Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supplementary Information

Direct synthesis of carbon nanotube interpenetrated doped porous carbon alloy as a durable Pt-free electrocatalyst for oxygen reduction reaction in alkaline medium†

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Table S1: Atom percentage of different elements in the electrocatalysts calculated from XPS

Catalyst	Carbon	Nitrogen	Oxygen	Iron	Cobalt	Zinc
FeCo-NCZ	86.55	5.65	5.46	1.29	0.96	0.08
Fe-NCZ	90.47	3.32	5.14	1.07	0.00	0.00
Co-NCZ	85.03	5.22	7.50	0.00	2.00	0.25
Co-NC	90.34	2.10	5.69	0.00	1.86	0.00

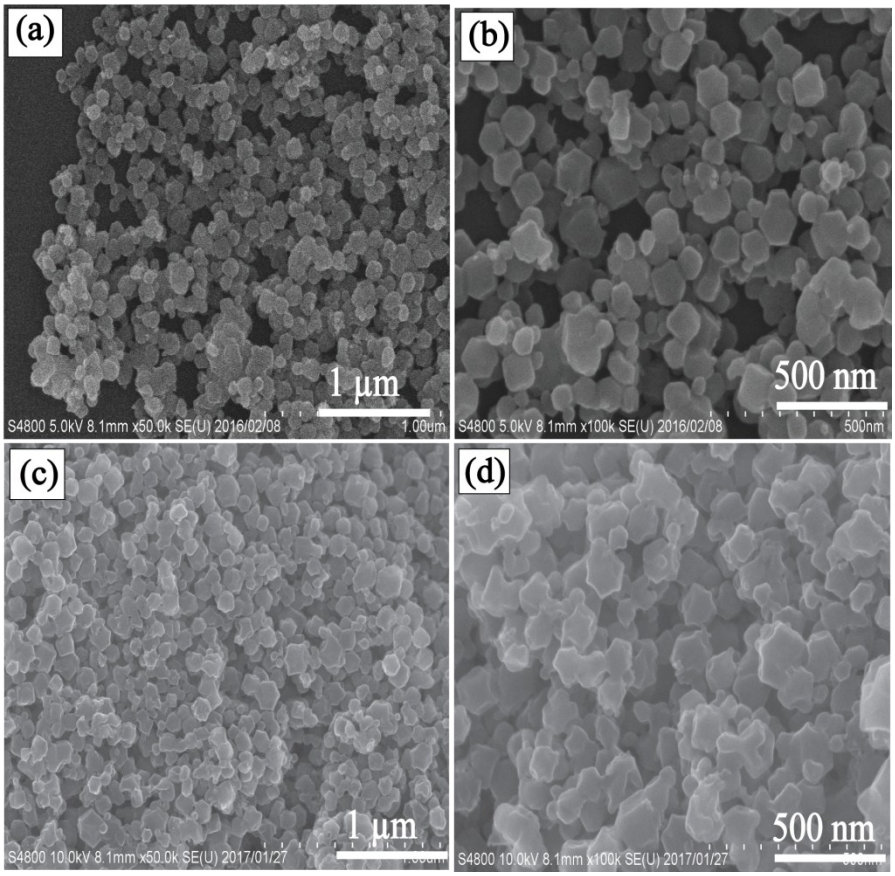

Figure S1. SEM images of (a & b) Co-ZIF at and (c & d) FeCoZn-ZIF at different magnification

