

**Supplementary information**

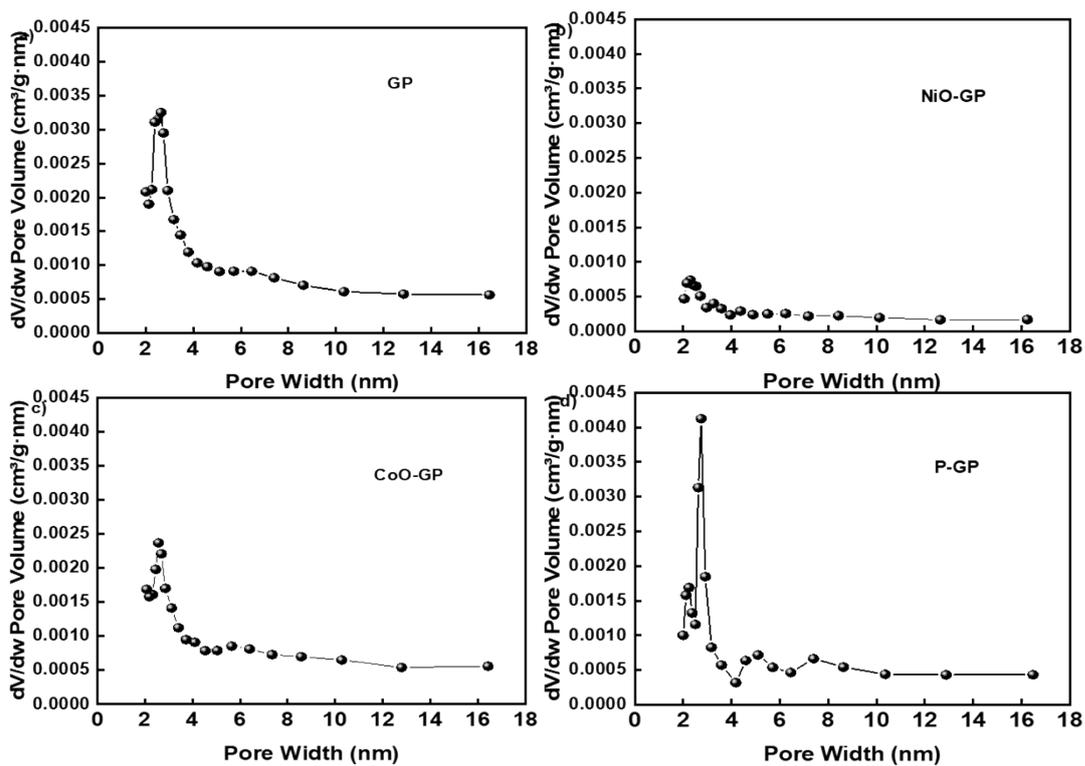
**Enhanced electrocatalytic performance of phosphorus- and metal oxide-modified graphite electrodes for all-vanadium redox Flow batteries.**

