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Shape-controlled octahedral cobalt disulfide nanoparticles supported on nitrogen and sulfur-doped graphene/carbon nanotube composites for oxygen reduction in acidic electrolyte

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Supporting information

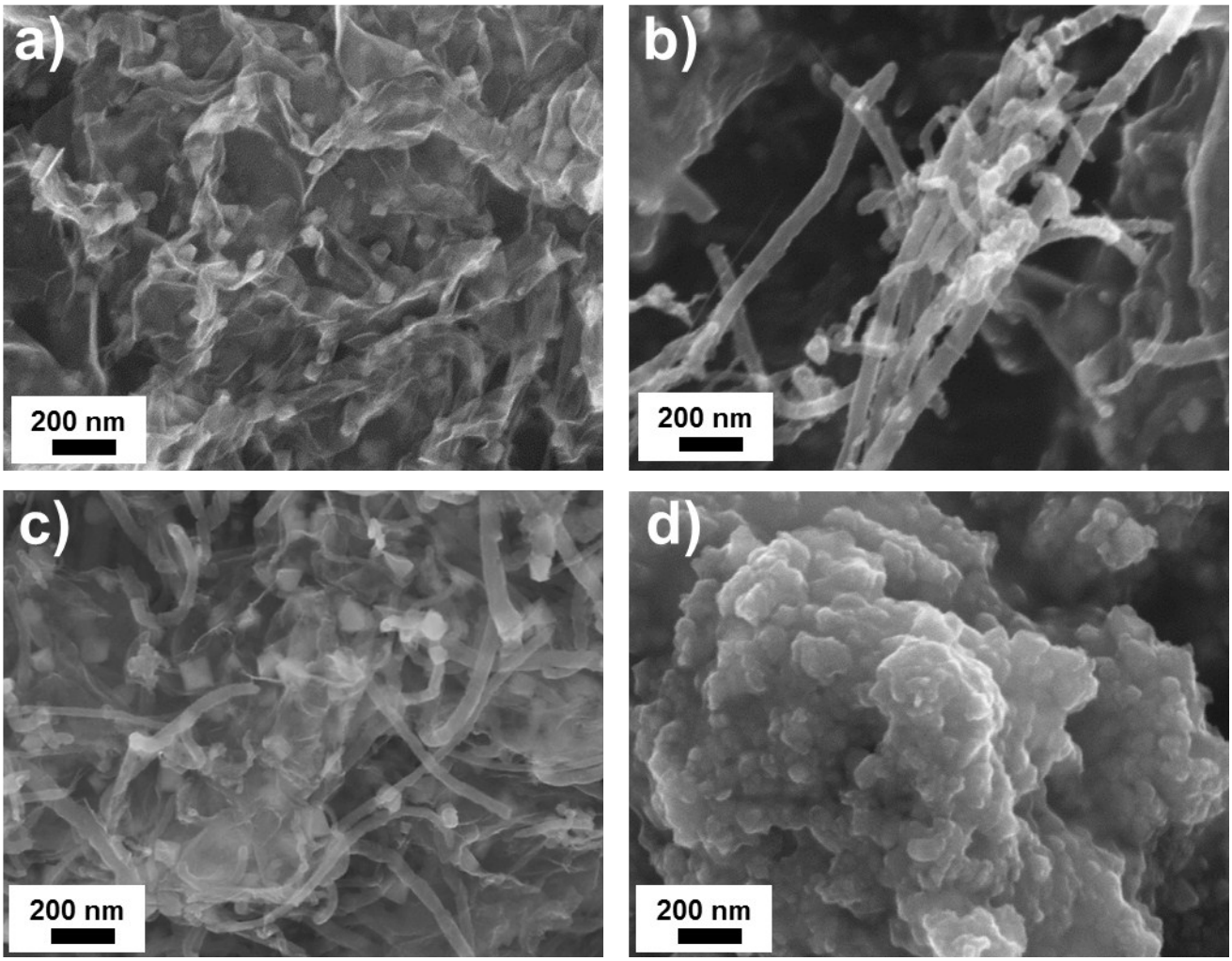

Figure S1. SEM images of (a) CoS_2-G, (b) CoS_2-C, (c) CoS_2-CG and (d) as-prepared, unsupported CoS_2.

