Supporting information

Cobalt boride modified with N-doped carbon nanotubes as high-performance bifunctional oxygen electrocatalyst

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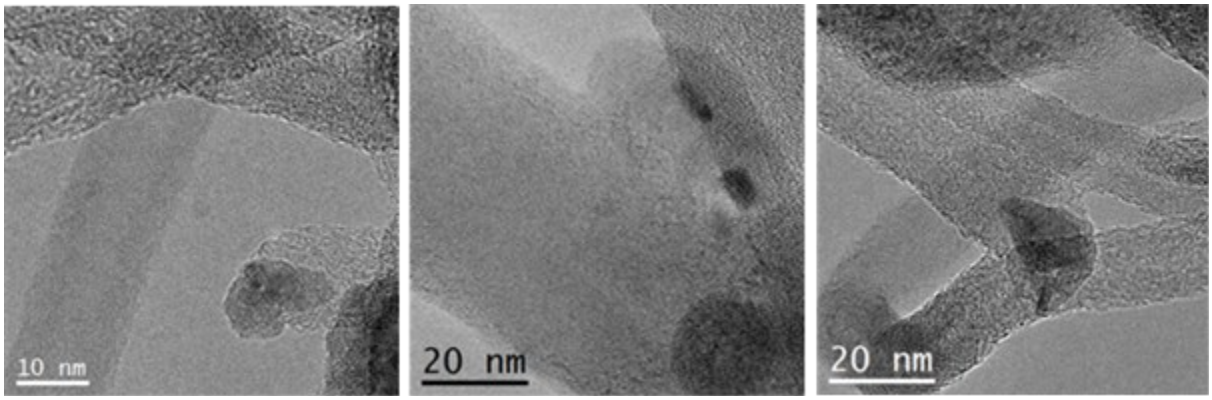

Fig. S1. Selected HRTEM analysis of CoB-500/NCNT.

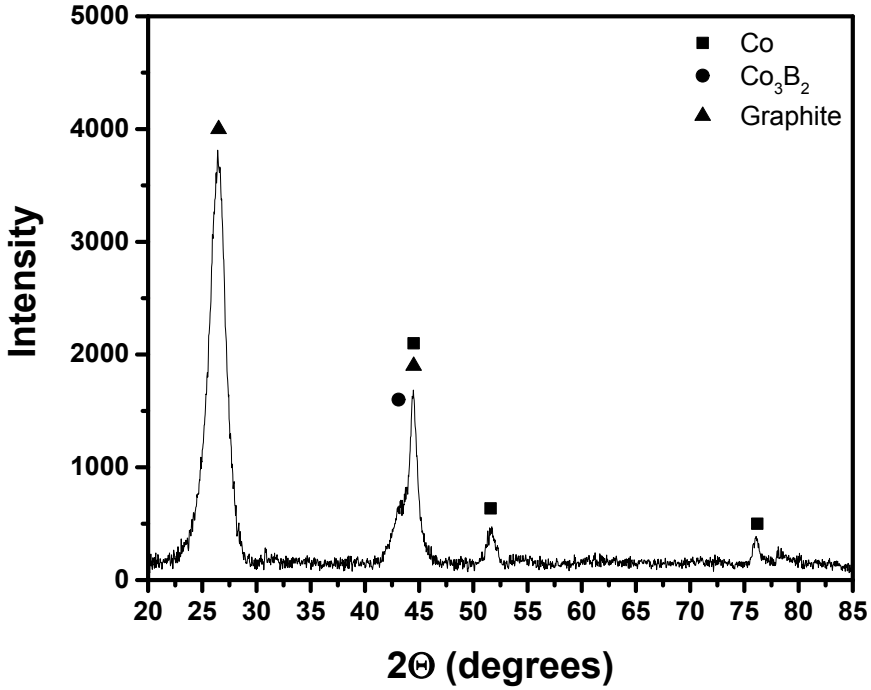

Fig. S2. XRD diffraction pattern of CoB-500/NCNT. XRD data were obtained using a Panalytical X'PERT Pro MPD X-ray diffractometer with a Cu Kα radiation source (λ = 1.5418 Å) in the range 2θ=20–85°.

