

**CLAIMS**

1. A particulate material consisting of a plurality of composite particles, wherein the composite particles comprise:

- 5 (a) a porous carbon framework comprising micropores and mesopores, wherein the micropores and mesopores have a total pore volume as measured by gas adsorption of  $P^1$  cm<sup>3</sup>/g, wherein  $P^1$  has a value of from 0.4 to 0.75, and wherein the micropore volume fraction is in the range of 0.55 to 0.85, based on the total volume of micropores and mesopores; and
- 10 (b) a plurality of nanoscale elemental silicon domains located within the pores of the porous carbon framework;

wherein the weight ratio of silicon to the porous carbon framework in the composite particles is in the range of from  $[0.9 \times P^1$  to  $1.8 \times P^1]$  : 1, and wherein the composite particles have a  $D_{50}$  particle diameter of at least 2  $\mu$ m.

15 2. A particulate material according to claim 1, wherein  $P^1$  has a value of at least 0.42, or at least 0.45, or at least 0.47, or at least 0.5.

3. A particulate material according to claim 1 or claim 2, wherein  $P^1$  has a value of up to 0.72, or up to 0.7, or up to 0.67, or up to 0.65, or up to 0.62, or up to 0.6.

4. A particulate material according to claim 1 or claim 2, wherein  $P^1$  has a value of less than 0.6.

20 5. A particulate material according to any preceding claim, wherein the micropore volume fraction is at least 0.56, or at least 0.58, or at least 0.6, or at least 0.62, or at least 0.64, or at least 0.65, based on the total volume of micropores and mesopores.

25 6. A particulate material according to any preceding claim, wherein the micropore volume fraction is up to 0.84, or up to 0.82, or up to 0.8, or up to 0.78, or up to 0.76, or up to 0.75, based on the total volume of micropores and mesopores.

7. A particulate material according to any preceding claim, wherein the  $PD_{90}$  pore diameter is up to 20 nm, or up to 15 nm, or up to 12 nm, or up to 10 nm, or up to 8 nm, or up to 6 nm, or up to 5 nm.

30 8. A particulate material according to any preceding claim, wherein the porous carbon framework has a bimodal or multimodal pore size distribution.

9. A particulate material according to any preceding claim, wherein the total volume of pores having a diameter in the range of from greater than 50 nm to 100 nm is defined as  $P^2$  cm<sup>3</sup>/g,

wherein  $P^2$  is up to  $0.2 \times P^1$ , or up to  $0.1 \times P^1$ , or up to  $0.05 \times P^1$ , or up to  $0.02 \times P^1$ , or up to  $0.01 \times P^1$ , or up to  $0.005 \times P^1$ .

- 5 10. A particulate material according to any preceding claim, wherein the weight ratio of silicon to carbon is at least  $0.95 \times P^1$ , or at least  $1 \times P^1$ , or at least  $1.05 \times P^1$ , or at least  $1.1 \times P^1$ , or at least  $1.15 \times P^1$ , or at least  $1.2 \times P^1$ .
11. A particulate material according to any preceding claim, wherein the weight ratio of silicon to carbon is up to  $1.75 \times P^1$ , or up to  $1.7 \times P^1$ , or up to  $1.65 \times P^1$ , or up to  $1.6 \times P^1$ .
12. A particulate material according to any preceding claim, wherein at least a portion of the micropores and/or mesopores comprise void space that is fully enclosed by the silicon.
- 10 13. A particulate material according to any preceding claim, wherein at least 80 wt%, or at least 85 wt%, or at least 90 wt%, or at least 95 wt%, or at least 98wt% of the silicon in the composite particles is located within the internal pore volume of the porous carbon framework.
14. A particulate material according to any preceding claim, wherein the composite particles have a  $D_{50}$  particle diameter in the range of 1 to 30  $\mu\text{m}$ .
- 15 15. A particulate material according to claim 14, wherein the composite particles have a  $D_{50}$  particle diameter of at least ~~2  $\mu\text{m}$~~ , or at least 3  $\mu\text{m}$ , or at least 4  $\mu\text{m}$ , or at least 5  $\mu\text{m}$ .
16. A particulate material according to claim 14 or claim 15, wherein the composite particles have a  $D_{50}$  particle diameter of up to 20  $\mu\text{m}$ , or of up to 18  $\mu\text{m}$ , or up to 16  $\mu\text{m}$ , or up to 14  $\mu\text{m}$ , or up to 12  $\mu\text{m}$ , or up to 10  $\mu\text{m}$ .
- 20 17. A particulate material according to any preceding claim, wherein the composite particles have a  $D_{10}$  particle diameter of at least 0.5  $\mu\text{m}$ , or at least 0.8  $\mu\text{m}$ , or at least 1  $\mu\text{m}$ , or at least 1.5  $\mu\text{m}$ , or at least 2  $\mu\text{m}$ .
18. A particulate material according to any preceding claim, wherein the composite particles have a  $D_{90}$  particle diameter of up to 50  $\mu\text{m}$ , or up to 40  $\mu\text{m}$ , or up to 30  $\mu\text{m}$ , or up to 25  $\mu\text{m}$ , or up to 20  $\mu\text{m}$ .
- 25 19. A particulate material according to any preceding claim, wherein the composite particles have a particle size distribution span of 5 or less, or 4 or less, or 3 or less, or 2 or less, or 1.5 or less, wherein the particle size distribution span is defined as  $(D_{90}-D_{10})/D_{50}$ .
20. A particulate material according to any preceding claim, wherein the composite particles have a BET surface area of up to 100  $\text{m}^2/\text{g}$ , or up to 80  $\text{m}^2/\text{g}$ , or up to 60  $\text{m}^2/\text{g}$ , or up to 50  $\text{m}^2/\text{g}$ , or
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up to 40 m<sup>2</sup>/g, or up to 30 m<sup>2</sup>/g, or up to 25 m<sup>2</sup>/g, or up to 20 m<sup>2</sup>/g, or up to 15 m<sup>2</sup>/g, or up to 10 m<sup>2</sup>/g.