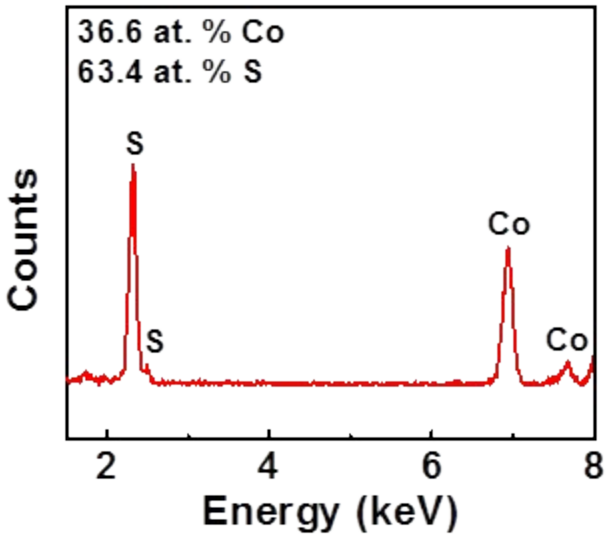

Figure S2. Energy dispersive x-ray spectrum of a single CoS_2 octahedral nanoparticle from the CoS_2-CG sample.

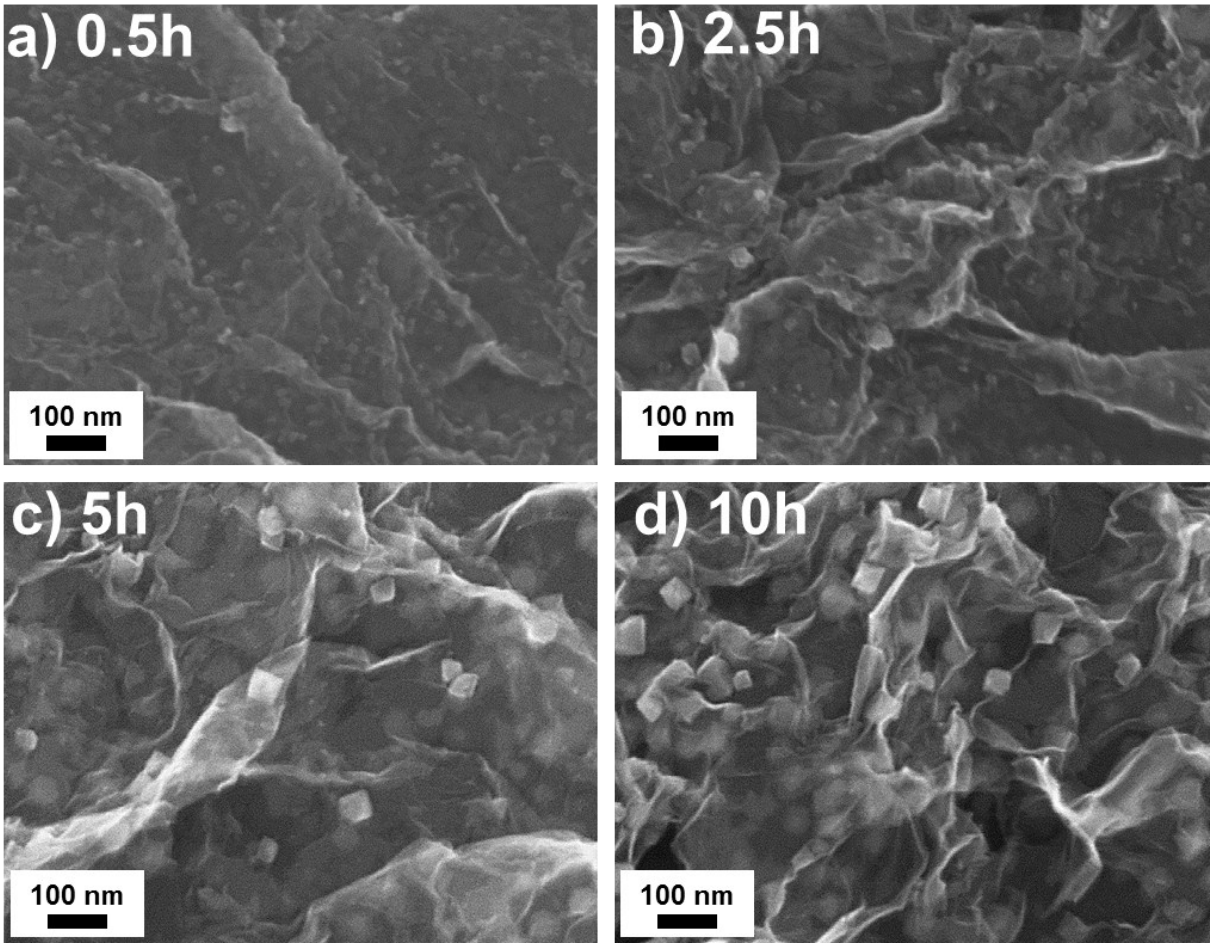

Figure S3. SEM images of the time dependent growth of CoS_2 supported on graphene held at 220 ^oC for (a) 0.5 h, (b) 2.5 h, (c) 5 h and (d) 10 h.

