Supporting Information

Unlocking the potential of proton-mediated detection of Ascorbic acid with Ni-Co Bimetallic MOF based Extended Gate FET

Guru Prasad Kuppuswamy[a,b,#], Akshaya Vinukumar[a, #], Kishore Pushparaj[c], Sujitha Murugaiyan[c], Larisa Lvova[d*], Surya Velappa Jayaraman[e,f], Corrado Di Natale[c*], Yuvaraj Sivalingam[e,g*]

[a] Department of Physics and Nanotechnology, SRM Institute of Science and Technology, Kattankulathur 603203, TamilNadu, India

[b] Department of Materials Engineering, Ben-Gurion University of the Negev, Beer-Sheva, 84105, Israel

[c] Department of Electronic Engineering, University of Rome Tor Vergata, Via del Politecnico 1, 00133 Roma, Italy

[d] Department of Chemical Science and Technologies, University of Tor Vergata, Via della Ricerca Scientifica, 000133 Rome, Italy

[e]Centre for Advanced Translational Research, KPR College of Arts, Science and Research, Coimbatore 641407, Tamil Nadu, India

[f]New Industry Creation Hatchery Center (NICHe), Tohoku University, Aoba-ku, Sendai 980-8579, Miyagi, Japan

[g]Department of Electronics and communication Engineering, Bannari Amman Institute of Technology, Sathyamangalam 638401, Tamil Nadu, India

# Both the authors have contributed equally

* Corresponding author

E-mail: Larisa Lvova - Larisa.Lvova@uniroma2.it

Corrado Di Natale - dinatale@uniroma2.it

Yuvaraj Sivalingam - yuvaraj.s@kprcas.ac.in

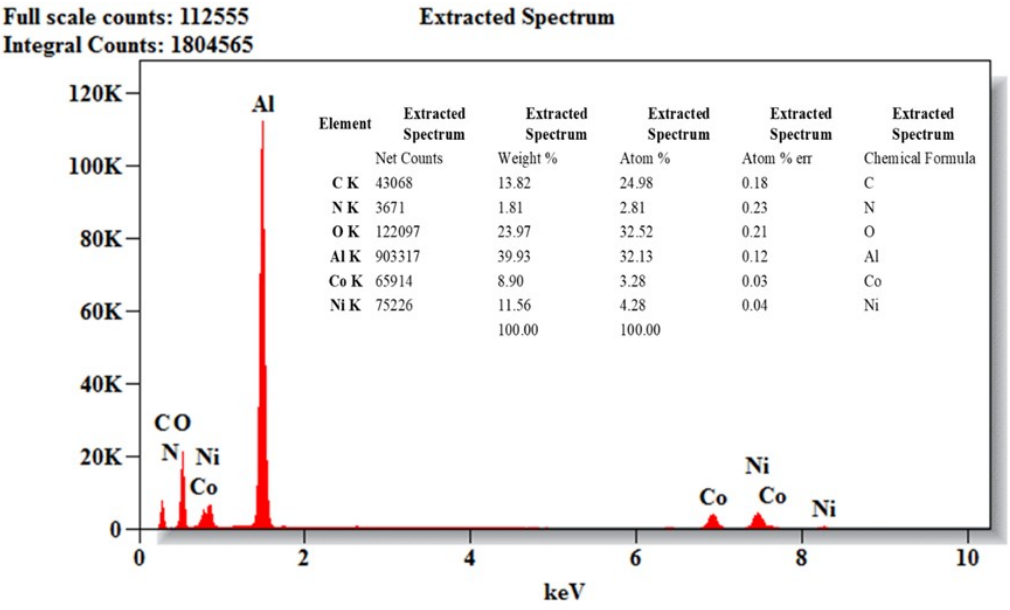

Figure S1. Energy Dispersive X-ray (EDX) spectrum of Ni-Co MOF. showcased that the occupation of Ni atoms in the Ni-Co MOF composition is slightly higher than the Co atoms.

