Supplementary Information

Valorization of Coffee Bean Waste: Coffee Bean Waste Derived Multifunctional Catalyst for Photocatalytic Hydrogen Production and Electrocatalytic Oxygen Reduction Reactions

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Table S1: The nitrogenous compounds present in the coffee bean.[1]

Component	Concentration (g/100g)
Protein	11-15
Amino Acid	0.8-1.0
Caffeine	1.5-2.0
Trigonelline	0.6-0.7

Table S2: Elemental composition calculated from XPS.

Element	Atom percentage (%)	
	p-Cof	Cof
Carbon	86.88	77.19
Oxygen	10.78	21.31
Nitrogen	1.36	1.48
Silicon	0.96	0.00

Table S3: Different nitrogen contents calculated from XPS.

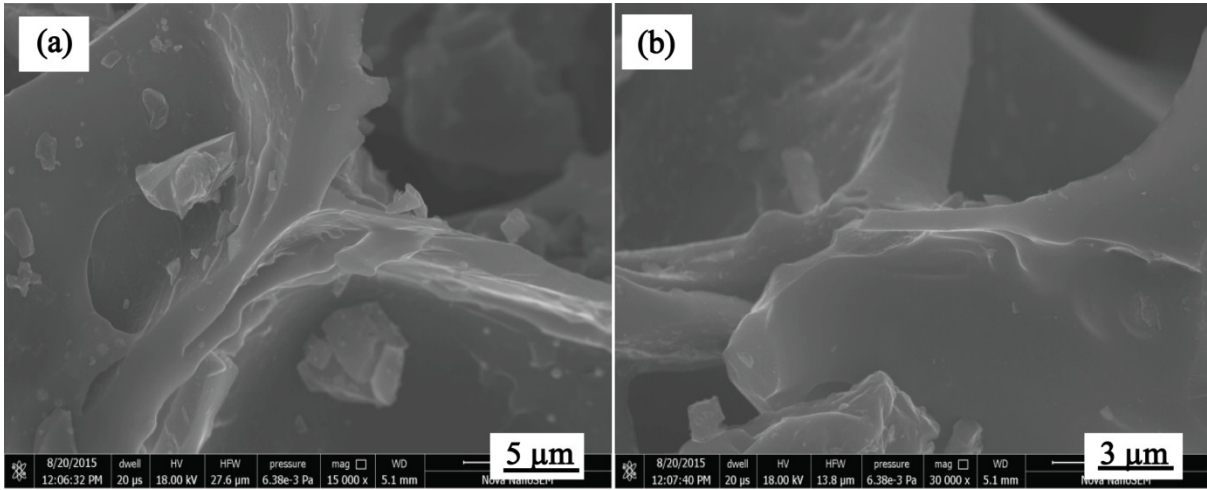| Nitrogen content	Atom percentage (%)	
	p-Cof	Cof
Nitride	0.00	7.67
Pyridinic	0.00	17.13
Pyrrolic	30.85	36.39
Graphitic	29.59	29.89
Oxide	39.56	8.92

