Electronic Supplementary Material (ESI) for New Journal of Chemistry.
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Supporting Information

Nano-spinel Cobalt decorated sulphur doped graphene:An efficient and durable electrocatalyst for Oxygen Evolution Reaction and Non- Enzymatic sensing of H_2O_2

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S (A)

Detailed electrochemical investigations were performed like cyclic voltammetry, linear sweep voltammetry (LSV), electrochemical impedance spectroscopy (EIS), chronocoulometry, differential pulse voltammetry (DPV) and, chronoamperometry were performed to arrive at a conclusive behavior of the Co@S-rGO nanocomposites as an efficient OER electroctalyst. The comparative electrochemical measurements of the Co@S-rGO, S-rGO, and GO in terms of the LSV curves is a clear indicative of the altering of chemical valences and electronic states. The EIS and chronocoulometry (Figure S1) measurements do further cement this claim.

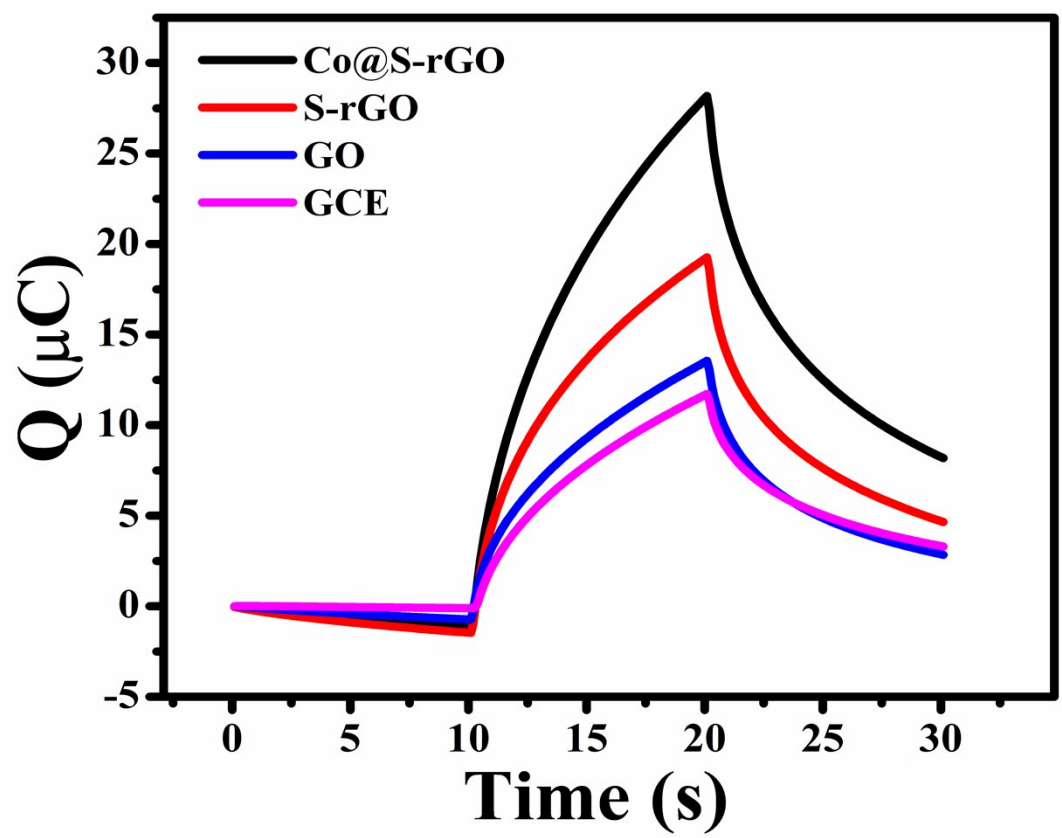

Fig.S1: *Typical chronocoulograms recorded over GCE and GO, S-rGO, and Co@S-rGO modified GCE in 1 mM FcMeOH in 0.1 M KNO_3 following purging with high purity Ar.*

S (B)

For the Chronoamperometric (i-t) stability test, appropriate amount of the Co@S-rGO nanocomposite material was loaded over an ITO-PET film followed by a nafion coating. Chronoamperometric (*i-t*) stability test was performed at the requisite potential to draw a benchmark current strength of 10 $mAcm^{-2}$. The FESEM imaging of the sample was carried, both before and after performing the stability test. As can be seen in figure S1, the gross morphological features constituting the Co NPs did not show any appreciable changes in them. The intactness of the Co NPs is an affirmative of the structural integrity and durability of the nanocomposite, thereby proving the claim for Co@S-rGO to be an efficient candidate as an OER electrocatalyst.

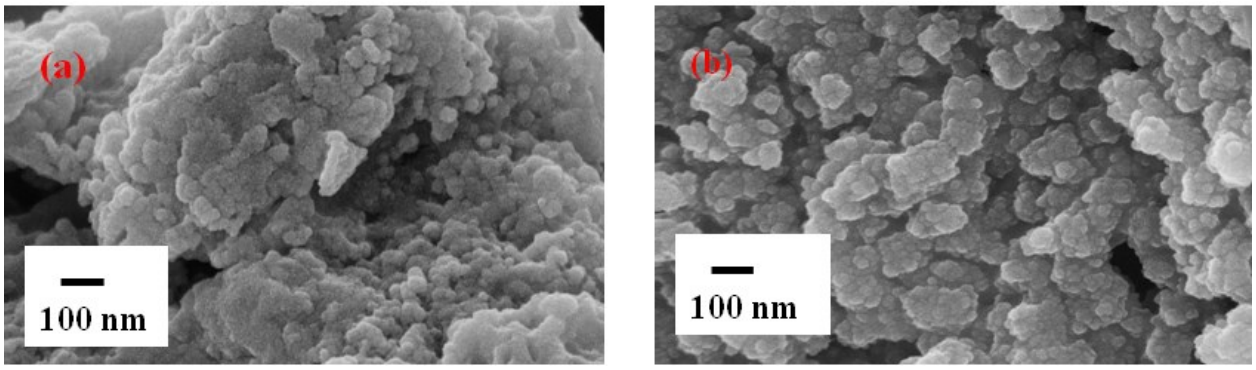

Figure S2. *FESEM image of the Co@S-rGO nanocomposite (a) before i-t stability test and (b) after i-t stability test.*