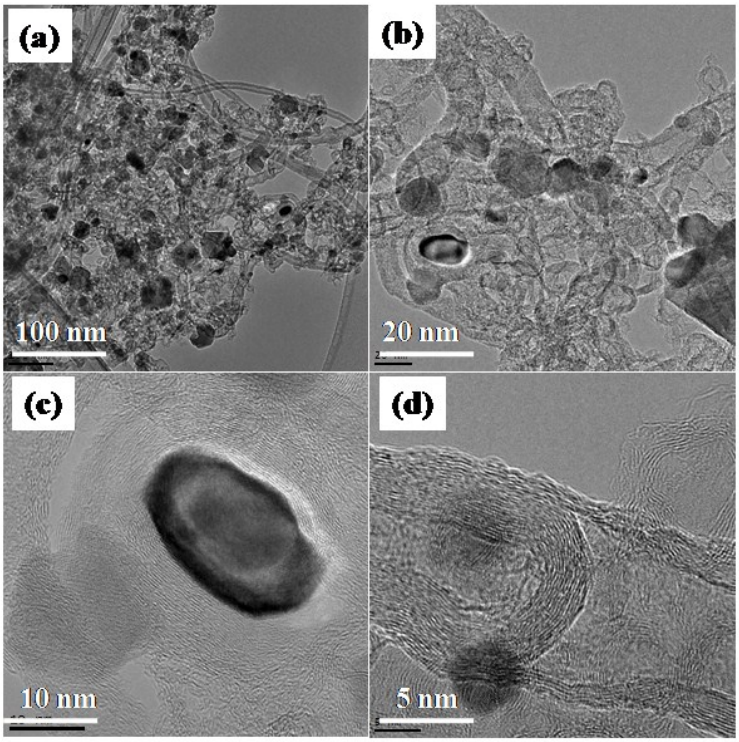

Figure S2. TEM images of Fe-NCZ at different magnifications.

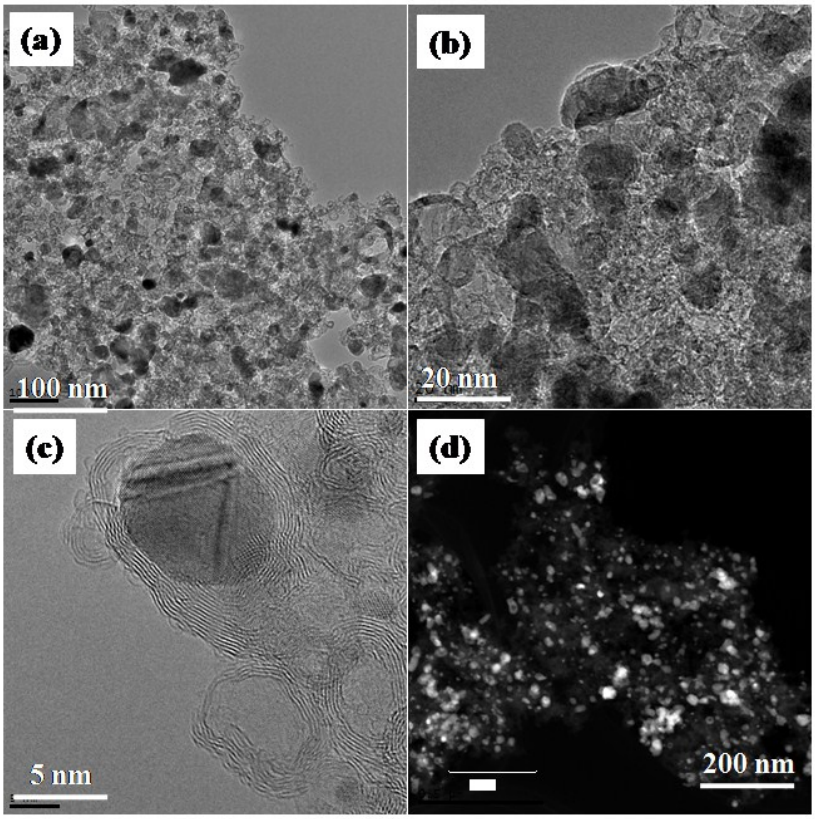

Figure S3. TEM images of Co-NCZ at different magnification.