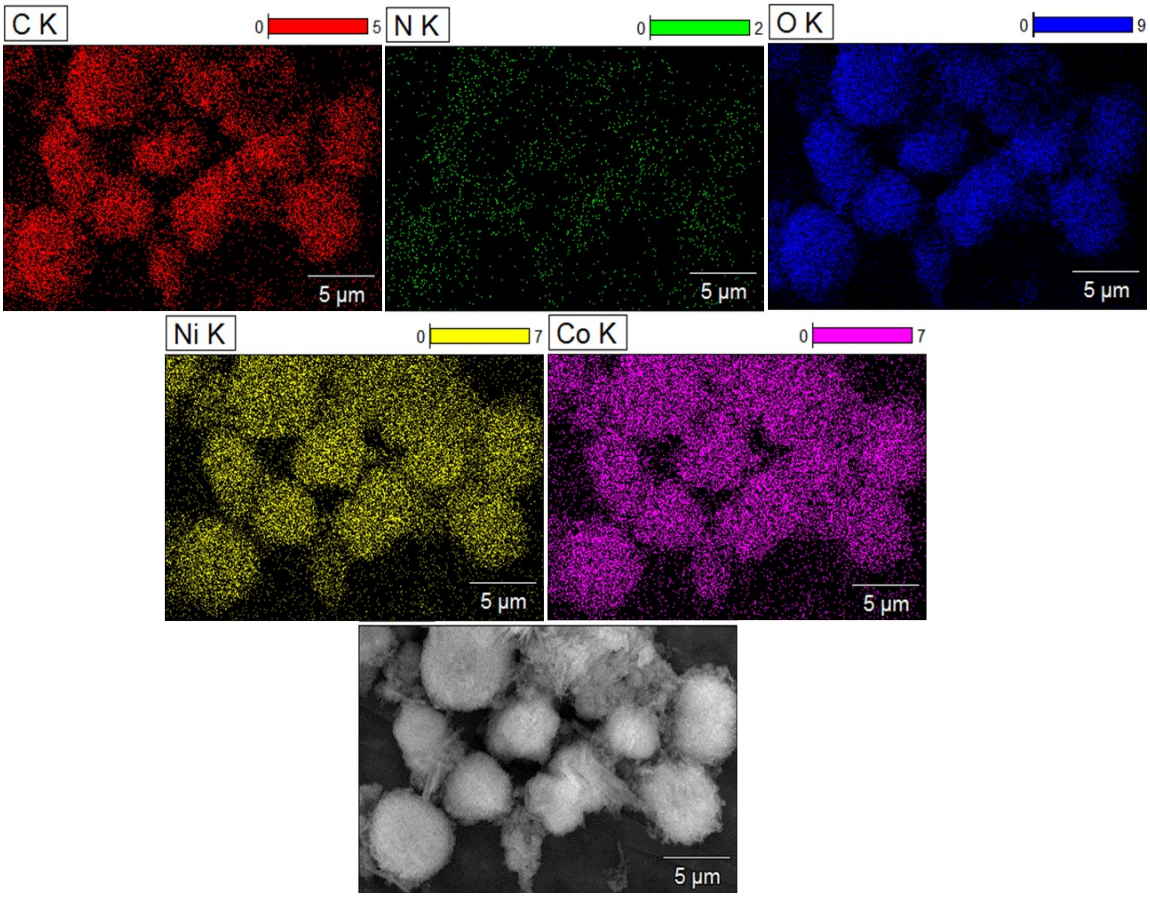

Figure S2. SEM-EDS colour mapping of Ni-Co MOF

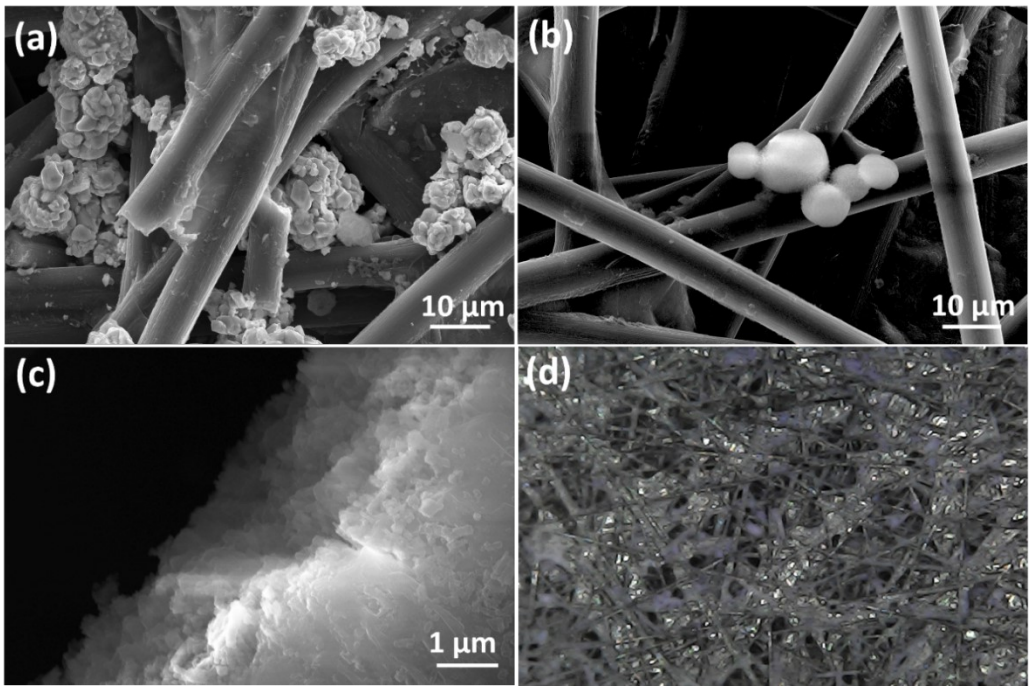

Figure S3. (a-c) SEM image of Ni-Co MOF/CP, (d) Digital Microscopic image of Ni-Co MOF

The Figure S3(a) illustrates that the distribution of Ni-Co MOF on the CP electrode, as depicted in the SEM image is non-uniform, with observable particle aggregation. Also, the digital microscopic image from Figure S3(d) show a similar non-uniform nature of drop-casted layer. This phenomenon arises from a surface effect known as the "coffee ring." Even when the dispersed Ni-Co MOF is drop-casted at the centre of the CP electrode geometric area, however solvent evaporation tends to be higher at the