CLAIMS:

1. A method for preparing lithium-containing particles suitable for use in an electrode of a battery, comprising:

a) forming a mixture comprising titanium dioxide precursor nanoparticles and an aqueous solution of a lithium compound, wherein the titanium dioxide precursor particles consist of greater than 95% anatase phase; ~~and~~

b) heating the mixture at a~~elevated~~ temperature of at least 80 °C for at least 3 hours in a sealed pressure vessel at autogenous pressure in order to form lithium-inserted titanium dioxide nanoparticles, wherein at least one particle size characteristic selected from the group consisting of average primary particle size, ~~particle size distribution,~~ average intra-particle pore size, average inter-particle pore size, ~~pore size distribution, and particle shape~~ of the titanium dioxide nanoparticles is within 10 percent of the same size characteristic of the titanium dioxide precursor nanoparticles~~substantially unchanged by said heating step~~; and

~~b)~~c) calcining the lithium-inserted titanium dioxide nanoparticles to form lithium titanate spinel nanoparticles.

2. The method of claim 1, wherein both the titanium dioxide precursor particles and the lithium-inserted titanium dioxide particles are characterized by one or more of the following:

a. an average intra-particle pore size in the mesopore range; and

b. a monodisperse intra-particle pore size distribution~~at least one of the average primary particle size, the average intra-particle pore size, and the average inter-particle pore size of the lithium-inserted titanium dioxide particles is within about 10 percent of the same size characteristic of the titanium dioxide precursor particles~~.

~~3. The method of claim 2, wherein at least one of the average primary particle size, the average intra-particle pore size, and the average inter-particle pore size of the lithium-inserted titanium dioxide particles is within about 5 percent of the same size characteristic of the titanium dioxide precursor particles.~~

~~4. The method of claim 1, wherein both the titanium dioxide precursor particles and the lithium-inserted titanium dioxide particles are characterized by one or more of the following:~~

~~a) an average primary particle size of less than about 100 nm;~~

~~b) a generally spherical shape;~~

~~c) an average intra-particle pore size in the mesopore range;~~

~~d) a monodisperse particle size distribution;~~

~~e) a bimodal particle size distribution; and~~

~~f) a monodisperse intra-particle pore size distribution.~~

~~5.~~3. The method of any one of claims 1 to ~~2~~4, wherein the lithium compound is selected from the group consisting of lithium hydroxide, lithium oxide, lithium chloride, lithium carbonate, lithium acetate, lithium nitrate, and combinations thereof.

~~6. The method of any one of claims 1 to 4, wherein the elevated temperature is at least about 80°C and the pressure during the heating step is autogenous.~~

~~7.~~4. The method of any one of claims 1 to ~~2~~4, wherein the pH of the mixture is greater than about 9, or wherein the amount of lithium compound in the mixture is between 2 and 20 weight percent based on the weight of the titanium dioxide particles.

~~8. The method of any one of claims 1 to 4, wherein the pressure applied to the mixture during the heating step is at least about 20 psig.~~

~~9. The method of any one of claims 1 to 4, wherein the amount of lithium compound in the mixture is between about 2 and about 20 weight percent based on the weight of the titanium dioxide particles.~~

~~10. The method of any one of claims 1 to 4, further comprising calcining the lithium-inserted titanium dioxide particles to form lithium titanate spinel particles.~~

~~11.~~5. The method of claim 1~~0~~, wherein the calcining step comprises heating the lithium-inserted titanium dioxide particles at a temperature of no more than about 650°C.

~~12. The method of claim 10, wherein the lithium titanate spinel particles are characterized by one or more of the following:~~

~~a) an average primary particle size of less than about 100 nm;~~

~~b) an average intra-particle pore size in the mesopore range;~~

~~c) a monodisperse particle size distribution;~~

~~d) a bimodal particle size distribution; and~~

~~e) a monodisperse intra-particle pore size distribution.~~

13. The method of claim 10, wherein at least one of the average primary particle size, the average intra-particle pore size, and the average inter-particle pore size of the lithium titanate spinel particles is within about 10 percent of the same size characteristic of the titanium dioxide precursor particles.

14. The method of any one of claims 1 to 4, comprising:

a) forming a mixture comprising titanium dioxide precursor nanoparticles and an aqueous solution of a lithium compound;

b) heating the mixture at a temperature of at least about 80°C for at least about 2 hours in a sealed pressure vessel at autogenous pressure in order to form lithium-inserted titanium dioxide nanoparticles, wherein at least one particle size characteristic selected from the group consisting of average primary particle size, particle size distribution, average intra-particle pore size, average inter-particle pore size, pore size distribution, and particle shape of the titanium dioxide nanoparticles is substantially unchanged by said heating step; and

c) optionally, calcining the lithium-inserted titanium dioxide nanoparticles to form lithium titanate spinel nanoparticles.

