CLAIMS

1. A method of fabricating a metal-carbon fibrous structure comprising the steps of:

(a) forming a fibrous support structure comprising composite nanocrystals and polymeric fibers by electrospinning a suspension, wherein the suspension comprises the composite nanocrystals and a polymer solution, wherein each of the composite nanocrystals comprises metal ions connected by organic ligands;

(b) growing the composite nanocrystals on the fibrous support structure; and

(c) subjecting the fibrous support structure of step (b) to carbonization to form the metal-carbon fibrous structure, wherein the metal-carbon fibrous structure comprises metal nanoparticles derived from the composite nanocrystals,

wherein the polymer solution comprises a polymer dissolved therein, and

wherein the composite nanocrystals and the polymer have a weight ratio of 2:8 to 6:4.

2. The method according to claim 1, wherein the forming in step (a) comprises dispersing the composite nanocrystals in the polymer solution to form the suspension.

3. The method according to claim 2, wherein the composite nanocrystals are formed by separately dissolving a metal nitrate or a metal chloride and the organic ligands in a solvent to form two solutions, mixing the two solutions to form a precipitate of the composite nanocrystals, and collecting and drying the precipitate to thereby form the composite nanocrystals.

4. The method according to claim 3, wherein the organic ligands comprise imidazole based ligands.

5. The method according to claim 3, wherein the precipitate is collected and dried in vacuum for 12 hours to 24 hours at 40°C to 100°C.

6. The method according to claim 3, wherein the composite nanocrystals comprise zeolitic imidazolate framework (ZIF) crystals.

7. The method according to claim 2, wherein the polymer solution is formed by dissolving the polymer in an organic solvent at 50°C to 80°C for 0.5 hours to 2 hours.

8. The method according to claim 7, wherein the polymer is selected from the group consisting of polyacrylonitrile, phenolic resins, polypyrrole, polystyrene, polymethylacrylonitrile, polyaromatic hydrocarbons, and biomass-derived polymers.

9. The method according to claim 2, wherein the polymeric fibers comprise polyacrylonitrile, phenolic resins, polypyrrole, polystyrene, polymethylacrylonitrile, polyaromatic hydrocarbons, and biomass-derived polymers.

10. The method according to claim 1, wherein the electrospinning is carried out with an air humidity of not more than 40%.

11. The method according to claim 1, wherein the electrospinning is carried out at a voltage of 7.5 kV to 13 kV with a feeding rate of 0.5 ml/hour to 3 ml/hour.

12. The method according to claim 1, wherein the growing in step (b) is carried out by contacting the fibrous support structure with an organic solution comprising a metal precursor and an organic linker to form a mixture, and incubating the mixture to grow the composite nanocrystals.

13. The method according to claim 12, wherein the organic linker comprises an imidazole based linker.

14. The method according to claim 12, wherein the incubating occurs at 40°C to 80°C for 1 hour to 3 hours.

15. The method according to claim 1, wherein the carbonization is carried out in an inert environment and at a temperature of 600°C to 1000°C for 2 hours to 3 hours.

16. The method according to claim 1, wherein the metal-carbon fibrous structure comprises carbon and cobalt, carbon and iron, or carbon and zinc.

17. The method according to claim 1, further comprising a step of calcinating the metal-carbon fibrous structure to yield a metal oxide-carbon fibrous structure.

18. The method according to claim 17, wherein the calcinating is carried out in air at 200°C to 350°C for 0.5 hours to 3 hours.

19. The method according to claim 17, wherein the metal oxide-carbon fibrous structure comprises Co_3O_4 and carbon, ZnO and carbon, Fe_2O_3 and/or Fe_3O_4 and carbon.