Figure S1. FE-SEM images of Cof at different magnifications (a) 5 µm and (b) 3 µm.
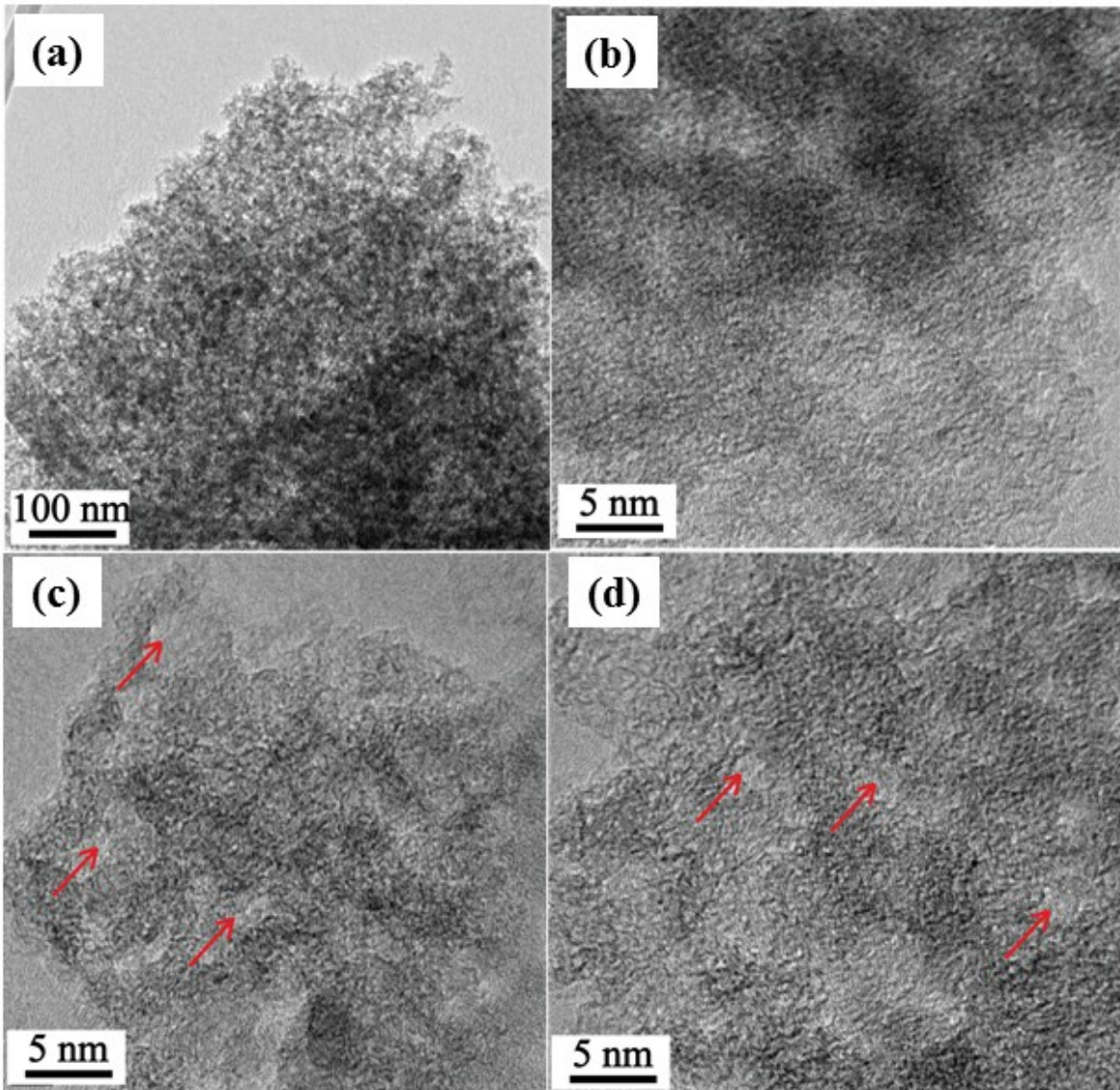
Figure S2. TEM (a) and HR-TEM (b-d) images of p-Cof. The