CLAIMS

1. A method of producing a porous carbon composite fibrous mats comprised of a network of carbon fibers incorporated with porous carbon particles, the method comprising:

electrospinning a polymer solution to form a porous layer of polymeric fibers and the polymeric fibers are doped with a precursor of conductive metal particles, wherein the polymer solution comprises a polymer and the precursor of the conductive metal particles, wherein the precursor of the conductive metal particles comprises iron, copper, tin, or titanium;

electrospraying a metal organic framework suspension onto the porous layer of polymeric fibers, wherein the metal organic framework suspension comprises metal organic framework particles, wherein the metal organic framework particles comprise a zeolitic imidazolate framework;

repeating the electrospinning and electrospraying in an alternating manner to form a porous network of polymeric fibers incorporated with the metal organic framework particles; and

heating the porous network of polymeric fibers incorporated with the metal organic framework particles to form the porous carbon composite fibrous mats.

2. The method of claim 1, wherein electrospinning the polymer solution comprises mixing the polymer and the precursor of conductive metal particles in an organic solvent to form the polymer solution.

3. The method of claim 1 or 2, wherein the polymer comprises polyacrylonitrile, phenolic resins, polypyrrole, polystyrene, polymethylacrylonitrile, polyaromatic hydrocarbons, biomass-derived polymers, or a combination thereof.

4. The method of any one of claims 1 to 3, wherein the precursor of conductive metal particles comprises tris(acetylacetonato)iron(III), iron(III) acetate, iron(III) nitrate, copper(II) acetate, or copper(II) nitrate.

5. The method of any one of claims 2 to 4, wherein the organic solvent comprises N,N-dimethylformamide, acetone, dimethyl sulfoxide, tetrahydrofuran, or ethanol.

6. The method of any one of claims 1 to 5, wherein electrospraying the metal organic framework suspension comprises mixing (i) a precursor of the metal organic framework particles and (ii) an alkyl substituted imidazole, a bicyclic imidazole, or a non-substituted imidazole to form the metal organic framework particles.

7. The method of claim 6, wherein the precursor of the metal organic framework particles comprises cobalt chloride, cobalt acetate, cobalt hydroxide, cobalt oxide, cobalt sulfate, cobalt carbonate, cobalt nitrate hexahydrate, zinc chloride, zinc acetate, zinc hydroxide, zinc oxide, zinc sulfate, zinc carbonate, or zinc nitrate hexahydrate.

8. The method of claim 6 or 7, wherein the alkyl substituted imidazole comprises 1-methylimidazole, 2-methylimidazole, or 2-ethylimidazole, wherein the bicyclic imidazole comprises benzimidazole.

9. The method of any one of claims 1 to 8, wherein the zeolitic imidazolate framework comprises zeolitic imidazolate framework-67 or zeolitic imidazolate framework-8.

10. The method of any one of claims 1 to 9, wherein the metal organic framework particles each has a diameter ranging from 20 nm to 10 μm.

11. The method of any one of claims 1 to 10, wherein electrospraying the metal organic framework suspension further comprises adding a porous additive to the metal organic framework suspension before electrospraying, wherein the porous additive comprises a metal organic framework, porous coordination polymers, active carbon particles, carbon spheres, zeolites, molecular sieves, microporous phosphates, or a combination thereof.

12. The method of any one of claims 1 to 11, wherein heating the porous network of polymeric fibers comprises subjecting the porous network of polymeric fibers incorporated with the metal organic framework particles to pyrolysis at a temperature ranging from 500°C to 1200°C.