Claims

1. A powder comprising pierced particles for use as an active component of a metal ion battery, the pierced particles each comprising a particle body and at least one passage extending through the particle body, wherein the pierced particles have an average aspect ratio of at least 3:1, an average thickness of no more than 3 μm, and the passages have an average width of at least 30 nm.

2. A powder according to claim 1 wherein the passages extend between opposed surfaces of the pierced particles.

3. A powder according to claim 1 or claim 2 wherein the pierced particles have an average thickness of no more than 500 nm, optionally no more than 300nm.

4. A powder according to any preceding claim wherein the pierced particles have an average thickness of at least 50nm.

5. A powder according to any preceding claim wherein the passages have an average width of at least 100 nm, optionally at least 250 nm, optionally at least 500 nm.

6. A powder according to any preceding claim wherein the pierced particles are formed from a material that, in use in as the active component of an anode of a metal ion battery, undergoes an volume expansion of at least 10 % upon complete insertion into the material of the metal ions of the metal ion battery.

7. A powder according to any preceding claim wherein the pierced particles comprise ~~silicon and/or~~ tin.

8. A powder according to any preceding claim wherein the pierced particles have a flake-like form.

9. A powder according to any preceding claim wherein the pierced particles have a largest dimension less than 40 μm.

10. A powder according to any preceding claim wherein the pierced particles have an average smallest dimension of less than 1 μm.

11. A powder according to any preceding claim wherein the passages make up no more than 50% of the volume of the pierced particles, optionally no more than 25%.

12. A powder according to any preceding claim wherein a BET value of the pierced particles is less than 100 m^2 / g, optionally less than 30 m^2 / g, optionally less than 15 m^2 / g.

13. A powder according to any preceding claim wherein a BET value of the pierced particles is at least 0.1 m^2 / g, optionally at least 1 m^2 / g.

14. A powder according to any preceding claim wherein the passages are separated by at least 1 micron.

15. A powder according to any preceding claim wherein the particles are substantially discrete from one another.

16. A powder according to any preceding claim wherein at least 50% of the total volume of the powder is made up of particles having a particle size of less than 50 microns as measured by a laser diffraction method in which the particles being measured are assumed to be spherical, and in which particle size is expressed as a spherical equivalent volume diameter.

17. A composition comprising a powder according to any preceding claim and at least one further component.

18. A composition according to claim 17 wherein the at least one further component comprises at least one further active component, optionally active carbon, optionally graphite.

19. A composition according to claim 17 or 18 wherein the at least one further component comprises at least one conductive, non-active component, optionally conductive, non-active carbon.

20. A composition according to any of claims 17 to 19 wherein the at least one further component comprises a binder.

21. A slurry comprising a solvent and a powder according to any of claims 1-16 or a composition according to any of claims 17-20.

22. An electrode comprising a composition according to any of claims 17-20.

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~~23. An electrode according to claim 22 wherein the pierced particles are silicon particles and wherein the electrode has a volumetric capacity in the charged state of at least 700mAh/cc~~

~~24.~~23. A metal ion battery comprising an anode, a cathode and an electrolyte between the anode and cathode wherein the anode comprises a powder according to any one of claims 1 to 16 or a composition according to any of claims 17 to 21.

~~25.~~24. A metal ion battery according to claim ~~24~~23 wherein the metal ion battery is a lithium ion battery.

~~26.~~25. A metal ion battery according to claim ~~24~~23 or ~~25~~24 wherein the anode comprises an anode layer comprising the powder and wherein the electrolyte permeates the whole thickness of the anode layer.

~~27.~~26. A method of forming a metal ion battery according to any of claims ~~24~~23-~~26~~25 comprising the step of forming the anode by depositing a slurry according to claim 21 and evaporating the solvent.

~~28.~~27. A method of forming a powder according to any of claims 1 to 16 comprising the step of piercing particles of a starting material powder to form the pierced particles.

~~29.~~28. A method according to claim ~~28~~27 wherein the particles are pierced by etching.

~~30.~~29. A method of forming a powder according to any of claims 1-16 comprising the step of forming a film comprising passages extending through the film, and breaking the film to form the pierced particles.

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