arrows in (c) and (d) indicate the porosity in p-Cof.
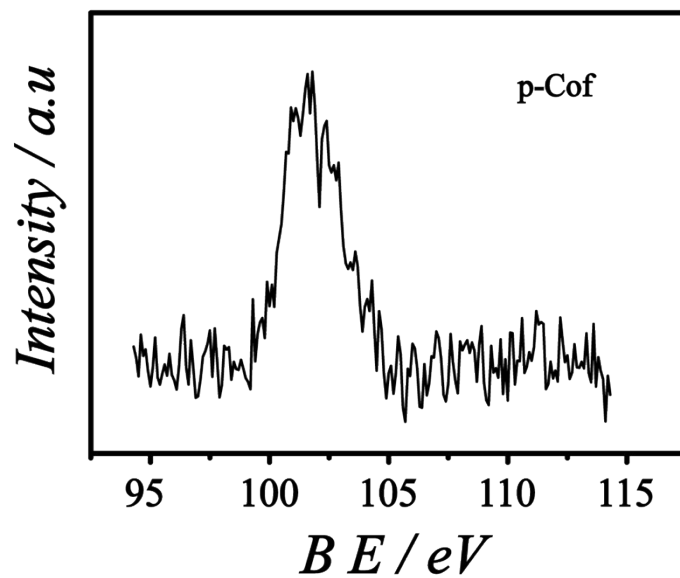
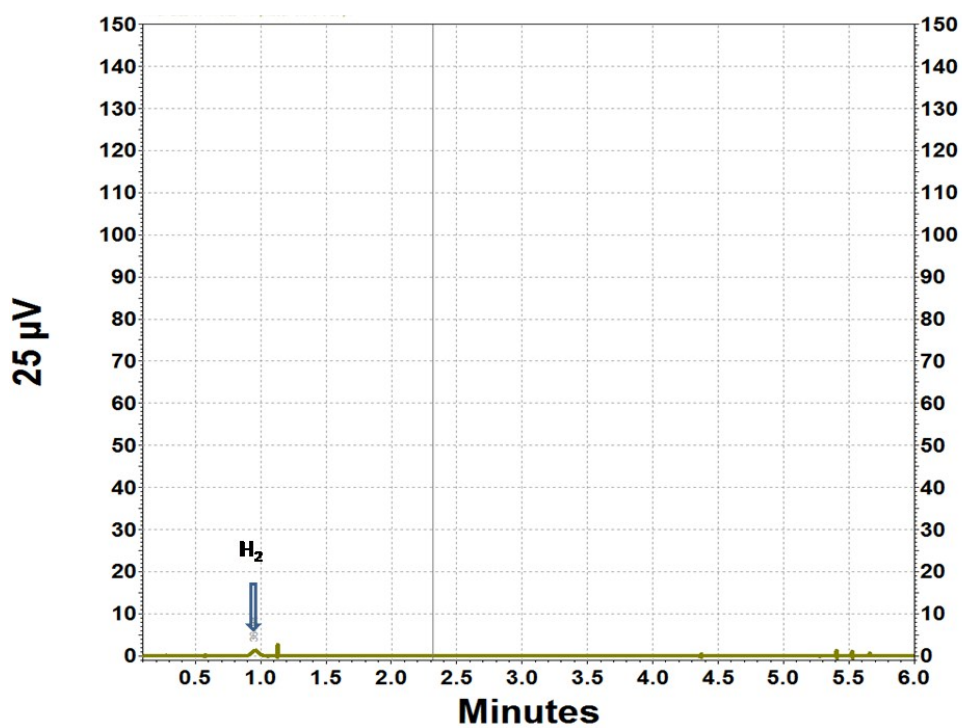Figure S3. Silicon 2p spectrum of p-Cof.