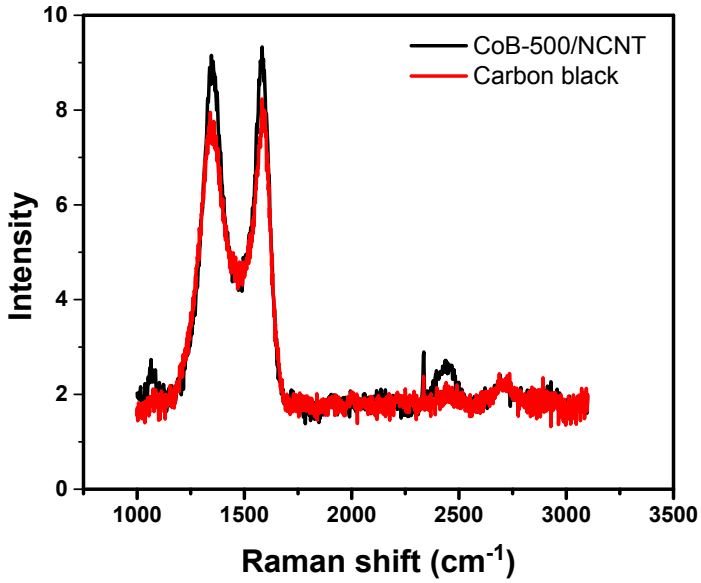

Fig.S3. Raman spectrum of the CoB-500/NCNT sample. Raman spectra were recorded using a Jubin–Yvon iHR550 spectrometer (HORIBA) equipped with a 532 nm laser source Ventus 532, Laser Quantum) and a power of 6.5 mW.

