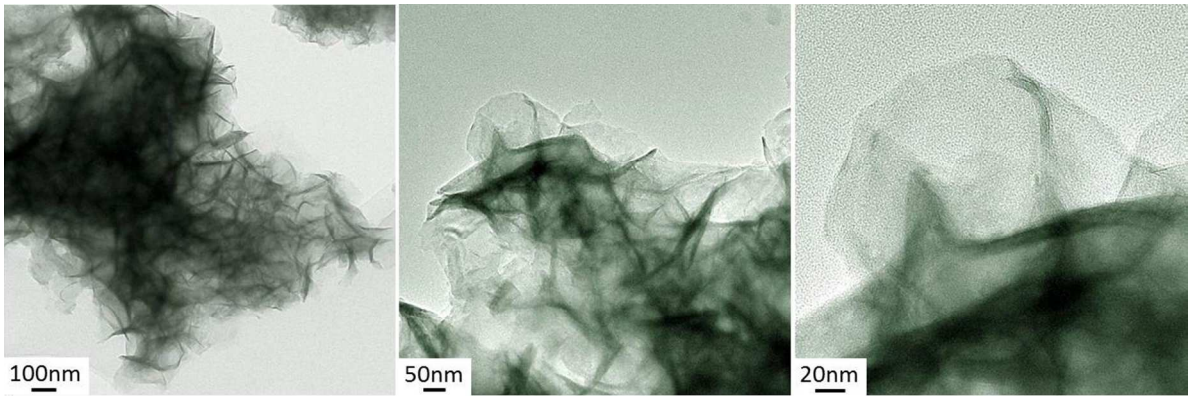

Figure S5 TEM images of CNS at different resolutions.

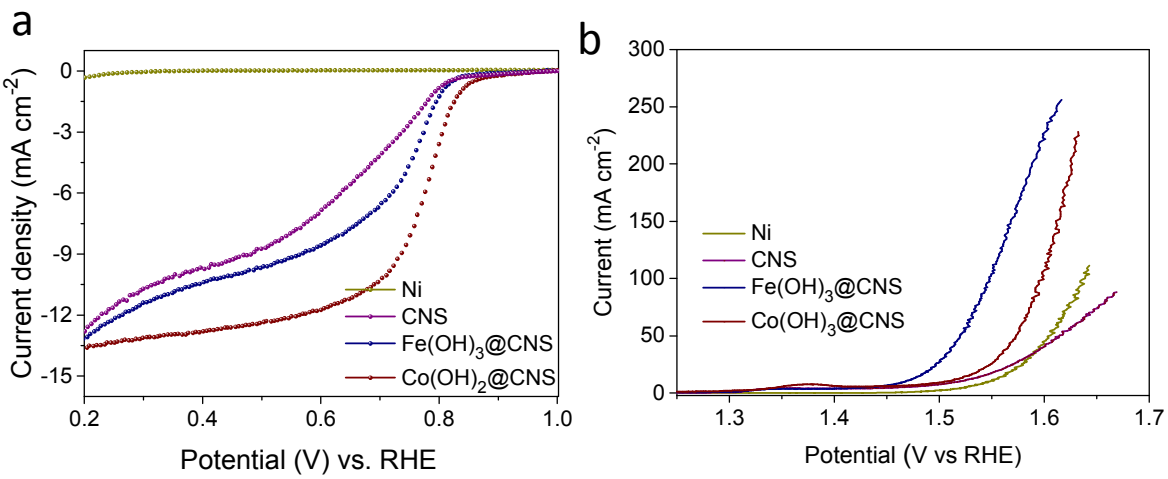

Figure S6 Electrocatalytic activities for oxygen reduction reaction (ORR) and oxygen evolution reaction (OER). (a) The linear sweep voltammetry (LSV) curves of ORR for pure nickel foam, CNS, $Co(OH)_2$@CNS and $Fe(OH)_3$@CNS (electrolyte: 0.1M KOH, scan rate: 1 mVs^{-1}, oxygen gas), (b) The LSV curves of OER for pure nickel foam, CNS, $Co(OH)_2$@CNS and $Fe(OH)_3$@CNS (electrolyte: 0.1M KOH, scan rate: 1 mVs^{-1}, oxygen gas).

