[0133] In an embodiment, the second carbonisation temperature is about 900 ºC, 950 ºC, 1000 ºC, 1050 ºC, 1100 ºC, 1150 ºC or 1200 ºC.

[0134] In an embodiment, the second carbonisation temperature is about 900, 925, 950, 975, 1000, 1025, 1050, 1075, 1100, 1125, 1150, 1175 or 1200 ºC.

[0135] In an embodiment, the second mixture is carbonised at the second carbonisation temperature for a time of equal to or between about 3 hours to about 8 hours.

[0136] In an embodiment, the second mixture is carbonised at the carbonisation temperature for a time of about 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5 or 8 hours.

[0137] In an embodiment, before the second carbonisation temperature is reached, the second mixture is held at a second holding temperature that is less than the second carbonisation temperature.

[0138] In an embodiment, the second holding temperature is equal to or between about 300 ºC to about 500 ºC.

[0139] In an embodiment, the second holding temperature is about 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490 or about 500 ºC.

[0140] In an embodiment, the method further comprises the step of milling the Si@C/graphite/carbon material.

[0141] In an embodiment, the milling is by dry ball milling.

[0142] In an embodiment, the method further comprises the step of mixing the Si@C/graphite/carbon material with one or more polymer binders.

[0143] In an embodiment, the one or more polymer binders include one or more linear polymers, one or more conductive polymers, one or more self-healing polymers, and one or more rubber polymers.

[0144] In an embodiment, the anode is formed by:

[0145] mixing the Si@C/graphite/carbon material and the one or more polymer binders to produce a slurry;

[0146] coating the slurry onto a metallic member; and

[0147] drying the metallic member with coated slurry to form the anode.

[0148] According to a third aspect of the present invention there is provided an anode for a lithium-ion battery, when produced by the method of the first or second aspects of the present invention.

[0149]

[0150] According to a fourth aspect of the present invention there is provided a lithium-ion battery, comprising:

[0151] an anode as defined according to the third aspect of the invention;

[0152] a cathode; and

an electrolyte and/or a separator positioned between the anode and the cathode.

[0153] An example non-limiting electrolyte includes 1.15 M $LiPF_6$ in a mixture of ethylene carbonate (EC) / ethyl methyl carbonate (EMC) / ethyl propionate (EP) / fluoroethylene carbonate (FEC) in a weight ratio of 27:35:27:10 (ethylene carbonate (EC) : ethyl methyl carbonate (EMC) : ethyl propionate (EP) : fluoroethylene carbonate (FEC)), with additive agents such as, for example, propylene sulfate (PS) and adiponitrile (AND).

[0154] As will be apparent to those skilled in the art, a separator is a physical barrier that keeps two sides of the battery apart whilst allowing ion transfer only. Non-limiting examples of separators include polymer separators, in particular, multilayer polymer separators and more particularly, polyethylene multilayer polymer separators.

[0155] In other examples, the method further includes: drying the wet slurry at a drying temperature prior to carbonising the mixture, and/or drying the second wet slurry at a second drying temperature prior to carbonising the second mixture. In another example, the mixture is milled by wet ball milling, and/or the second mixture is milled by wet ball milling. Optionally, but preferably, the one or more solvents and/or the one or more second solvents are one or more inert solvents.

[0156] In other examples, the one or more second carbonaceous materials are the same as the one or more carbonaceous materials; the one or more second carbonaceous materials are different to the one or more carbonaceous materials; the one or more second solvents are the same as the one or more solvents; or the one or more second solvents are different to the one or more solvents.

[0157] In other examples, before the carbonisation temperature is reached, the mixture is held at a holding temperature that is less than the carbonisation temperature, and/or before the second carbonisation temperature is reached, the second mixture is held at a second holding temperature that is less than the second carbonisation temperature.

[0158] In another example, the resulting Si@C/graphite/carbon material is further milled, preferably by dry ball milling. In another example, the Si@C/graphite/carbon material is mixed with one or more polymer binders in fabricating the anode. In another example, the anode is formed by: mixing the Si@C/graphite/carbon material and the one or more

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of fabricating an anode for a lithium-ion battery, comprising the steps of:

milling a mixture of nano-silicon, one or more carbonaceous materials and one or more solvents, wherein the mixture is retained as a wet slurry during milling;

carbonising the mixture at a carbonisation temperature to produce a silicon thinly coated with carbon (Si@C) material;

milling a second mixture of the Si@C material, graphite, one or more second carbonaceous materials and one or more second solvents, wherein the second mixture is retained as a second wet slurry during milling;

carbonising the second mixture at a second carbonisation temperature to produce a Si@C/graphite/carbon material; and

forming the anode from the Si@C/graphite/carbon material.

2. A method according to claim 1, further comprising the step of drying the wet slurry at a drying temperature prior to carbonising the mixture.

3. A method according to claim 1 or 2, further comprising the step of drying the second wet slurry at a second drying temperature prior to carbonising the second mixture.

4. A method according to any one of claims 1 to 3, wherein the mixture is milled by wet ball milling.

5. A method according to any one of claims 1 to 4, wherein the nano-silicon and the one or more carbonaceous materials are mixed in a mass ratio (nano-silicon : carbonaceous material) of equal to or between about 40:60 to about 70:30.

6. A method according to any one of claims 1 to 5, wherein the average particle size of the nano-silicon is equal to or between about 50 nm and about 500 nm.