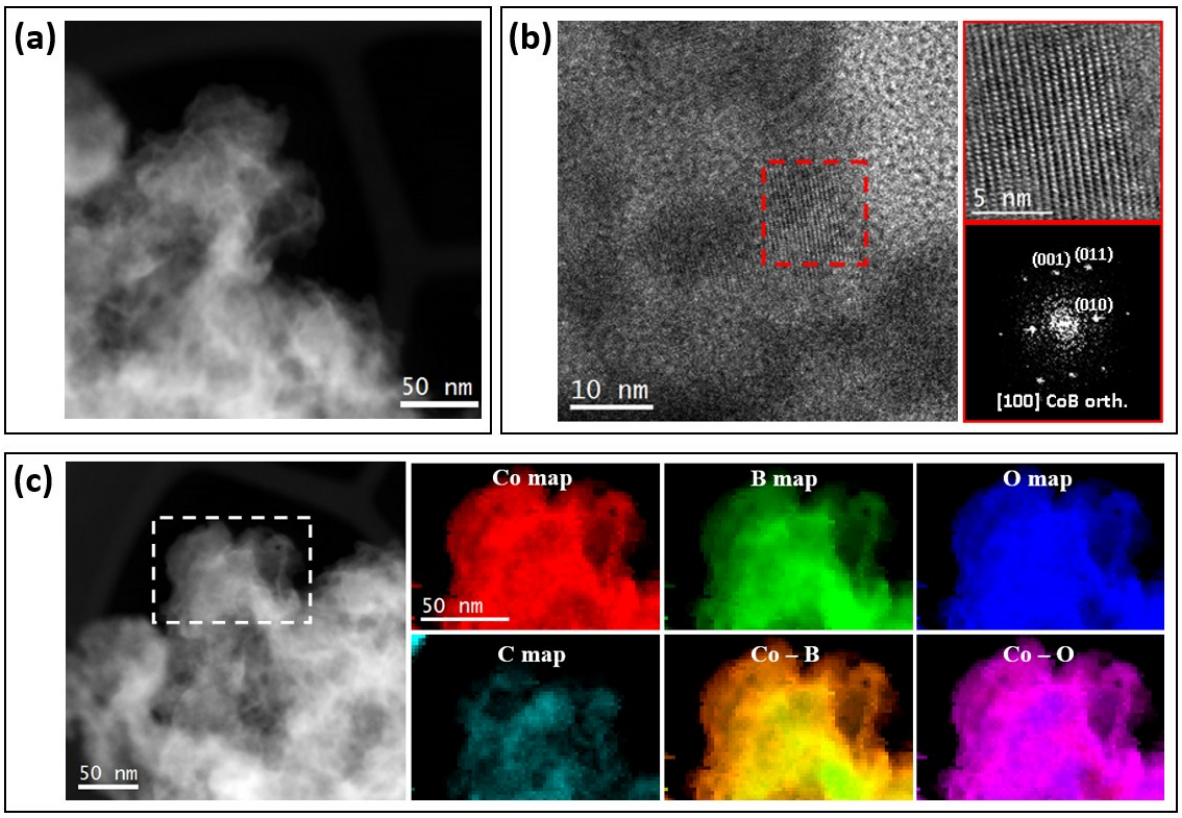

Fig. S4. TEM analysis of the initial CoB sample before the electrochemical tests. a) ADF STEM micrograph. b) High-resolution TEM image with an enlarged view of the red squared region showing details of the microstructure and its corresponding power spectrum. c) ADF STEM micrograph and STEM – EELS elemental composition maps of the area indicated with a white rectangle: Co (red), B (green), O (blue), C (turquoise) and N (violet) and their overlay (Co – B, Co – O and C – N). The scale bar is the same for all the compositional maps.

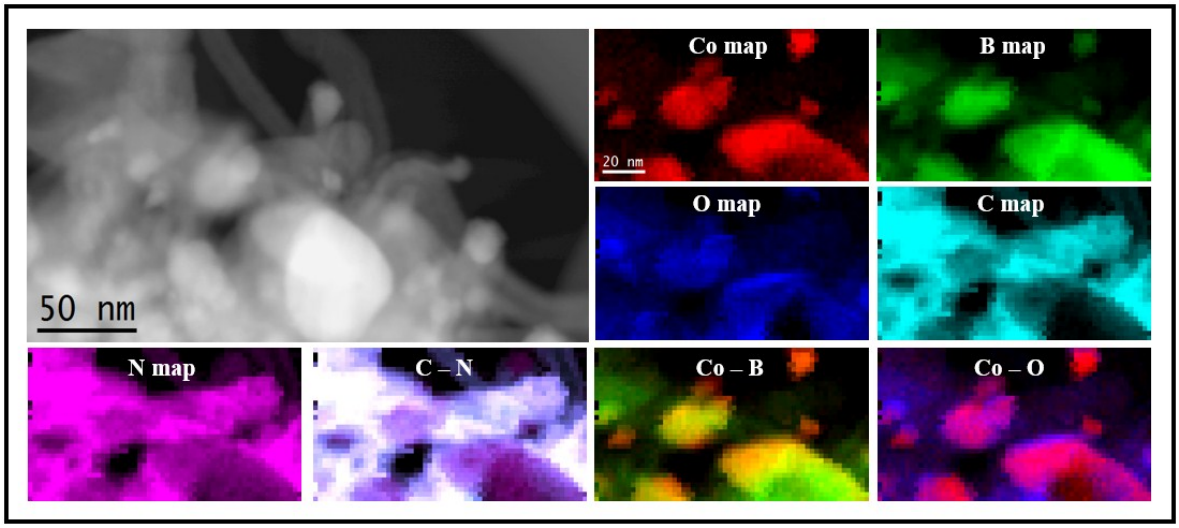

Fig. S5. ADF STEM micrograph of CoB/NCNT-500 before electrochemical testing showing an ensemble of nanoparticles and nanotubes, and STEM – EELS elemental composition maps of the area indicated with a white rectangle: Co (red), B (green), O (blue), C (turquoise) and N (violet) and their overlay (Co – B, Co – O and C – N). The scale bar is the same for all the compositional maps.