Figure S4. Chromatogram corresponding to the evolved hydrogen by N-AC.
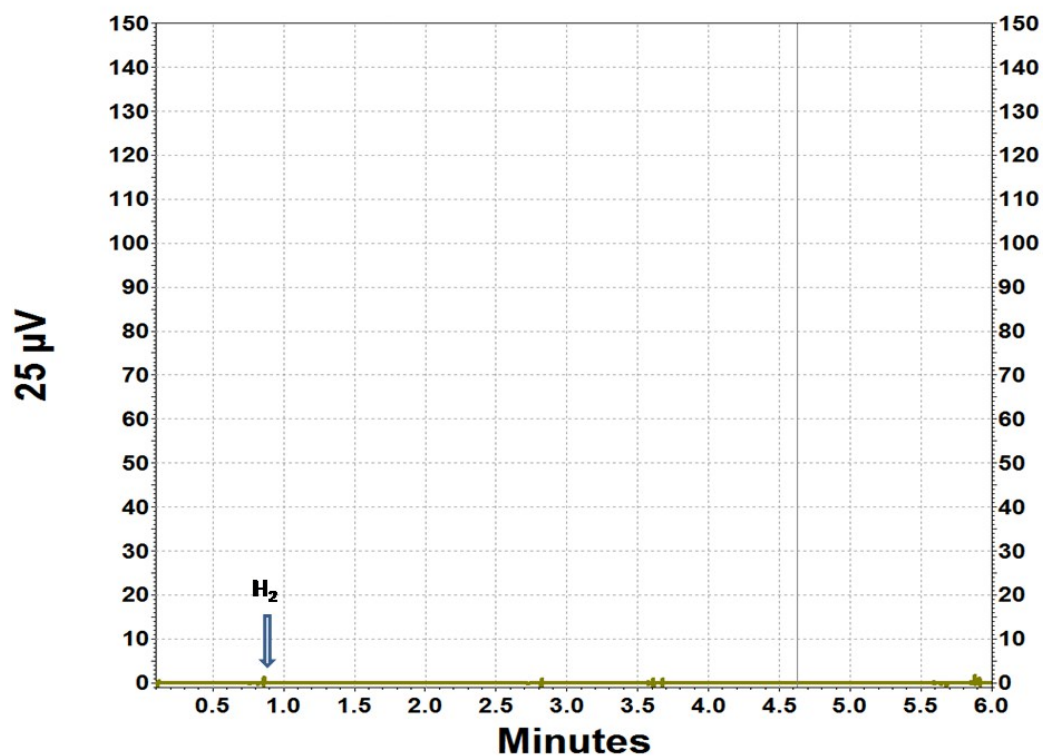
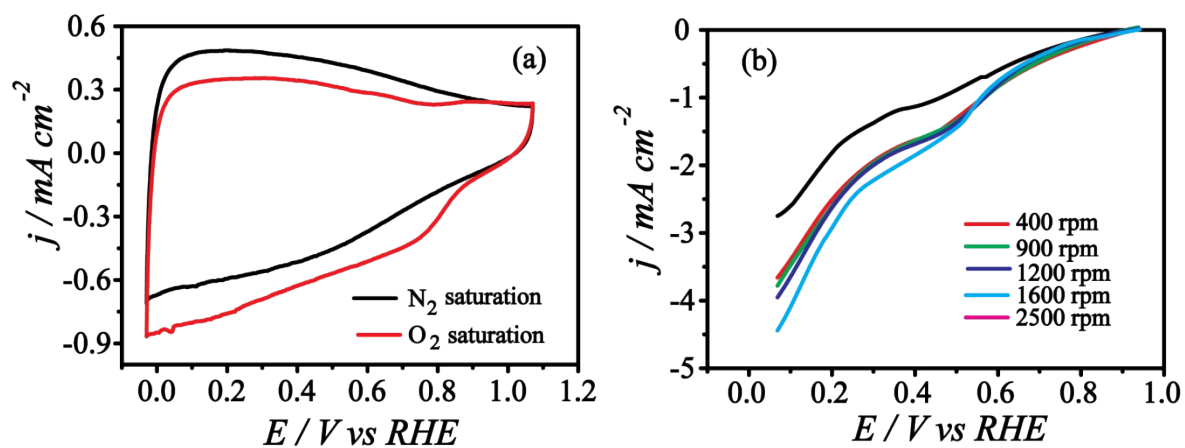Figure S5. Chromatogram corresponding to the evolved hydrogen by AC.