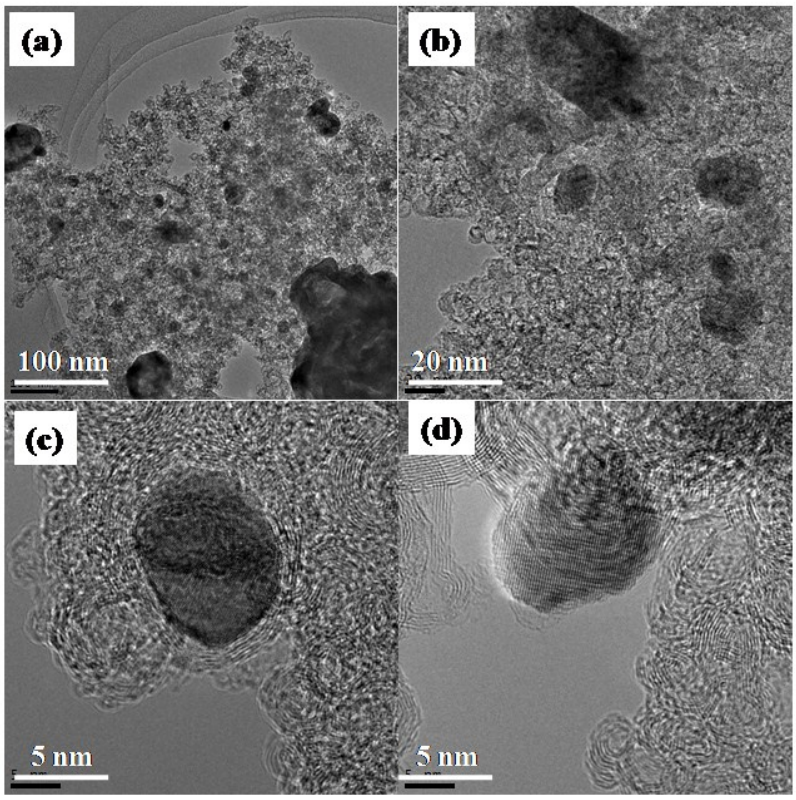

Figure S4. TEM images of Co-NC at different magnifications.

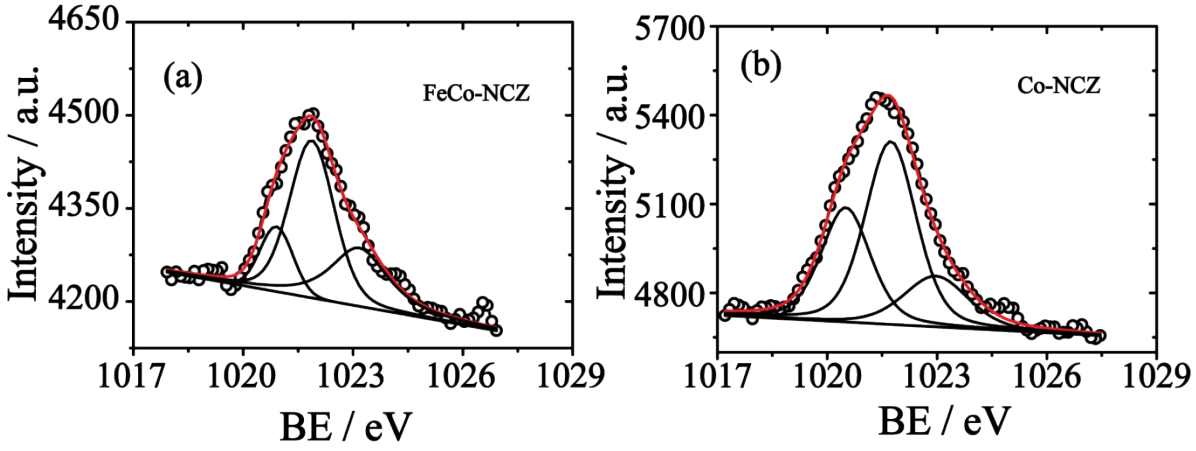

Figure S5. Deconvoluted XPS spectrum of Zn 2p of (a) FeCo-NCZ and (b) Co-NCZ.