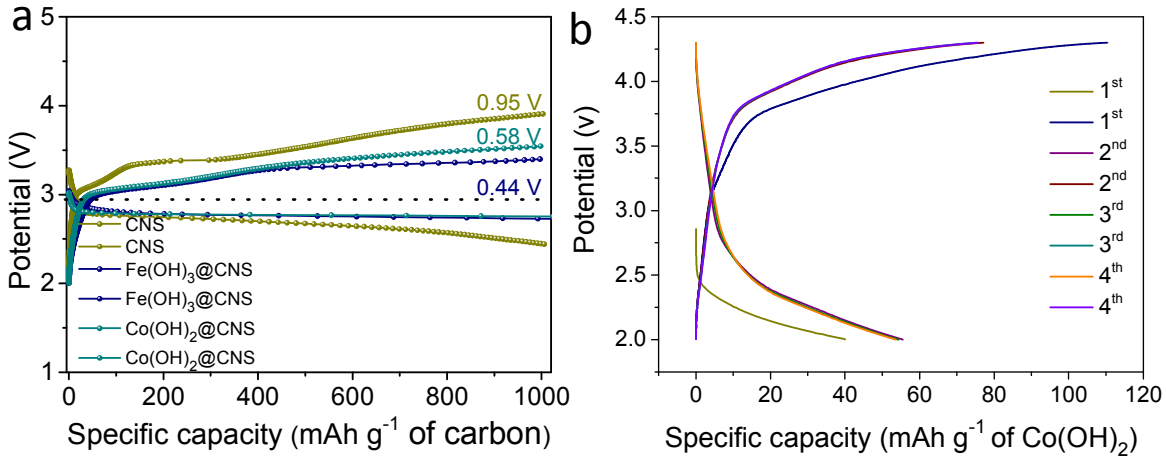

Figure S7 (a) the comparison of discharge-charge profile CNS, $Co(OH)_2$@CNS and $Fe(OH)_3$@CNS plotted to 1000 mAh g^{-1}; (b) the first four cycles of charge-discharge profiles of pure nickel foam with $Co(OH)_2$.

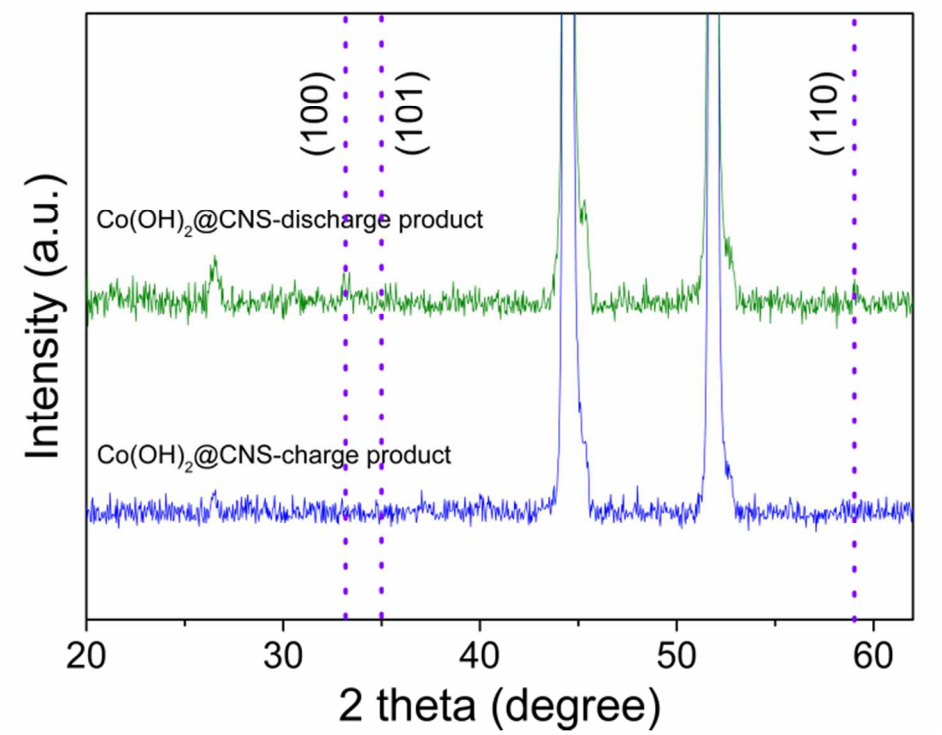

Figure S8 XRD patterns of $Co(OH)_2$@CNS after discharge after charge back.