7. A method according to any one of claims 1 to 6, wherein the one or more solvents are selected from the group consisting of toluene, xylenes, quinoline, pyridine, tetrahydrofuran (THF),diethyl ether, di-isopropyl ether, methylethyl ether, dioxane, methanol, ethanol, 1-propanol, isopropanol, n-butanol, t-butanol, ethyl acetate,

dimethylacetamide (DMA), dimethylformamide (DMF), dimethylsulfoxide (DMSO), pentane, n-hexanes, cyclohexane, acetonitrile, acetone, chloroform, dichloromethane carbon tetrachloride, ethylene glycol (EG), propylene glycol, polyacrylic acid, or mixtures thereof.

8. A method according to any one of claims 1 to 7, wherein the one or more carbonaceous materials are selected from the group consisting of functionalised graphene platelets, carbon nanotubes (CNTs), reduced graphene oxide (rGO), pyrolysed carbon derived from precursors of glucose, sucrose or critic acid (CA), pitch, polyacrylonitrile (PAN), polyvinyl chloride (PVC), poly(diallyldimethylammonium chloride) (PDDA), poly(sodium 4-styrenesulfonate) (PSS)), polydopamine (PDA), polypyrrole (PPy) and phenolic resin.

9. A method according to any one of claims 1 to 8, wherein the graphite is synthetic flake graphite or graphite microspheres.

10. A method according to claim 9, wherein the graphite microspheres have an average size of equal to or between about 1 μm and about 20 μm.

11. A method according to any one of claims 1 to 10, wherein the wet slurry is vacuum dried in an oven.

12. A method according to any one of claims 1 to 11, wherein carbonising the mixture occurs in a tube furnace under a flowing inert gas.

13. A method according to any one of claims 1 to 12, wherein the carbonisation temperature is equal to or between about 900 ºC to about 1200 ºC.

14. A method according to any one of claims 1 to 13, wherein the mixture is carbonised at the carbonisation temperature for a time of equal to or between about 3 hours to about 8 hours.

15. A method according to any one of claims 1 to 14, wherein before the carbonisation temperature is reached, the mixture is held at a holding temperature that is less than

the carbonisation temperature.

16. A method according to any one of claims 1 to 15, wherein the Si@C material, the graphite and the one or more second carbonaceous materials are mixed in a mass ratio (Si@C material : graphite : second carbonaceous material) of equal to or between about 10-30:40-80:10-30.

17. A method according to any one of claims 1 to 16, wherein the one or more second solvents are selected from the group consisting of toluene, xylenes, quinoline, pyridine, tetrahydrofuran (THF), diethyl ether, di-isopropyl ether, methylethyl ether, dioxane, methanol, ethanol, 1-propanol, isopropanol, n-butanol, t-butanol, ethyl acetate, dimethylacetamide (DMA), dimethylformamide (DMF), dimethylsulfoxide (DMSO), pentane, n-hexanes, cyclohexane, acetonitrile, acetone, chloroform, dichloromethane carbon tetrachloride, ethylene glycol (EG), propylene glycol, polyacrylic acid, or mixtures thereof.

18. A method according to any one of claims 1 to 17, wherein carbonising the second mixture occurs in a tube furnace under a flowing inert gas.

19. A method according to any one of claims 1 to 18, wherein the second carbonisation temperature is equal to or between about 900 ºC to about 1200 ºC.

20. A method according to any one of claims 1 to 19, wherein the second mixture is carbonised at the second carbonisation temperature for a time of equal to or between about 3 hours to about 8 hours.

21. A method according to any one of claims 1 to 20, wherein before the second carbonisation temperature is reached, the second mixture is held at a second holding temperature that is less than the second carbonisation temperature.

22. A method according to any one of claims 1 to 21, further comprising milling the Si@C/graphite/carbon material.

23. A method according to any one of claims 1 to 22, further comprising mixing the

Si@C/graphite/carbon material with one or more polymer binders.

24. A method according to claim 23, wherein the one or more polymer binders include one or more linear polymers, one or more conductive polymers, one or more self-healing polymers, and one or more rubber polymers.

25. A method according to claim 23 or claim 24, wherein the anode is formed by:

mixing the Si@C/graphite/carbon material and the one or more polymer binders to produce a slurry;

coating the slurry onto a metallic member; and

drying the metallic member with coated slurry to form the anode.

26. A method of fabricating an anode for a lithium-ion battery, comprising the steps of:

mixing micro-silicon and one or more inert solvents to produce a wet slurry mixture; and

milling the wet slurry mixture of the micro-silicon and the one or more inert solvents to obtain nano-silicon, wherein the mixture is retained as a wet slurry mixture during milling;

milling a mixture of the nano-silicon, one or more carbonaceous materials and one or more solvents, wherein the mixture is retained as a wet slurry during milling;

carbonising the mixture at a carbonisation temperature to produce a silicon coated with carbon (Si@C) material;

milling a second mixture of the Si@C material, graphite, one or more second carbonaceous materials and one or more second solvents, wherein the second mixture is retained as a second wet slurry during milling;

carbonising the second mixture at a second carbonisation temperature to produce a Si@C/graphite/carbon material;

mixing the Si@C/graphite/carbon material, one or more linear polymers, one or more conductive polymers, one or more self-healing polymers, and one or more rubber polymers to produce a slurry;

coating the slurry onto a metallic member; and

drying the metallic member with coated slurry to form the anode.

27. An anode for a lithium-ion battery, produced by a method according to any one of

claims 1 to 26.

28. A lithium-ion battery, comprising:

an anode according to claim 27;

a cathode; and

an electrolyte and/or a separator positioned between the anode and the cathode.