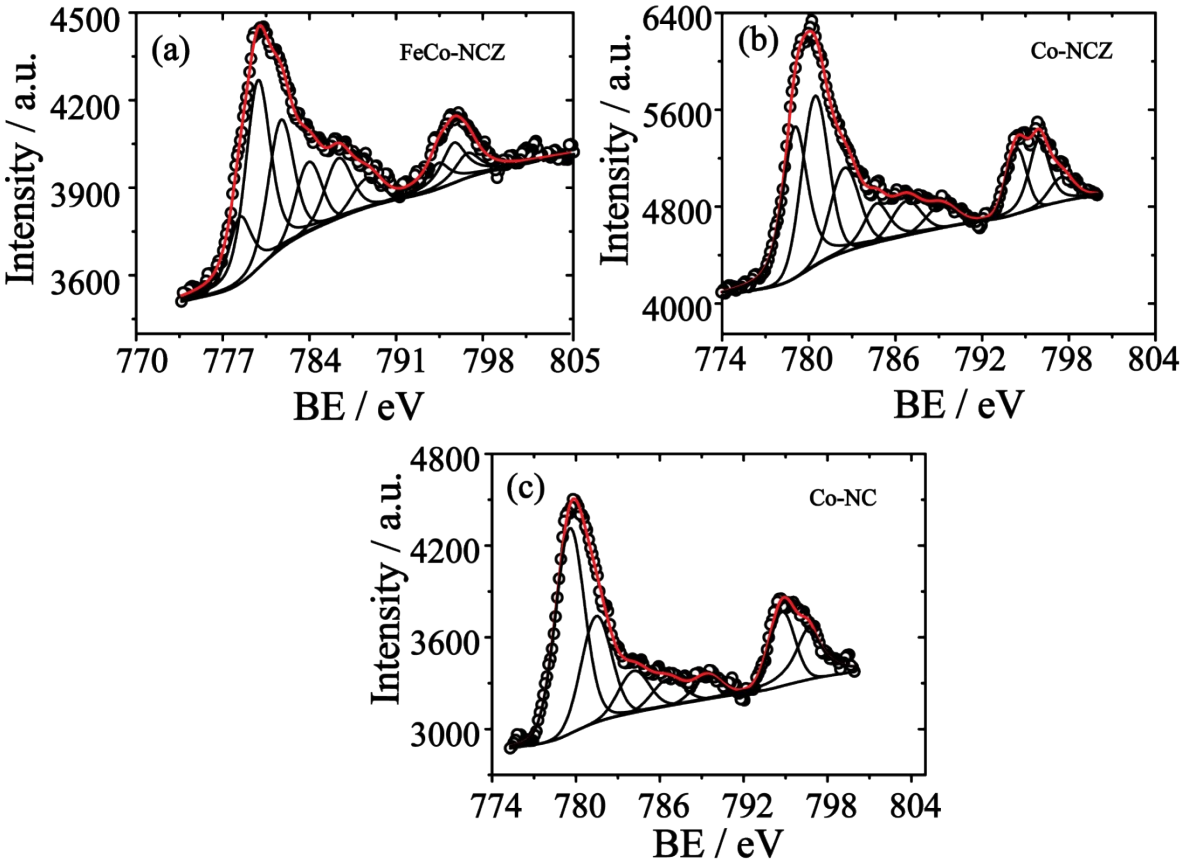

Figure S6. Deconvoluted XPS spectrum of Co 2p of (a) FeCo-NCZ, (b) Co-NCZ, and (c) Co-NC.

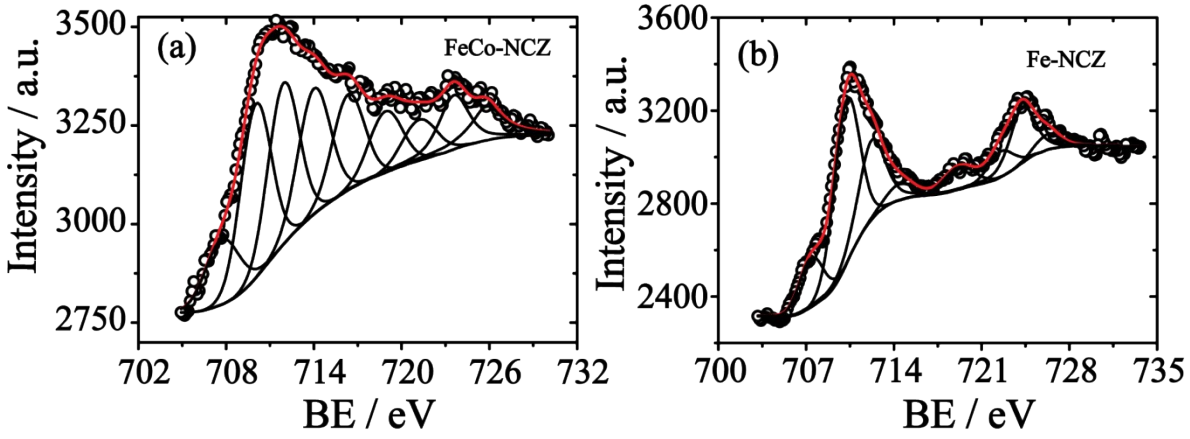

Figure S7. Deconvoluted XPS spectrum of Fe 2p of (a) FeCo-NCZ and (b) Fe-NCZ.