15. The method of claim 14, wherein the titanium dioxide precursor nanoparticles, the lithium-inserted titanium dioxide nanoparticles, and the lithium titanate spinel nanoparticles are characterized by one or more of the following:

a) an average intra-particle pore size in the mesopore range;

b) a monodisperse particle size distribution

c) a bimodal particle size distribution; and

d) a monodisperse intra-particle pore size distribution.

16. The method of any one of claims 1 to 4, comprising:

a) preparing titanium dioxide precursor particles by forming an aqueous solution of a titanium salt and an organic acid, and thermally hydrolyzing the aqueous solution at an elevated temperature, optionally in the presence of a titanium dioxide seed material, to produce titanium dioxide precursor particles in a mother liquor;

b) separating the resulting titanium dioxide precursor particles from the mother liquor;

c) optionally, drying the separated titanium dioxide precursor particles;

d) forming a mixture comprising the titanium dioxide precursor particles and an

aqueous solution of a lithium compound;

e) heating the mixture at a temperature of at least about 80°C for at least about 2 hours in a sealed pressure vessel at autogenous pressure in order to form lithium-inserted titanium dioxide particles, wherein at least one particle size characteristic selected from the group consisting of average primary particle size, particle size distribution, average intra-particle pore size, average inter-particle pore size, pore size distribution, and particle shape of the precursor titanium dioxide precursor particles is substantially unchanged by said heating step; and

f) optionally, calcining the lithium-inserted titanium dioxide particles to form lithium titanate spinel particles.

17. A battery comprising a first electrode, a second electrode, and a separator comprising an electrolyte between the first and second electrodes, wherein one of the first and second electrodes comprises lithium-inserted titanium dioxide particles made according to the process of any one of claims 1 to 4 or lithium titanate spinel particles made according to the process of claim 10.

18.6. Lithium-containing particles suitable for use in an electrode of a lithium-ion battery, comprising:

a) a plurality of lithium-inserted titanium dioxide particles characterized by one or more of the following:

i. an average primary particle size of less than about 100 nm;

ii. a generally spherical shape;

iii. an average intra-particle pore size in the mesopore range;

iv. a monodisperse particle size distribution;

v. a bimodal particle size distribution; and

vi. a monodisperse intra-particle pore size distribution; or

b) a plurality of lithium titanate spinel nanoparticles, wherein the lithium titanate spinel particles have an average primary particle size of no more than 80 nm and a monodispersity of particle size such that all particles have a primary particle size within 10 percent of the average primary particle size, optionally wherein said particles are characterized by one or more of the following:

i. an average intra-particle pore size in the mesopore range;-and

ii. a monodisperse particle size distribution;

iii. a bimodal particle size distribution; and

~~iv.~~ii. a monodisperse intra-particle pore size distribution.

~~19. The particles of claim 18, wherein the lithium-inserted titanium dioxide particles are in the form of nanoparticles comprising between about 1 and about 12 weight percent lithium, based on the total weight of the lithium-inserted titanium dioxide nanoparticles, and wherein the lithium-inserted titanium dioxide nanoparticles are characterized by one or more of the following:~~

~~a) a generally spherical shape;~~

~~b) an average intra-particle pore size in the mesopore range;~~

~~c) a monodisperse particle size distribution;~~

~~d) a bimodal particle size distribution; and~~

~~e) a monodisperse intra-particle pore size distribution.~~

~~20. The particles of claim 19, wherein the lithium-inserted titanium dioxide nanoparticles are characterized by a generally spherical shape and a monodisperse particle size distribution, and wherein the nanoparticles have an average primary particle size of no more than about 80 nm and a monodispersity of particle size such that all particles have a primary particle size within about 10 percent of the average primary particle size.~~

~~21. The particles of claim 19, wherein the lithium-inserted titanium dioxide nanoparticles are characterized by an XRD diffraction pattern substantially as shown in FIG. 6.~~

~~22. The particles of claim 18, wherein the lithium titanate spinel nanoparticles have an average primary particle size of no more than about 80 nm and a monodispersity of particle size such that all particles have a primary particle size within about 10 percent of the average primary particle size.~~

~~23.~~7. A battery comprising a first electrode, a second electrode, and a separator comprising an electrolyte between the first and second electrodes, wherein one of the first and second electrodes comprises the particles of ~~any one of~~ claim~~s~~ ~~6~~18 ~~to 22~~.