# ABSTRACT

Designing of novel porous materials with multifunctional properties and having versatile Nano geometries called metal organic frameworks (MOFs) are emerging as a remarkable contender to upsurge the performance of renewable energy storage devices. Here, we widely investigate the hydrothermally synthesized copper-MOF (M1) and its based composites which were made by physical blending technique for high energy density supercapattery device. They include copper-MOF/polyaniline (M2), copper-MOF/polyaniline/reduced-graphene-oxide (M3) and copper-MOF/polyaniline/reduced-graphene-oxide/silver-nanoparticles (M4).

Hydrothermally synthesized copper-MOF exhibits a specific capacity of 14.8 mAh/g while its based composites show 39.8, 52 and 118 mAh/g at initial current density of 0.5 A/g in three electrodes electrochemical setup. Owing to excellent electrochemical performance merits, the composite M3 and composite M4 are utilized for real device fabrication as battery type electrode by conjugating with highly porous carbon electrode separated by cellulose filter paper in 1 M electrolyte assembly.

The composite M3 is utilized in real device fabrication by conjugating it with highly porous crystalline activated carbon separated by cellulose filter paper in 1 M Alkaline electrolyte (KOH) solution. After exposed to electrochemical characterization, composite M3 based coupled system exhibits maximum energy density of 26 Wh/kg relative to the power density of 594 W/kg at minimum threshold current density of 0.7 A/g, and also retains specific capacity up to 87% with faradic efficiency of 99.5% by exposing to 1500 charge discharge cycles.

Additionally, we have constructed another supercapattery which is based on as-synthesized composite M4 electrode material. Further, when this hybrid paradigm is subjected to electrochemical profile CV and GCD tests characterization, it endorses promising power density of 1192 W/kg at energy density of 52 Wh/kg, and still holds the energy density of 27.2 Wh/kg by delivering outstanding power density of 10200 W/kg. Moreover, Cyclic durability is tested by exposing the composite M4 based supercapattery to 3000 charge-discharge cycles. As a result, the supercapattery system retains interesting cyclic stability of 91.2% along with faradic efficiency of 99.6%. Overall, this unique architecture of MOFs-based composites would assist to meet the ever-increasing renewable energy demands to power this world.