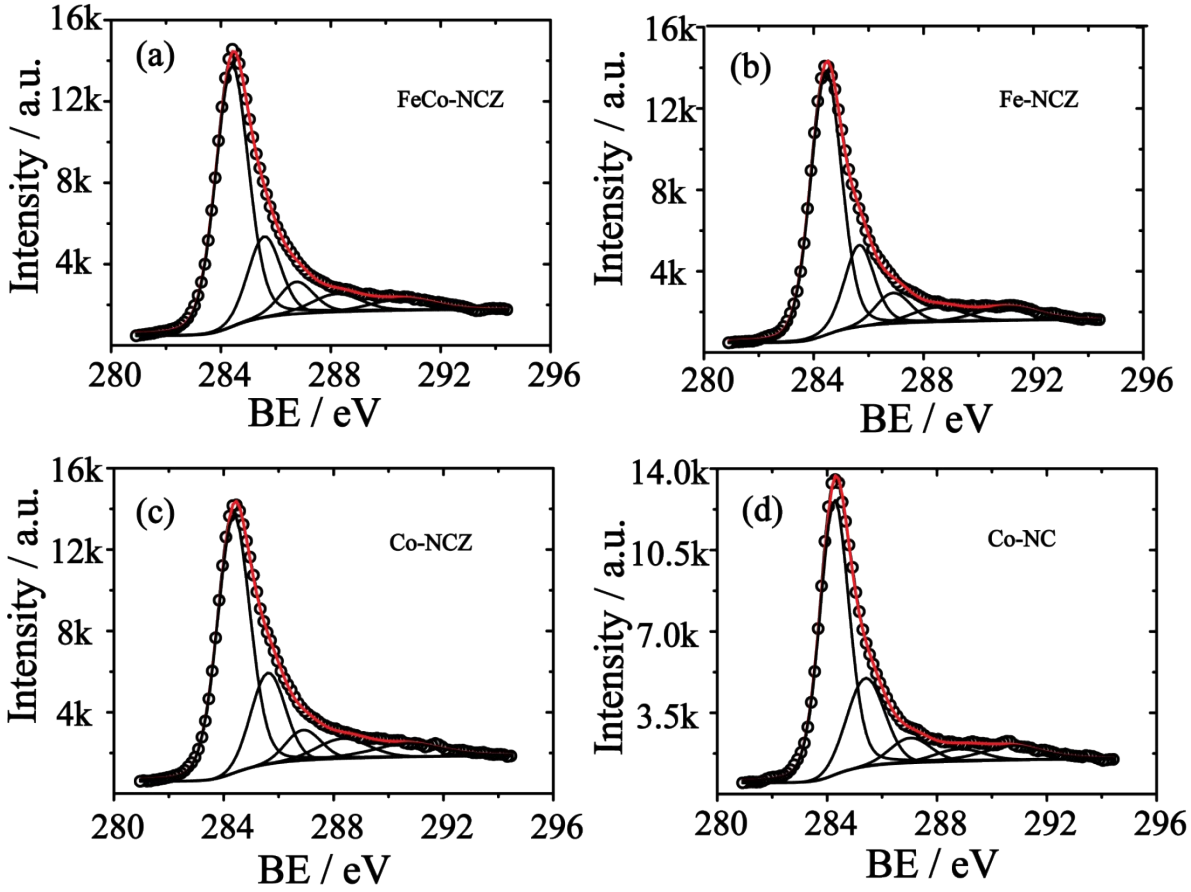

Figure S8. Deconvoluted XPS spectrum of C 1s of (a) FeCo-NCZ, (b) Fe-NCZ, (c) Co-NCZ, and (d) Co-NC.