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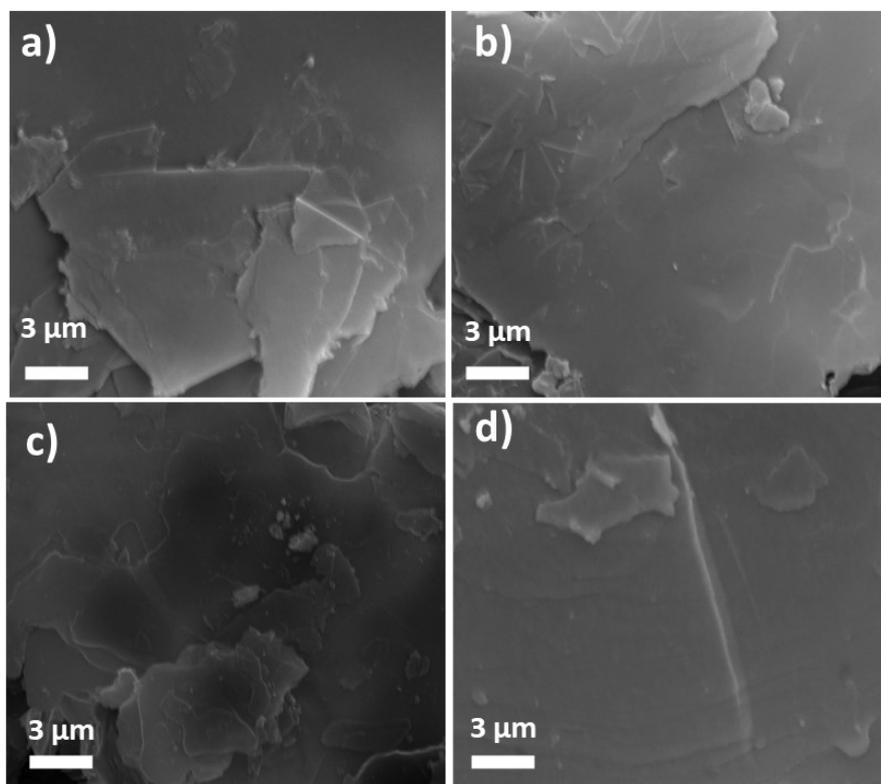
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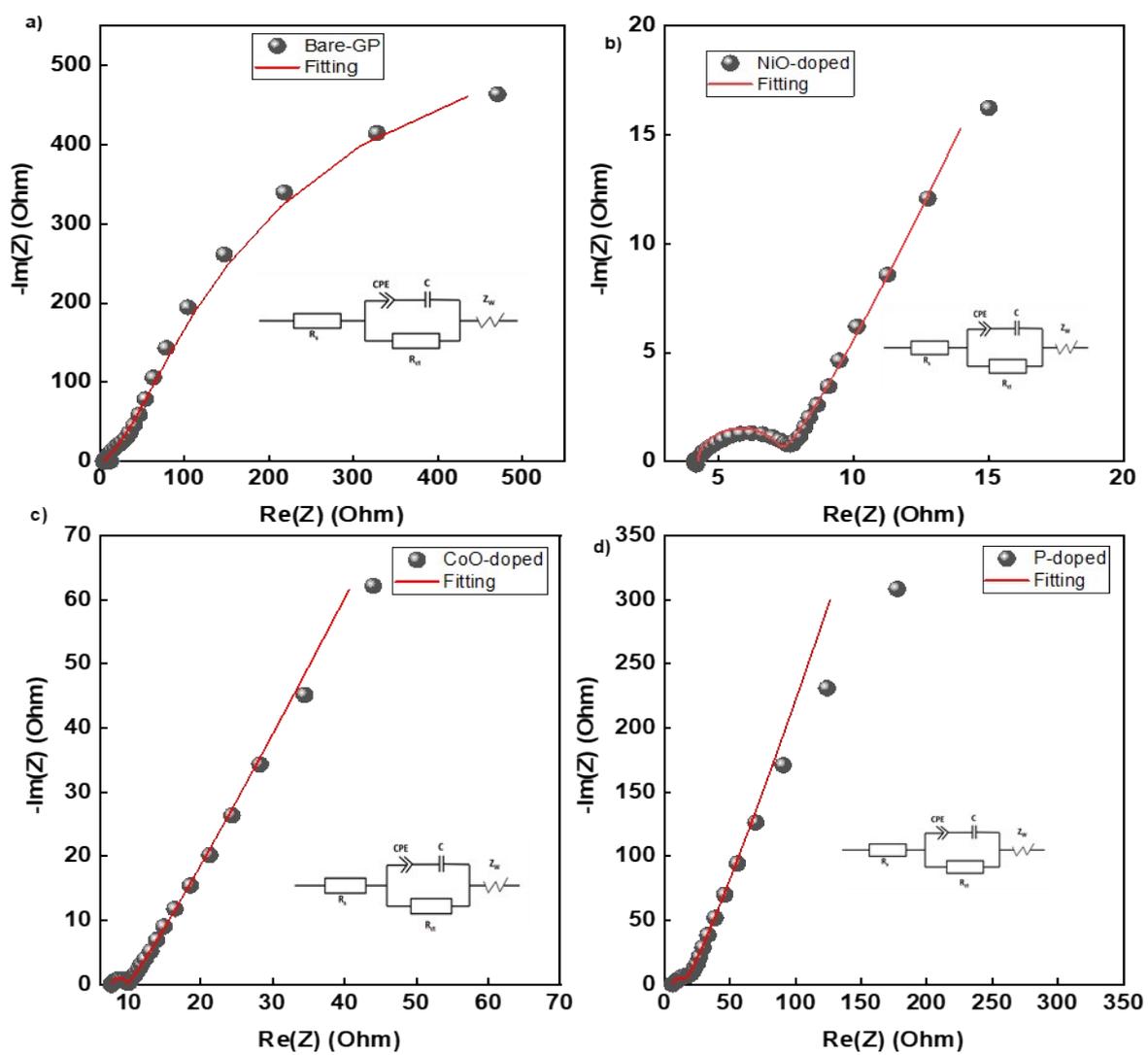
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**Figure S1:** Pore size distribution of Bare graphite, P-doped GP, CoO-doped GP and NiO-doped GP samples.



**Figure S2:** SEM images of of a) bare graphite, b) NiO-GP, c) CoO-GP, d) P-doped GP.



**Figure S3:** Nyquist plots with correspondent equivalent circuit of a) bare graphite, b) NiO-doped GP, c) CoO-doped GP, d) P-doped GP.

