

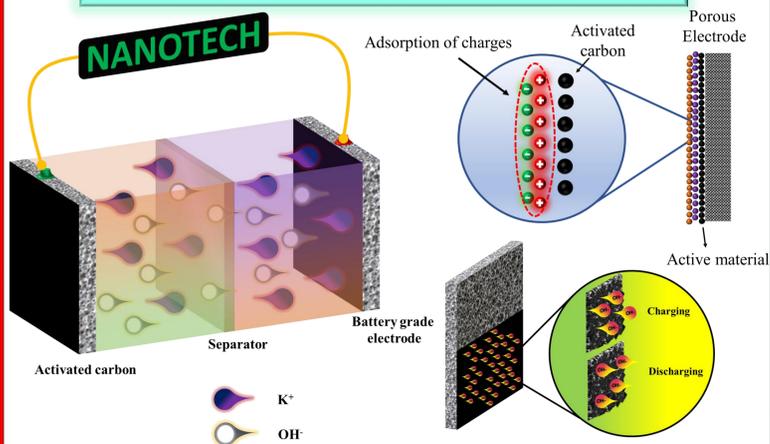
Mian Muhammad Faisal[†], Muhammad Zahir Iqbal^{*}

Nanotechnology Research Laboratory, Faculty of Engineering Sciences,
GIK Institute of Engineering Sciences and Technology, Khyber Pakhtunkhwa, Pakistan
Email: [†]mianmuhfaisal@gmail.com, ^{*}zahir@giki.edu.pk,

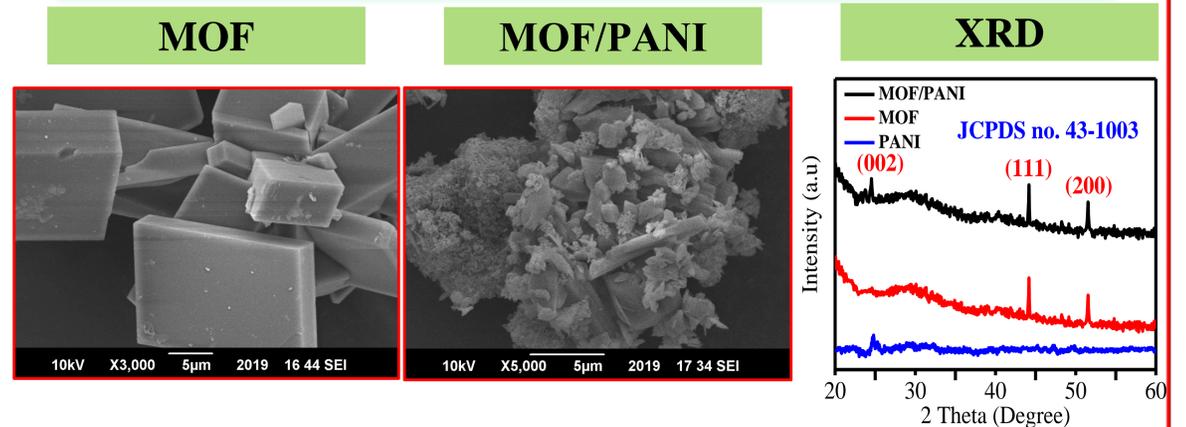
Motivation

Cobalt intercalated metal-organic framework (MOF) with polyaniline (PANI) boosts the electroactive properties of MOF, the basic requisite of the charge storage mechanism in electrochemical energy storage devices. Here, we report the enhancement in the electrochemical performance of supercapattery devices using MOF-PANI matrix with equal percentage ratio of both. The accumulation of PANI to MOF enhances the specific capacity, energy density, power density and life time of the device. Our study introduces the versatile strategy of using Co-MOF-PANI, which paved the way to synthesize other MOFs with superior electrochemical performance for hybrid energy storage devices.

