

Supplementary Information

Metal Oxide Heterostructures as Multifunctional Electrode Materials for Battery-Type Supercapacitor and Oxygen Evolution Reaction

Urooj Ashfaq^{#1}, Muhammad Nasir Hussain^{#1,2}, Abdul Naveed¹, Irsa Tariq^{*1,3}, Muhammad Adil Mansoor⁴, Sedat Yaşar², Talha Nisar,^{5,6} Veit Wagner,⁵ Amin Badshah^{*1,7}, Ali Haider^{*1,7}

¹Department of Chemistry, Quaid-i-Azam University, Islamabad, 45320, Pakistan

²İnönü University, Faculty of Science and Art, Department of Chemistry, 44280, Malatya, Türkiye.

³School of Materials Science and Engineering, Anhui University, Hefei, Anhui 230601, PR China

⁴Department of Chemistry, School of Natural Sciences (SNS), National University of Sciences and Technology (NUST), H-12, Islamabad, 44000, Pakistan

⁵School of Science, Constructor University, Campus ring 1, 28759, Bremen, Germany

⁶Karlsruhe Institute of Technology (KIT), Institute for Applied Materials (IAM), Karlsruhe 76131, Germany

⁷Pakistan Academy of Sciences, 3-Constitution Avenue, Sector G-5/2, Islamabad 44000, Pakistan

[#]U.A. and M.N.H. contributed equally to this paper

Corresponding Authors: I.T. (irsatariq@chem.qau.edu.pk); A.B. (aminbadshah@qau.edu.pk);
A.H. (ahaider@qau.edu.pk)

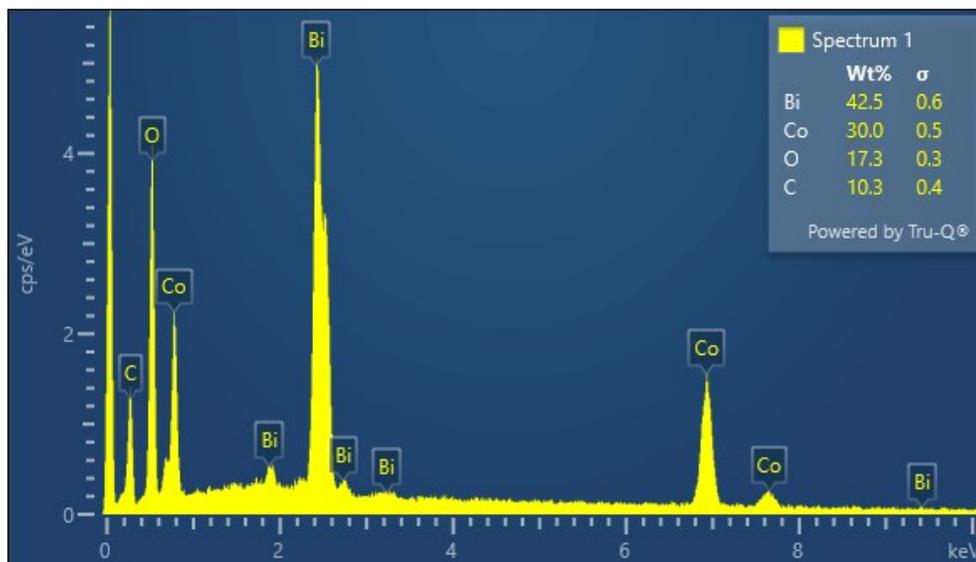


Figure S1. EDX spectrum of Bi₂O₃/Co₃O₄ heterostructure material.