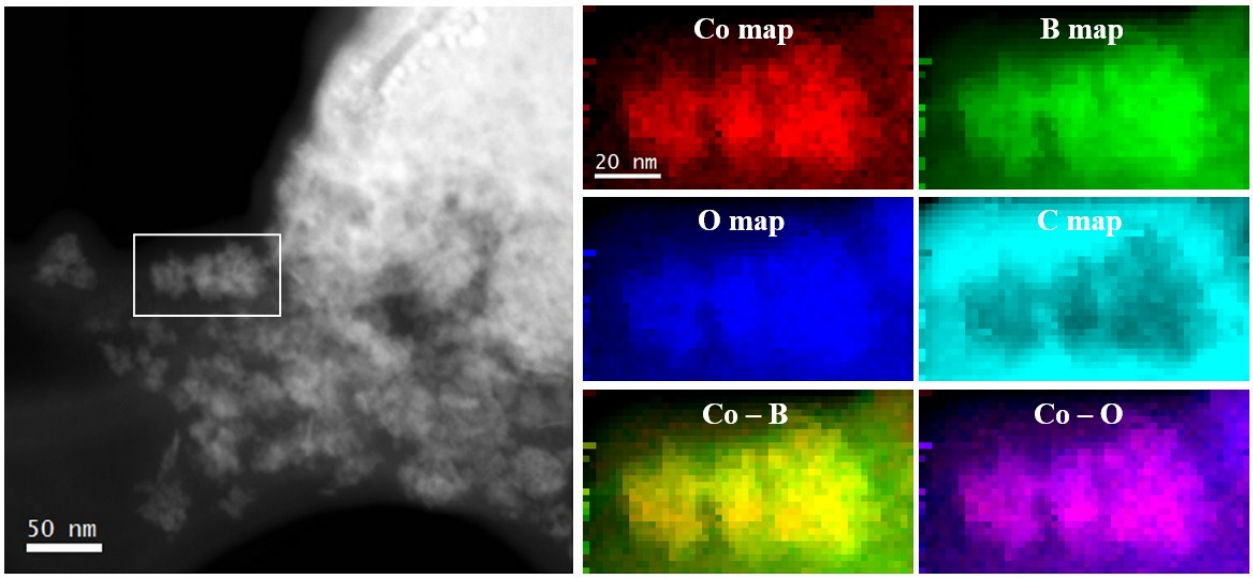

Fig. S6. ADF STEM micrograph of CoB/NCNT-500 after electrochemical OER activation showing an ensemble of nanoparticles and nanotubes, and STEM – EELS elemental composition maps of the area indicated with a white rectangle: Co (red), B (green), O (blue), C (turquoise) and N (violet) and their overlay (Co – B, Co – O and C – N). The scale bar is the same for all the compositional maps.

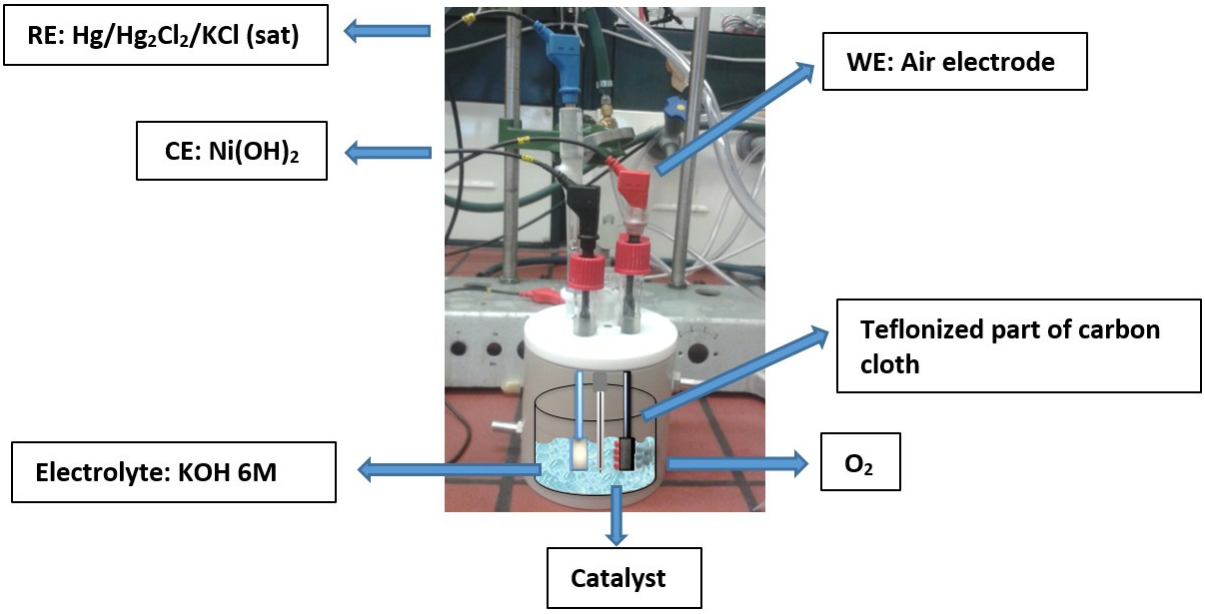

Fig. S7. Schematic representation of a home-made electrochemical cell for the charge-discharge stability test in 6 M KOH.