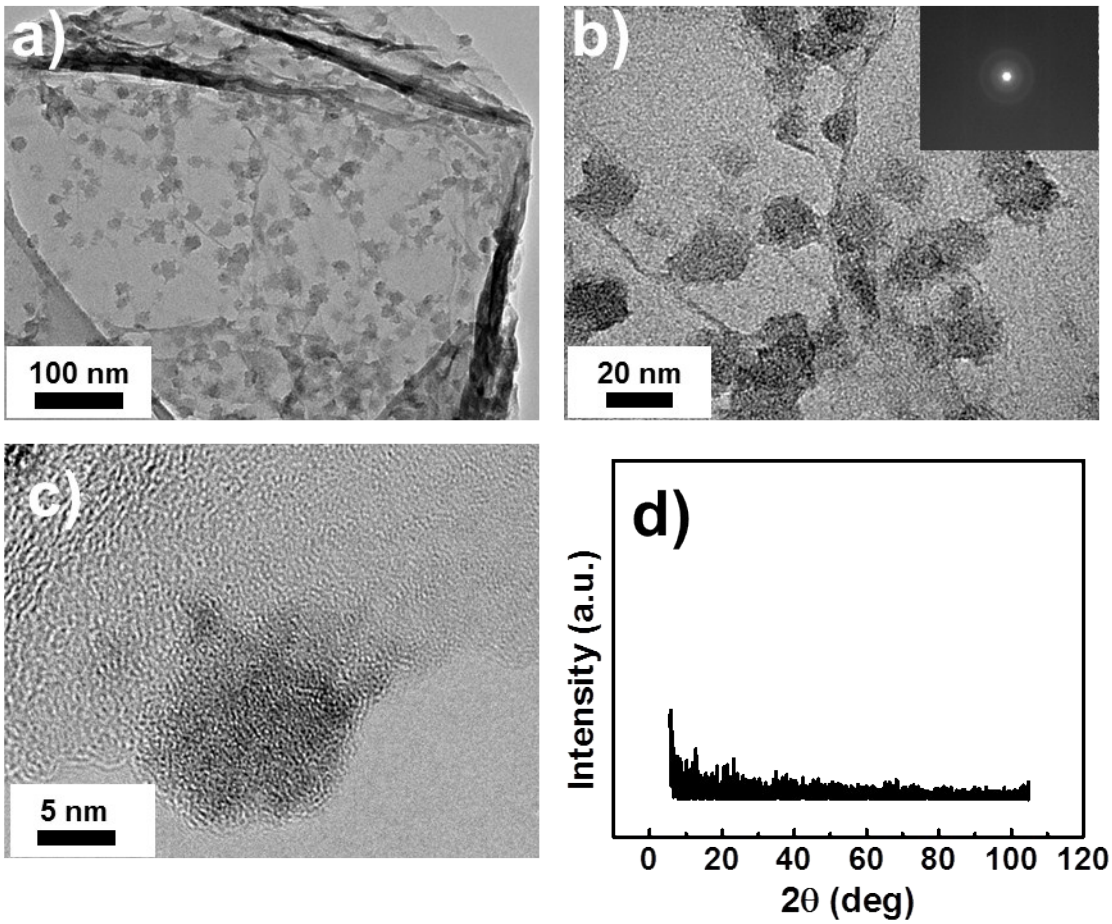

Figure S4. (a,b) TEM images, (c) high resolution TEM image, (d) XRD pattern and (b-inset) SAED