Claims

1. A method of fabricating a composite, comprising

a) mixing porous carbon with a rylene dye in order to form a mixture;

b) heating the mixture from 300 ˚C to 600 ˚C under an inert atmosphere; and

c) carbonising the mixture at a temperature of 700 ˚C to 1300 ˚C;

wherein the heating step is performed for 2 h to 10 h.

2. The method according to claim 1, wherein a mass ratio of porous carbon to rylene dye is 1:1 to 1:4.

3. The method according to claim 1 or 2, wherein the porous carbon is selected from activated carbon, mesoporous carbon, carbonised sugar, low specific surface area carbon and low specific surface area carbon.

4. The method according to any one of claims 1 to 3, wherein the rylene dye is selected from perylenetetracarboxylic dianhydride (PTCDA), perylenediimide, terrylendiimide, terrylen, perylen, and quaterrylen.

5. The method according to any one of claims 1 to 4, wherein the inert atmosphere is argon.

6. The method according to any one of claims 1 to 5, wherein the carbonisation step is performed for at least 3 h under a rate of 3 ˚C/min to 10 ˚C/min.

7. A modified porous carbon composite comprising:

a) a porous carbon structure; and

b) a carbonised rylene dye;

wherein the carbonised rylene dye coats at least inner pores of the porous carbon structure; wherein the composite has a BET (CO_2) specific surface area of 10 m^2 g^{-1} to 220 m^2 g^{-1} and/or a BET (N_2) specific surface area of 5 m^2 g^{-1} to 80 m^2 g^{-1}.

8. The composite according to claim 7, wherein the composite comprises ultra-micropores, the ultra-micropores having a pore diameter (based on CO_2 adsorption) of 0.2 nm to 0.8 nm.

9. The composite according to claim 7 or 8, wherein a mass ratio of porous carbon structure to at least partially carbonised rylene dye is about 1:1 to about 1:4.

10. The composite according to any one of claims 7 to 9, wherein the composite has a BET (CO_2) specific surface area to BET (N_2) specific surface area ratio of about 0.1 to about 50.

11. The composite according to any one of claims 7 to 10, the composite having an XRD pattern which indicates the presence of a (002) peak of a carbon derived from the carbonised rylene dye and a (002) peak of the porous carbon structure;
wherein the (002) peak of a carbon derived from the carbonised rylene dye is about 25.2˚, and/or wherein the (002) peak of the porous carbon is about 21.2˚.

12. The composite according to any one of claims 7 to 11, the composite having a total volume (based on N_2 adsorption) of about 0.01 $cm^3\ g^{-1}$ to about 0.13 $cm^3\ g^{-1}$ and/or a total volume (based on CO_2 adsorption) of about 0.08 $cm^3\ g^{-1}$ to about 0.4 $cm^3\ g^{-1}$.

13. The composite according to any one of claims 7 to 12, the composite having a R value of about 2 to about 5.

14. The composite according to any one of claims 7 to 13, the composite having a skeletal density of about 1.8 g cm^{-3} to about 2.5 g cm^{-3}.

15. A method of fabricating an electrode, comprising:
a) mixing a composite according to any one of claims 7 to 14 with a binder solution to form a slurry;

b) applying the slurry on a surface of an electrical conductor; and

c) drying the slurry.

16. The method according to claim 15, wherein a weight ratio of composite to binder solution is about 80:20 to about 95:5.

17. The method according to claim 15 or 16, wherein the binder solution comprises a binder selected from sodium carboxymethyl cellulose and/or polyvinylidene fluoride (PVDF); and

wherein the binder solution has a concentration of about 10 mg/mL to about 20 mg/mL.

18. The method according to any one of claims 15 to 17, wherein the drying step is performed at 40 ˚C to 80 ˚C for 2 h to 6 h; and

wherein the drying step further comprises vacuum drying the slurry at 100 ˚C to 140 ˚C for at least 8 h.

19. An electrode, comprising:

a) a composite according to any one of claims 7 to 14;

b) a binder; and

c) an electrical conductor;

wherein the composite and the binder are homogenously combined; and

wherein the composite and the binder coats at least a surface of the electrical conductor;

wherein a mass loading of the composite and binder on the electrical conductor is at least 15 mg cm^{-2}.

20. A battery, comprising:

a) an organic cathode; and

b) an anode, the anode comprising the composite according to any one of claims 7 to 14;

wherein a mass loading ratio of the organic cathode to the anode is about 1:2 to about 1:3.