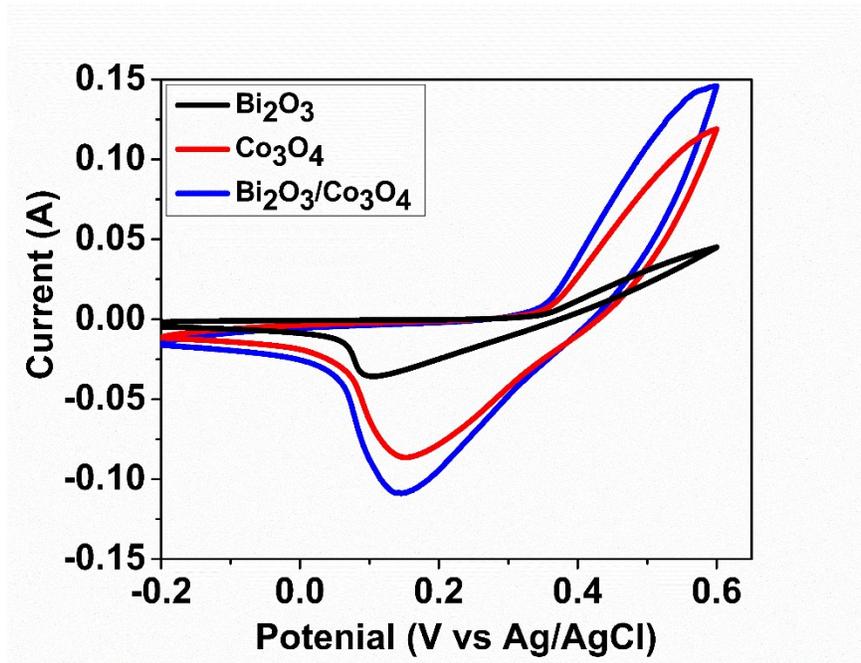


Figure S2. Comparative CV profiles of Bi₂O₃, Co₃O₄, and Bi₂O₃/Co₃O₄ heterostructure materials at 10 mV s⁻¹ in 5 M KOH.

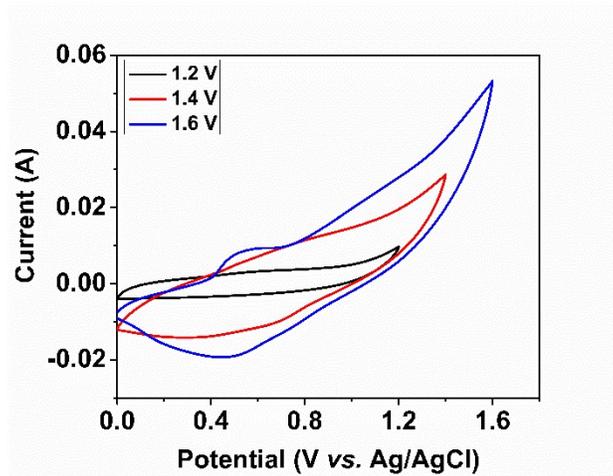


Figure S3. Potential window optimization of as fabricated asymmetric device.

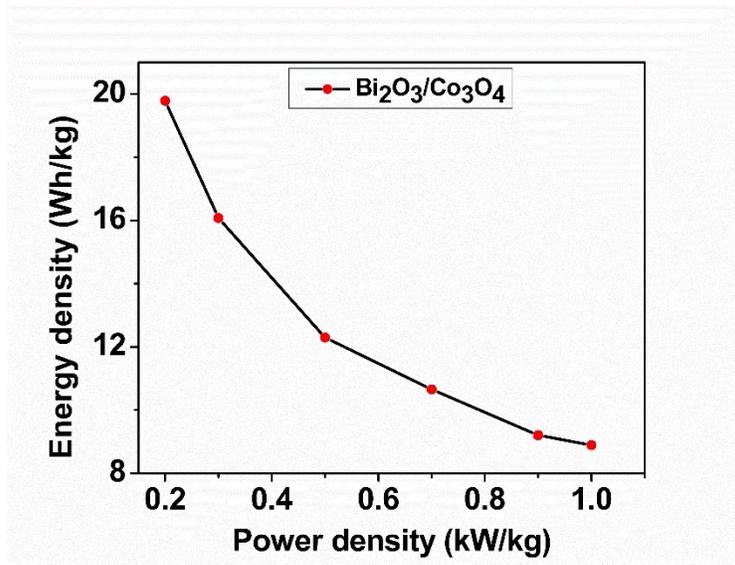


Figure S4. Ragone plot of asymmetric device.