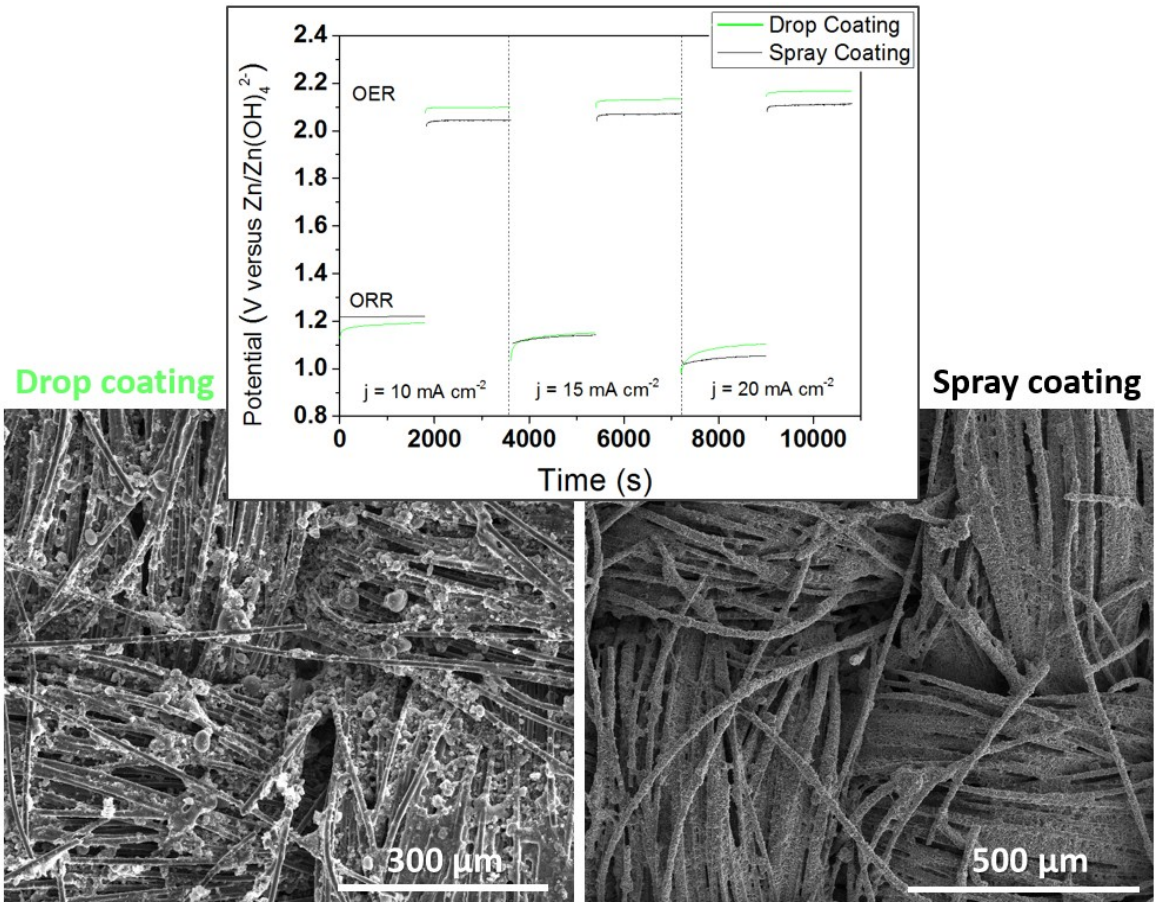

Fig. S8. A comparison of the discharge-charge cycling curves with a 1800 s cycle period performed at 10, 15 and 20 mA cm^{-2} (top), and SEM images (bottom) of the air electrodes prepared by drop-coating (left) and spray-coating of CoB/NCNT (right) on carbon cloth teflonized on one side. The deposition was on the non-teflonized side.