pattern of CoSG-120.

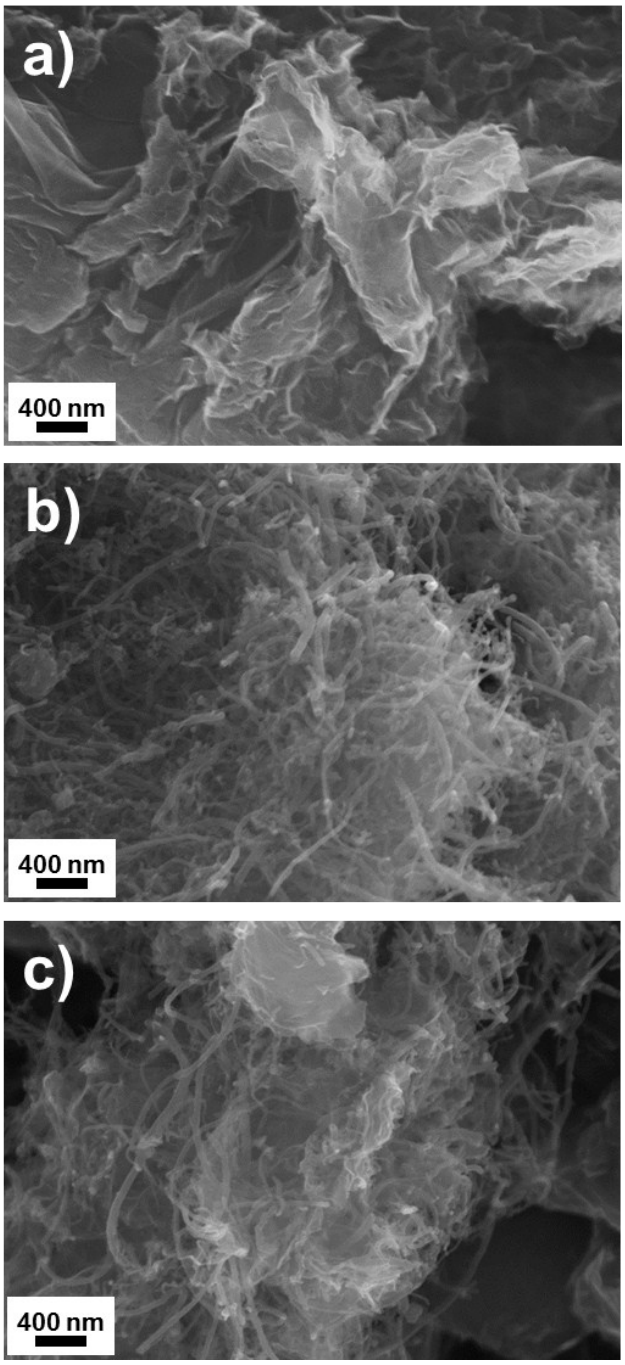

Figure S5. SEM images of (a) NS-G, (b) NS-C and (c) NS-CG.