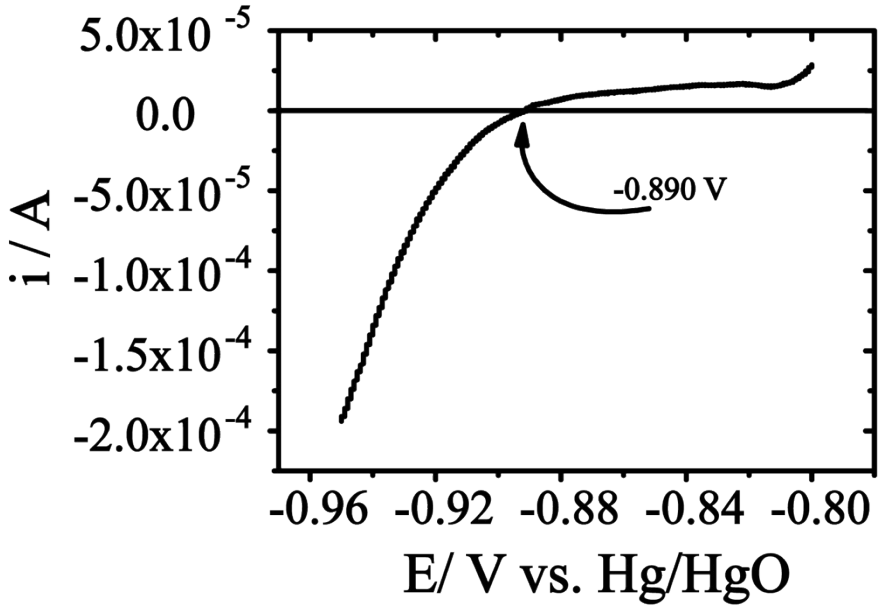

Figure S9. Calibration of Hg/HgO reference electrode. Linear sweep voltammogram (LSV) of Pt disc in hydrogen saturated 0.1 M KOH at a scan rate of 1 mV s^{-1}. The electrode potential was converted to RHE using formula, $E_{RHE} = E_{Hg/HgO} + 890$.