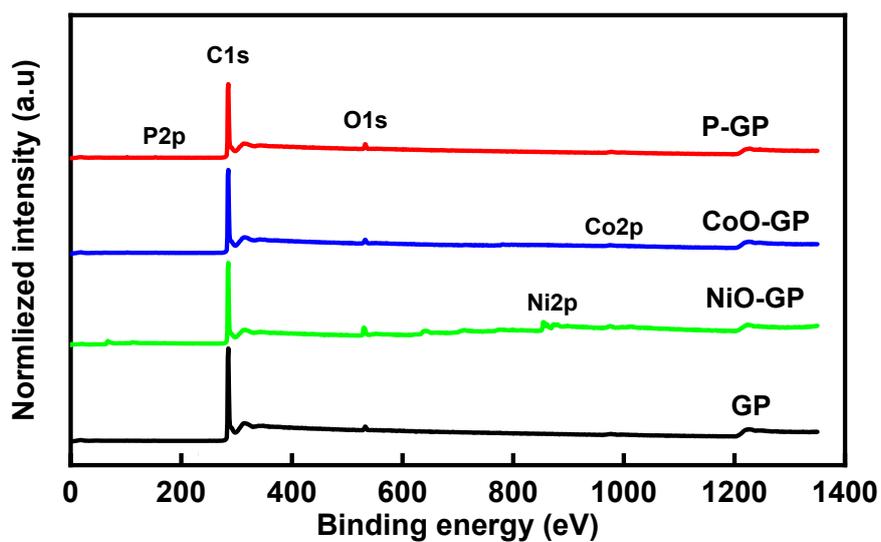


Figure S4: XPS Survey of Bare graphite (GP) and modified ones.

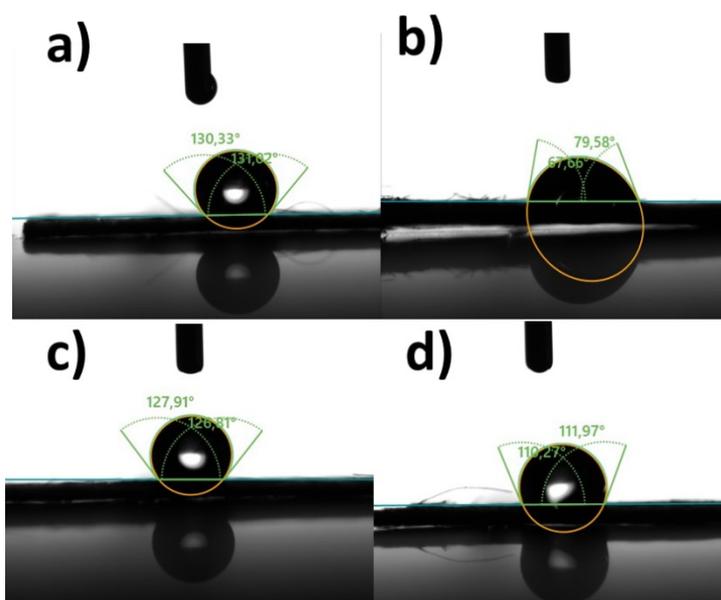
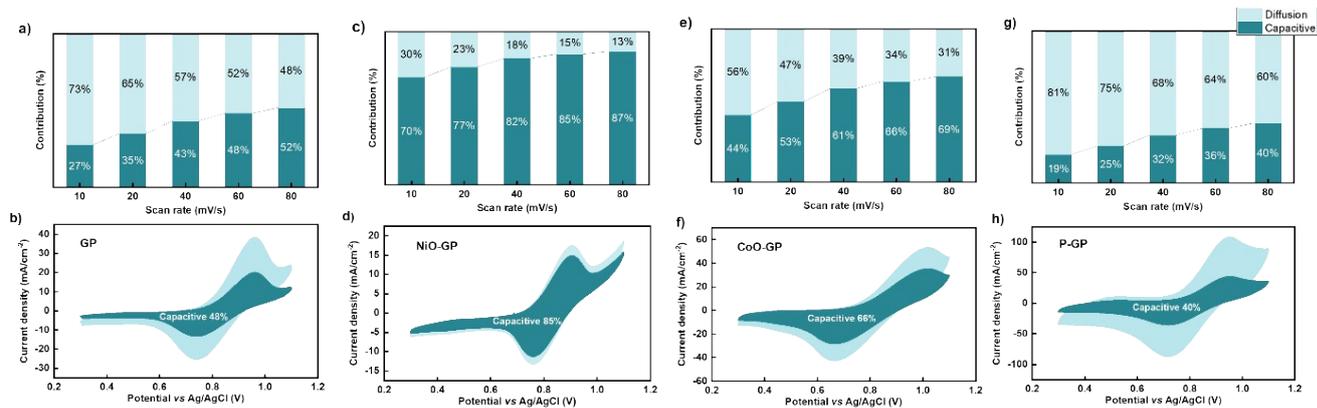


Figure S5: Contact angle measurements of a) GP b) P-GP c) NiO-GP d) CoO-GP.