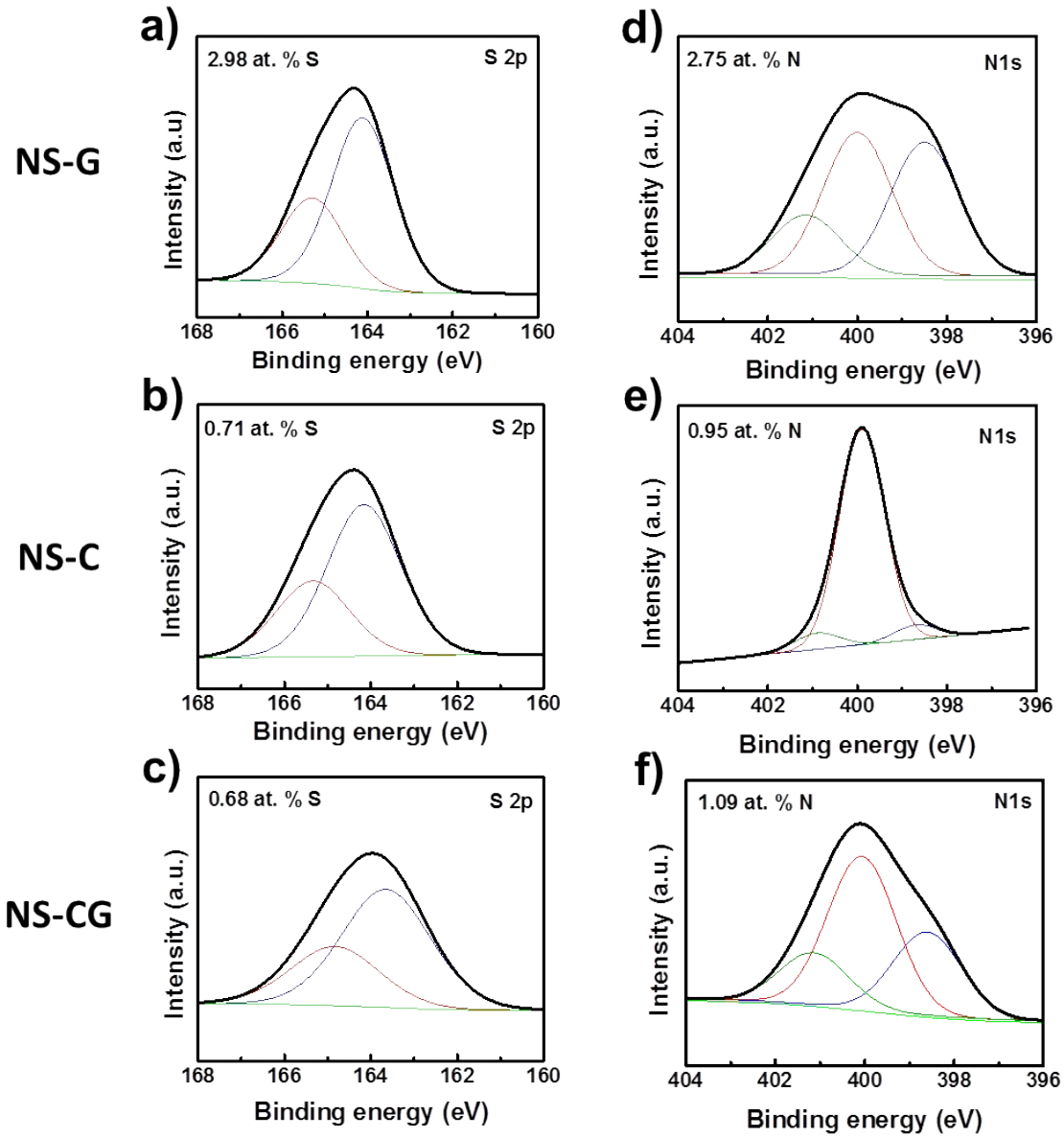

Figure S6. High resolution XPS (a-c) S2p and (d-f) N1s spectra for NS-G, NS-C and NS-CG.