droplet's edges. To compensate for this loss, solvent from the centre flows outward, carrying solute particles with it. This results in an uneven distribution of material, leading to a heterogeneous electrode surface.[1] This provides us with an insight that even when we drop-cast the material under the same conditions, the distribution and reaction of particles at the nanometre scale are unpredictable.

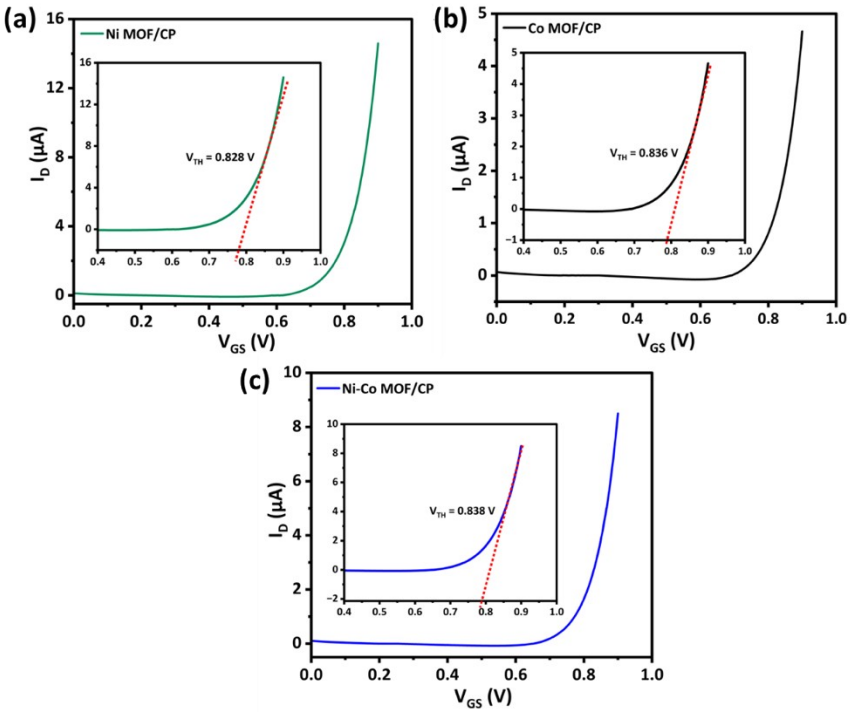

Figure S4. Transfer characteristics of (a) Ni MOF/CP, (b) Co MOF/CP and (c) Ni-Co MOF and its corresponding threshold voltage (V_{TH}). Fig.S11 (a-c) displayed the positive value of V_{TH} which indicates that the fabricated electrode has p-type semiconductor behaviour.