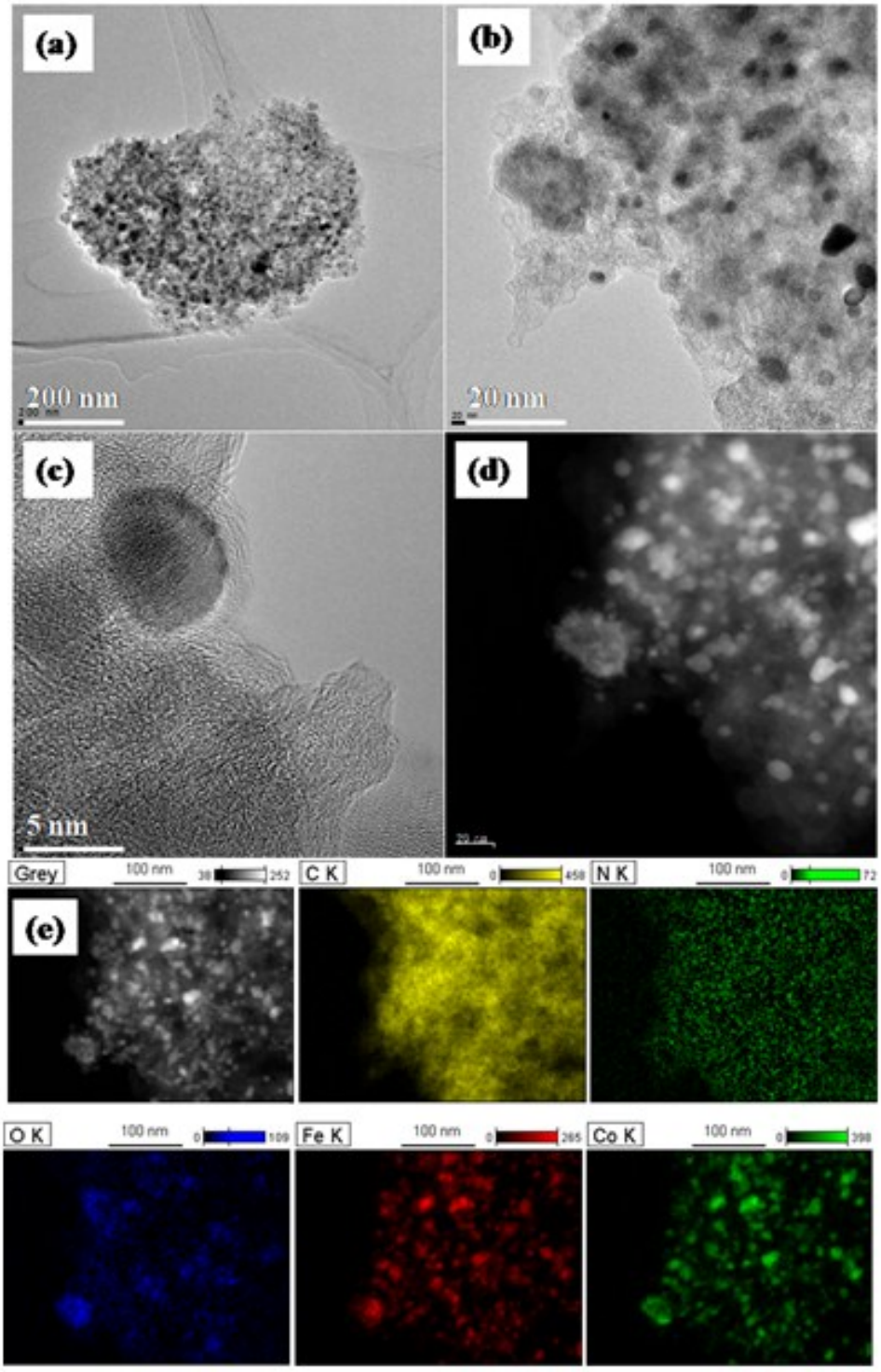

Figure S10. TEM images of FeCo-NCZ at different magnifications ((a) 200 nm, (b) 20 nm, and (c) 5 nm) after durability study. (d) STEM image of FeCo-NCZ and (e) represent the elemental mapping of FeCo-NCZ after durability study.

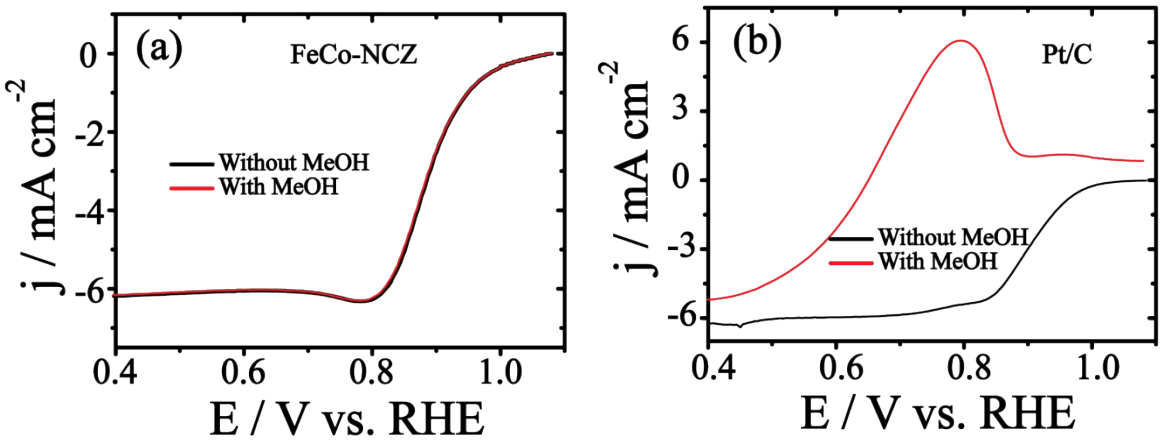

Figure 11. Linear sweep voltammogram (LSV) of (a) FeCo-NCZ and (b) Pt/C in oxygen saturated 0.1 M KOH with/without methanol (0.16 M) at an electrode rotation of 1600 rpm with a scan rate of 10 mV s^{-1}.