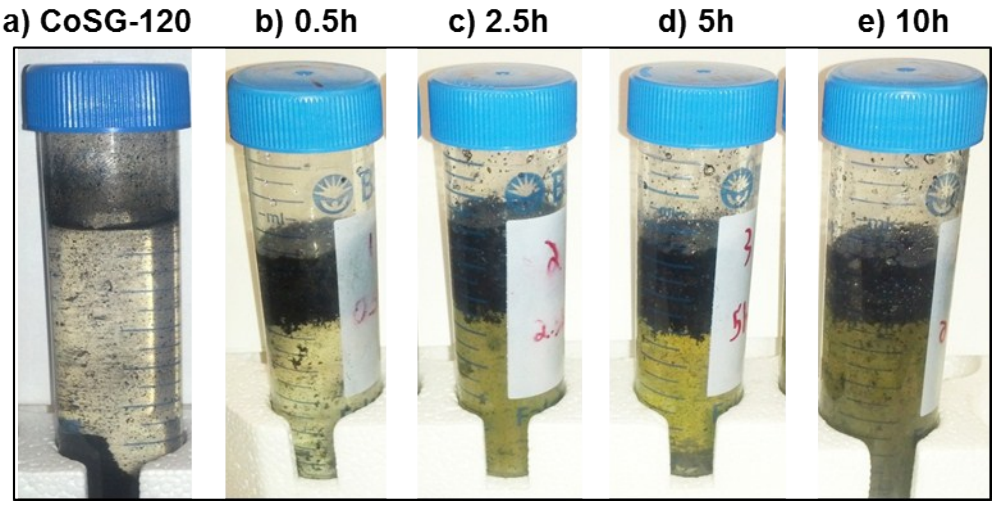

Figure S7. Solution obtained after solvothermal synthesis for (a) CoSG-120 and CoS2 supported on graphene reaction mixture materials held at 220 oC for (b) 0.5 h, (c) 2.5 h, (d) 5 h and (e) 10 h.

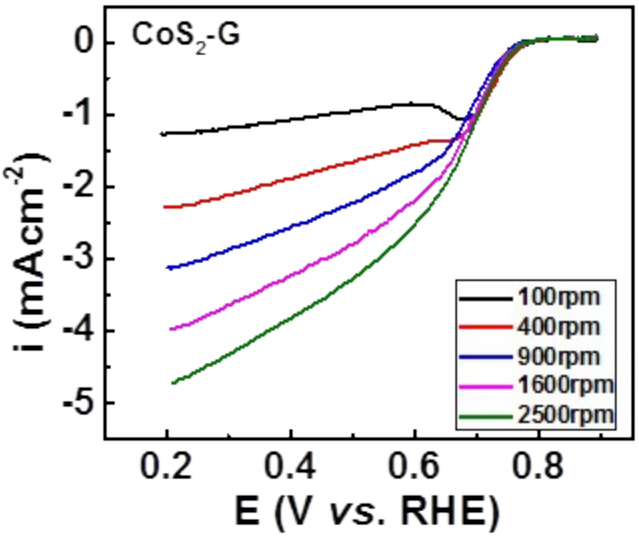

Figure S8. ORR polarization curve for CoS_2-G at various electrode rotation rates.