Figure S6. (a) Cyclic voltammograms of Cof in oxygen and nitrogen saturated 0.1 M KOH at a scan rate of 5 mV s^{-1} and (b) Linear sweep voltammograms (LSVs) of Cof at different rotation rates in oxygen saturated 0.1 M KOH at a scan rate of 5 mV s^{-1}.
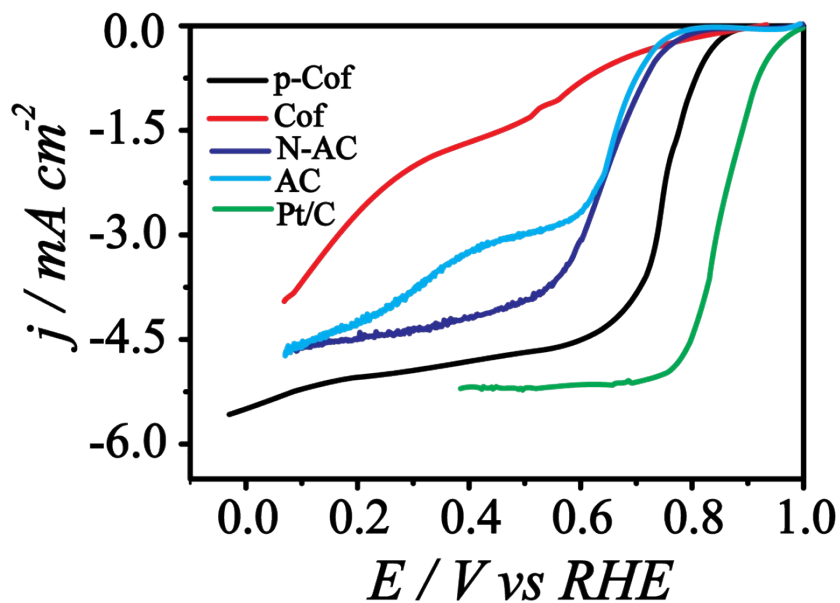
Figure S7. LSVs of p-Cof, Cof, AC and N-AC with an electrode rotation rate of 1600 rpm at a scan rate of 5 mV s^{-1} in oxygen saturated 0.1 M KOH.
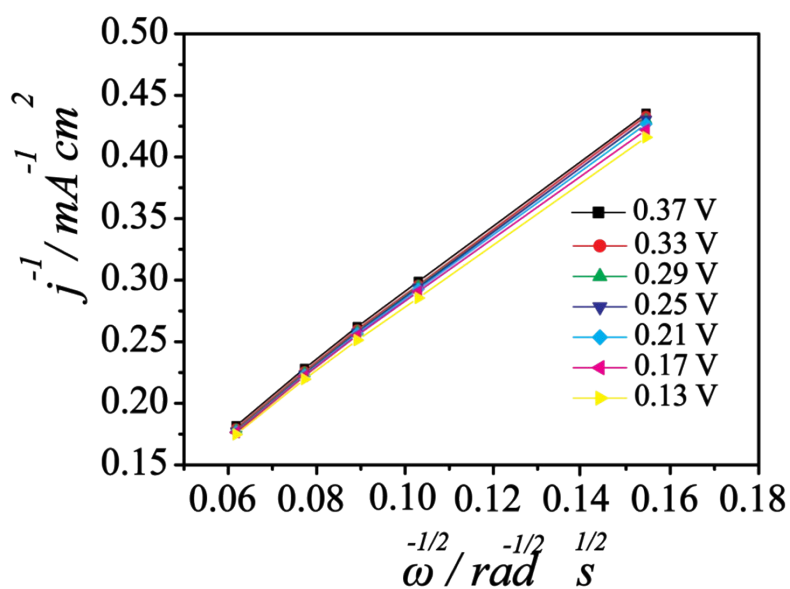

Figure S8. Koutckey – Levich plots of p-Cof derived from linear sweep voltammograms at different rotation rates carried out in oxygen saturated 0.1 M KOH at a scan rate of 5 mV s^{-1}.

References

1.   Y.-F. Chu, *Coffee: Emerging Health Effects and Disease Prevention*, 2012, John wiley & Sons, Inc. Blackwell Publishing Ltd.