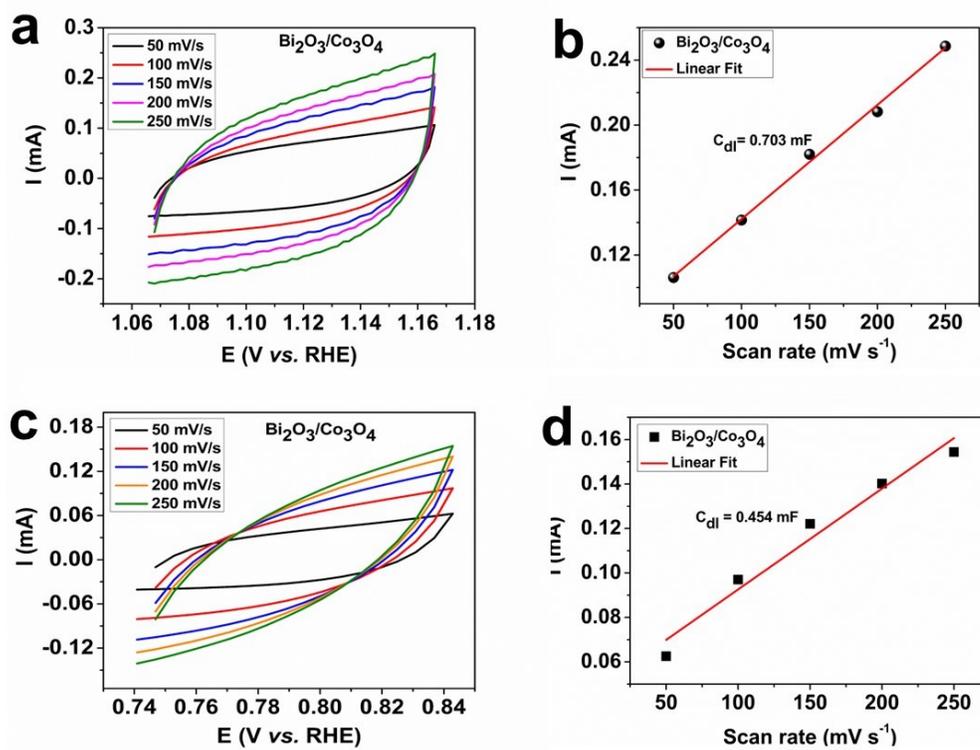


Figure S5. CV and C_{dl} plots for $\text{Bi}_2\text{O}_3/\text{Co}_3\text{O}_4$; a, b) alkaline media, c, d) neutral media

Table S1. Performance comparison of Bi₂O₃/Co₃O₄ heterostructure with reported materials .

Electrode material	Specific capacitance	Current density (A g⁻¹)	Electrolyte	Potential window (V)	Mass loading (mg)	Capacitance retention (%)	Reference
Co ₃ O ₄ @NiO	1306	1	3 M KOH	0 - 0.5	4	95.5	1
NiCo ₂ O ₄ /Bi ₂ O ₃ /CNTs	2762.3	1	1 M KOH	0 - 0.5	2.15	92.3	2
Bi ₂ O ₃ /N-Carbon	684.9	0.5	6 M KOH	-1-0	5	85.2	3
Co ₃ O ₄ /graphene	978.1	1	2 M KOH	0 - 0.45	6.5	93.7	4
Bi ₂ O ₃ -rGO	1053	1	6 M KOH	-1 - 0	3	84.2	5
Co ₃ O ₄ /NiCo ₂ O ₄	1767	0.5	6 M KOH	0 - 0.4	1	93.8	6
Co ₃ O ₄ /CoS	1658	1	2 M KOH	0 - 0.5	3	92.3	7
Bi₂O₃/Co₃O₄	2998	1	5 M KOH	0 - 0.45	1	93.6	This Work

Table S2. R_{ct} values for $\text{Bi}_2\text{O}_3/\text{Co}_3\text{O}_4$, Co_3O_4 , and Bi_2O_3 calculate from EIS Nyquist plots.

Electrocatalyst	pH	R_{ct} (Ohm)
$\text{Bi}_2\text{O}_3/\text{Co}_3\text{O}_4$	Alkaline	3.51
Co_3O_4	-	5.12
Bi_2O_3	-	5.89
$\text{Bi}_2\text{O}_3/\text{Co}_3\text{O}_4$	Neutral	120
Co_3O_4	-	189
Bi_2O_3	-	264

Table S3. OER parameters for Bi₂O₃/Co₃O₄, Co₃O₄, and Bi₂O₃ in alkaline and neutral medium.

Electrocatalyst	Medium	OER	
		η (mV) @mA cm ⁻²	Tafel slope (mV dec ⁻¹)
Bi ₂ O ₃ /Co ₃ O ₄	Alkaline	464@50	168.8
Co ₃ O ₄	-	524@50	277.0
Bi ₂ O ₃		575@50	338.2
Bi ₂ O ₃ /Co ₃ O ₄	Neutral	153@10	171.9
Co ₃ O ₄	-	250@10	190.1
Bi ₂ O ₃	-	280@10	220.5

Table S4. C_{dl}, ECSA and RF for Bi₂O₃/Co₃O₄, Co₃O₄, and Bi₂O₃-NF in alkaline and neutral media.

Electrocatalysts	Medium	C _{dl} (mF)	ECSA (cm ²)	RF
Bi ₂ O ₃ /Co ₃ O ₄	Alkaline	1.24	31.0	44
Co ₃ O ₄	-	0.703	17.6	25
Bi ₂ O ₃	-	0.605	15.1	21
Bi ₂ O ₃ /Co ₃ O ₄	Neutral	0.871	21.8	31
Co ₃ O ₄	-	0.454	11.3	16

Bi ₂ O ₃	-	0.280	7.0	10
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References

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