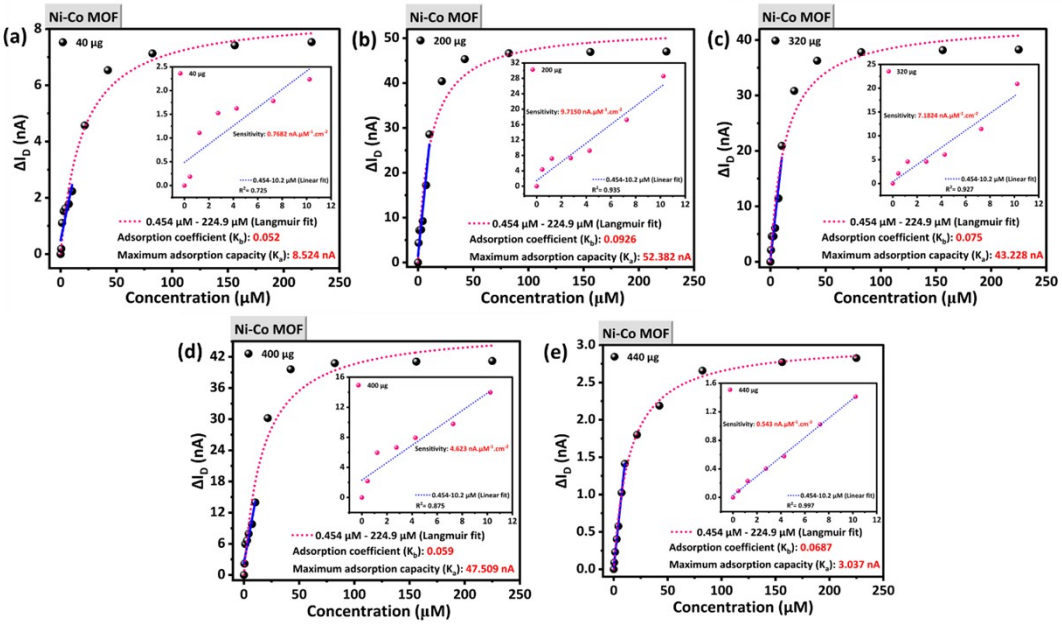

Figure S5. Calibration plot of 40, 200, 320, 400 and 440 μg of Ni-Co MOF/CP following Langmuir adsorption

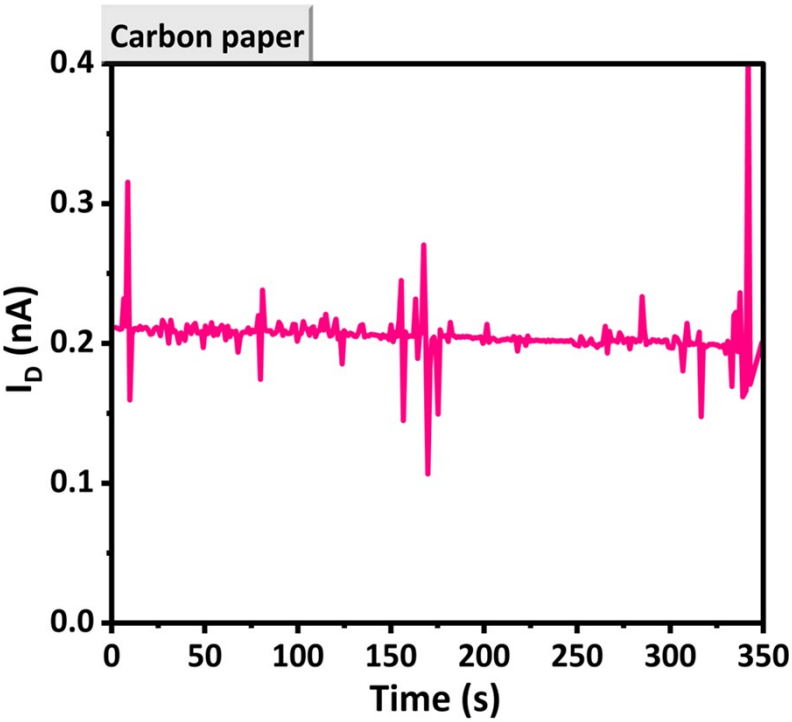

Figure S6. I-t curve of carbon paper (CP) showing no response with the addition of ascorbic acid.

References:

1 Y. Zhang, A. K. Selva Kumar, D. Li, M. Yang and R. G. Compton, *ChemElectroChem*, 2020, **7**, 4614–4624.