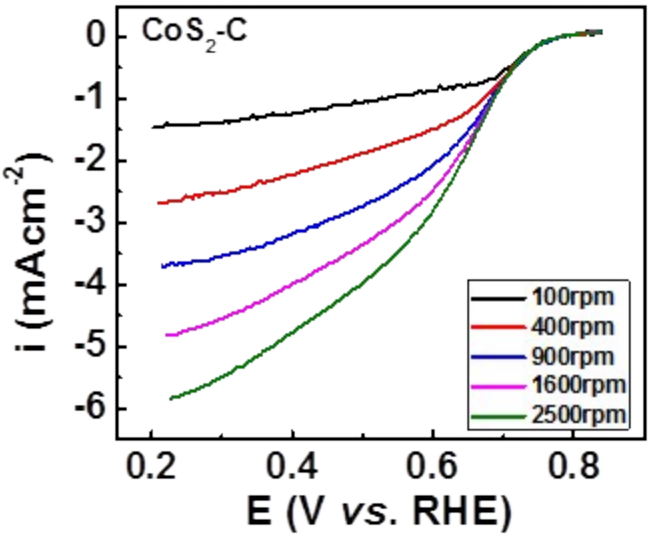

Figure S9. ORR polarization curve for CoS_2-C at various electrode rotation rates.

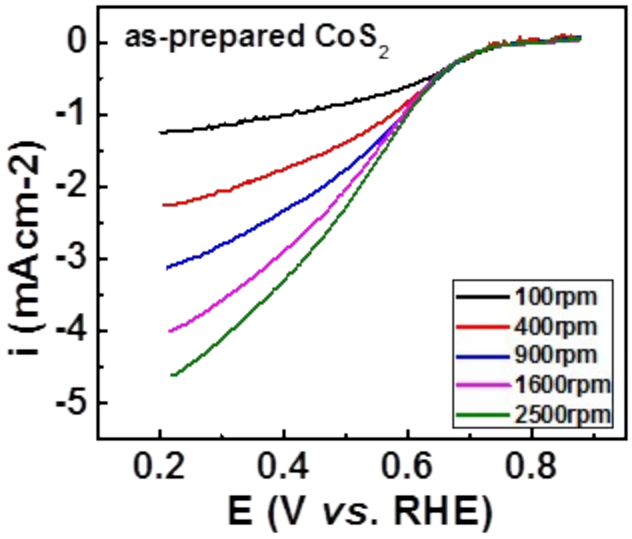

Figure S10. ORR polarization curve for as-prepared CoS_2 at various electrode rotation rates.

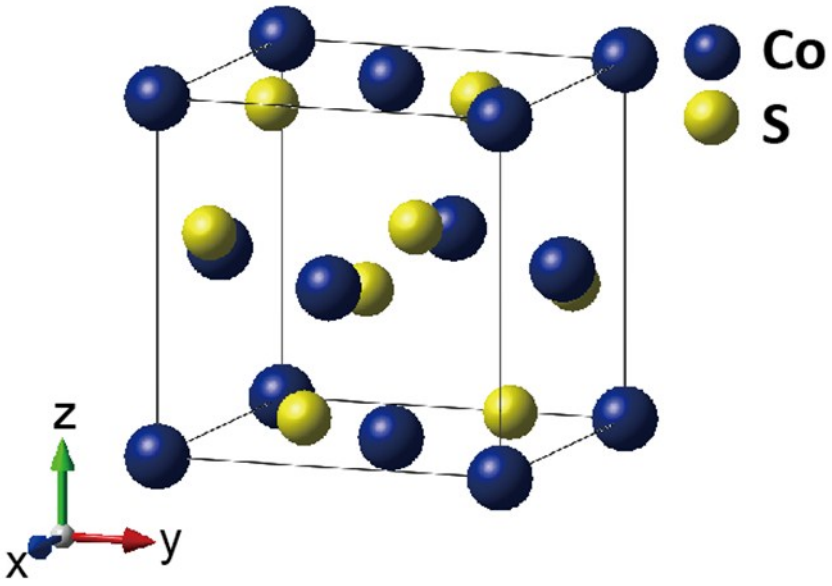

Figure S11. Fully relaxed bulk CoS_2 structure.