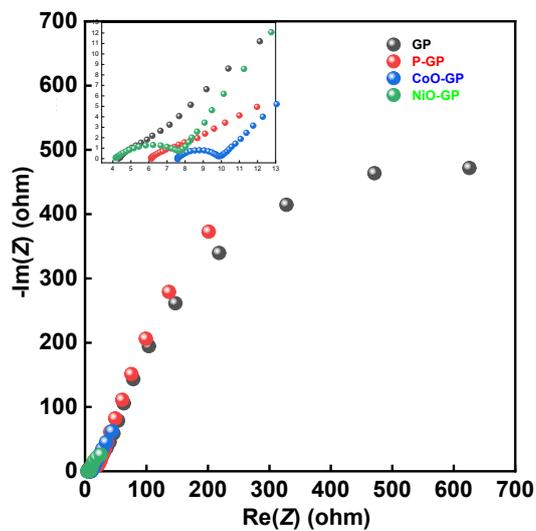
TableS1. The relevant surface parameters obtained by isotherms analysis.

Sample	Specific surface area (m <sup>2</sup> /g)	Total pore volume (cm <sup>3</sup> /g)
Bare-GP	8.99	0.013522

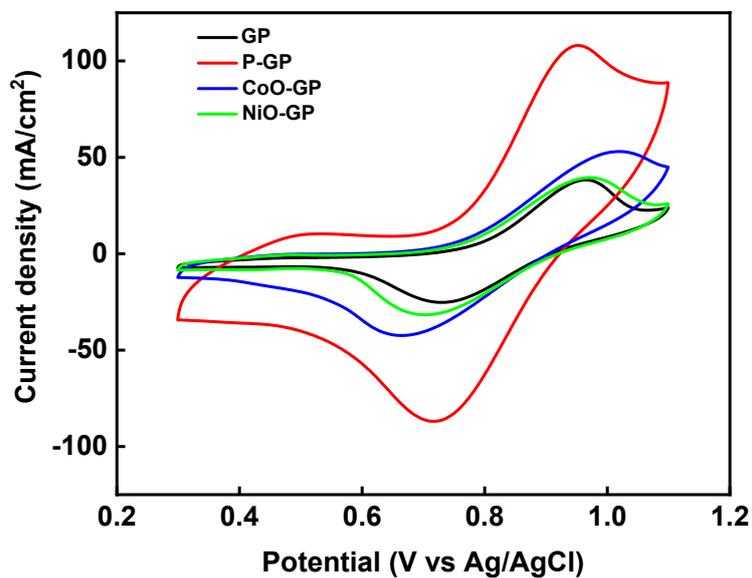
NiO-GP	2.07	0.003667
CoO-GP	7.52	0.000265
P-GP	5.75	0.009150



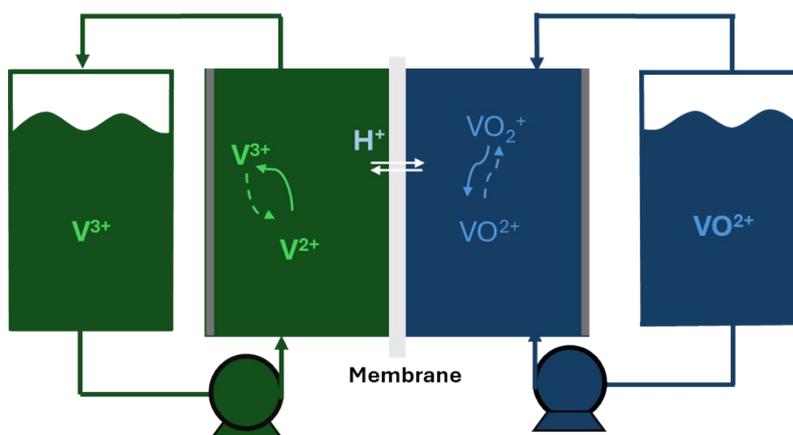
**Figure S6:** Contribution of diffusive and capacitive contribution at different scan rates and CV curve displaying the capacitive contribution (dark area) to the total current at scan rate of 80 mV/s of a,b) GP, c,d) NiO-GP, e,f) CoO-GP,g,h) P-GP respectively.



**Figure S7:** Nyquist plots of bare graphite and modified electrodes at constant potential with an amplitude of 10 mV.



**Figure S8:** CV curves of all GP-based electrodes measured at 80 mV/s.



**Figure S9:** Schematic illustration of the vanadium redox flow battery.