Schematics

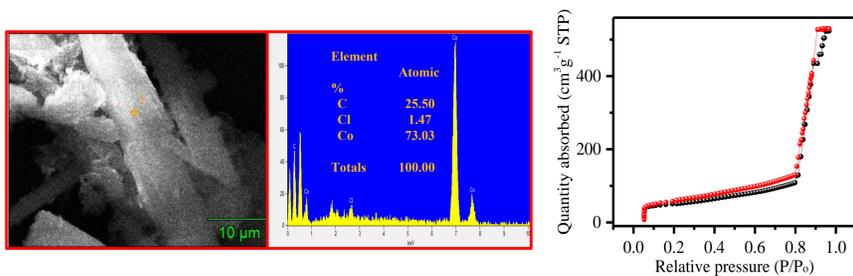


Structural characterization



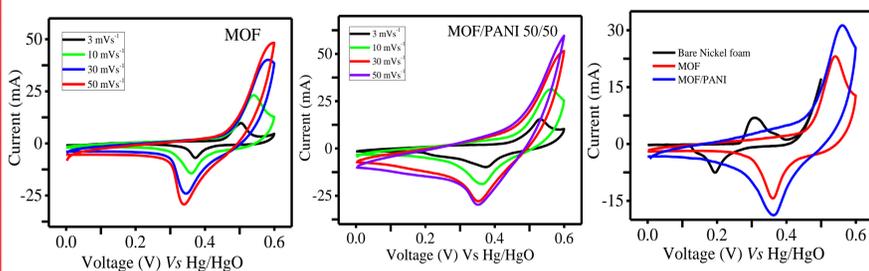
Results and Discussion

EDX and BET analysis

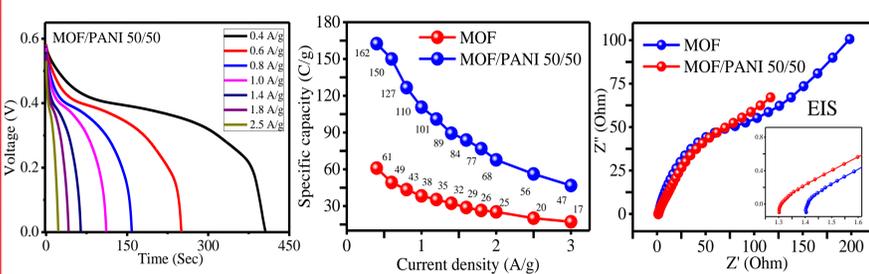


Electrochemical Characterization

Cyclic Voltammetry for MOF and MOF-PANI Composites

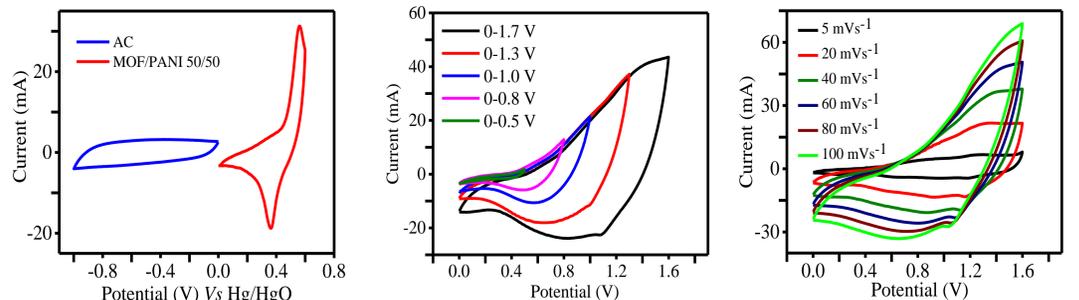


GCD and EIS Measurements

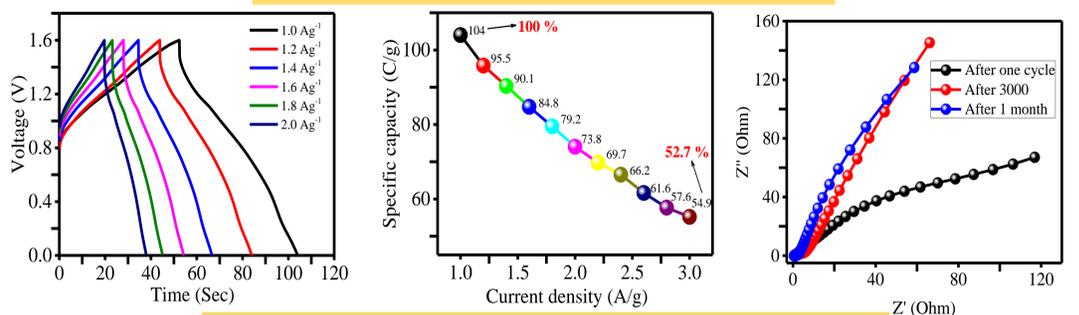


Real Device of Supercapattery

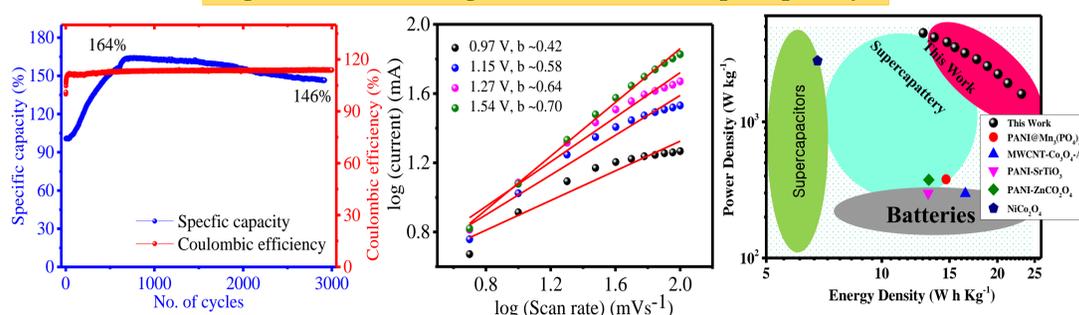
Cyclic Voltammetry Curves for Supercapattery Device



GCD and EIS Measurements for the Real Device



Ragone Plot and Fitting Parameters of the Supercapattery



Conclusion

Here, we have studied the MOF and MOF-PANI matrix as an electrode material for hybrid energy storage applications. To identify the electroactive nature of the MOF and its matrix electrochemical tests, cyclic voltammetry (CV), galvanostatic charge discharge (GCD) and electrochemical impedance spectroscopy (EIS), have been carried out. MOF-PANI shows the excellent performance in three electrode symmetry by indicating specific capacity of **154 C/g** in CV and **162 C/g** in GCD. The better conductivity of the electrode is evidenced by EIS results. This best is then used to fabricate supercapattery device which expresses the notable performance with the specific capacity of **104 C/g** and energy density of **23.2 W.h.Kg⁻¹** in parallel with high power density of **1600 W.Kg⁻¹**. The highest specific power obtained is **4480 W.Kg⁻¹**.