21. A particulate material according to any preceding claim, wherein the composite particles have a BET surface area of at least 0.1 m<sup>2</sup>/g, or at least 1 m<sup>2</sup>/g, or at least 2 m<sup>2</sup>/g, or at least 5 m<sup>2</sup>/g.

22. A particulate material according to any preceding claim, wherein the volume of micropores and mesopores of the composite particles, in the presence of silicon, as measured by nitrogen gas adsorption, is up to 0.15 x P<sup>1</sup>, or up to 0.10 x P<sup>1</sup>, or up to 0.05 x P<sup>1</sup>, or up to 0.02 x P<sup>1</sup>.

23. A composition comprising a particulate material as defined in any of claims 1-22 and at least one other component.

24. A composition according to claim 23, comprising at least one additional particulate electroactive material.

25. A composition according to claim 24, comprising from 15 to 60 wt%, or from 20 to 50 wt%, or from 30 to 50 wt% of the particulate material as defined in any of claims 1-22, based on the total dry weight of the composition.

26. A composition according to claim 24 or claim 25, comprising from 20 to 70 wt%, or from 25 to 65 wt%, or from 30 to 60 wt% of the at least one additional particulate electroactive material.

27. A composition according to any of claims 24 to 26, wherein the at least one additional particulate electroactive material is selected from graphite, hard carbon, silicon, tin, germanium, aluminium and lead.

28. A composition according to claim 23, wherein the composition is substantially free of additional particulate electroactive materials.

29. A composition according to claim 28 comprising at least 50 wt%, or at least 60 wt%, or at least 70 wt%, or at least 80 wt%, or at least 90 wt% of the particulate material as defined in any of claims 1-22, based on the total dry weight of the composition.

30. A composition according to any of claims 23 to 29, comprising a binder.

31. A composition according to claim 30, comprising from 0.5 to 20 wt%, or from 1 to 15 wt%, or from 2 to 10 wt%, or from 5 to 10 wt% of the binder, based on the total dry weight of the composition.

32. A composition according to any of claims 23 to 31, comprising one or more conductive additives.

33. A composition according to claim 32, comprising from 0.5 to 20 wt%, or from 1 to 15 wt%, or from 2 to 10 wt%, or from 5 to 10 wt% of the one or more conductive additives, based on the total dry weight of the composition.
- 5 34. An electrode comprising a particulate material as defined in any of claims 1 to 22 in electrical contact with a current collector.
35. An electrode according to claim 34, wherein the particulate material is in the form of a composition as defined in any of claims 23 to 33.
36. A rechargeable metal-ion battery comprising:
- 10 (i) an anode, wherein the anode comprises an electrode as described in claim 34 or claim 35;
- (ii) a cathode comprising a cathode active material capable of releasing and reabsorbing metal ions; and
- (iii) an electrolyte between the anode and the cathode.
37. Use of a particulate material as defined in any of claims 1-22 as an anode active material.
- 15 38. Use according to claim 37, wherein the particulate material is in the form of a composition as defined in any of claims 23 to 33.