CLAIMS

1. A method of preparing coated particles comprising drug-containing core enclosed by an inorganic oxide coating, wherein the drug-containing core comprises a drug, the method comprising the sequential steps of:

(a) loading particles comprising a drug into a chamber of a reactor;

(b) performing a first number of first cycles, wherein each first cycle comprises steps (b1)-(b4):

(b1) applying a vaporous or gaseous first inorganic oxide precursor to the particles in the reactor by pulsing the vaporous or gaseous first inorganic oxide precursor into the reactor;

(b2) purging using an inert gas or performing one or more pump-purge cycles of the reactor using an inert gas;

(b3) applying a vaporous or gaseous oxidant to the particles in the reactor by pulsing the oxidant into the reactor;

(b4) purging using an inert gas or performing one or more pump-purge cycles of the reactor using an inert gas;

(c) performing a second number of second cycles, wherein each second cycle comprises steps (c1)-(c4):

(c1) applying a vaporous or gaseous second inorganic oxide precursor to the particles in the reactor by pulsing the vaporous or gaseous second inorganic oxide precursor into the reactor;

(c2) purging using an inert gas or performing one or more pump-purge cycles of the reactor using an inert gas;

(c3) applying a vaporous or gaseous oxidant to the particles in the reactor by pulsing the oxidant into the reactor;

(c4) purging using an inert gas or performing one or more pump-purge cycles of the reactor using an inert gas; and

(d) repeating steps (b)-(c) at least once;

wherein, the first inorganic oxide precursor and second inorganic oxide precursor are different; in each repeat of step (b) the first number is independently selected from 1-10 or 1-20; and in each repeat of step (c) the second number is independently selected from 1-10 or 1-20.

2. The method claim 1, wherein the inorganic oxide precursors are selected from the group consisting of a zinc oxide precursor, an aluminum oxide precursor and a silicon oxide precursor.

3. The method of any one of claims 1-2 wherein each of steps (b1), (b3), (c1) and (c3) comprises: (i) introducing the vaporous or gaseous inorganic oxide precursor into the chamber, (ii) allowing a holding time to pass, and (iii) pumping the vaporous or gaseous inorganic oxide precursor of the chamber; and repeating steps (i) – (ii) at least once.

4. The method of any one of claims 1-3, wherein the first cycles and second cycles take place at a temperature between 25°C and 60°C.

5. The method of any one of claims 1-4, wherein the oxidant in step (b3) is water.

6. The method of any one of claims 1-5, wherein the oxidant in step (c3) is water.

7. The method of any one of claims 1-6, wherein each pump-purge cycle comprises flowing the inert gas into the reactor chamber to a desired pressure and after a delay time pumping the inert gas out of the reactor until the pressure of the inert gas is below 1 torr and repeating the steps of flowing the inert gas into the reactor chamber to a desired pressure and after a delay time pumping the inert gas out of the reactor until the pressure of the inert gas is below 1 torr.

8. The method of any one of claims 1-7, wherein: a) the first and second inorganic acid precursors are selected from an aluminum oxide precursor and a zinc oxide precursor; b) the first and second inorganic acid precursors are selected from an aluminum oxide precursor and a silicone oxide precursor; or c) the first and second inorganic acid precursors are selected from an silicone oxide precursor and a zinc oxide precursor.

9. The method of any one of claims 1-8, the method further comprising, after step (d):
(e) performing a third number of third cycles, wherein each third cycle comprises steps (e1)-(e4):

(e1) applying a vaporous or gaseous third inorganic oxide precursor to the particles in the reactor by pulsing the vaporous or gaseous third precursor into the reactor;

(e2) purging using an inert gas or performing one or more pump-purge cycles of the reactor using an inert gas;

(e3) applying a vaporous or gaseous oxidant to the particles in the reactor by pulsing the oxidant into the reactor;

(e4) purging using an inert gas or performing one or more pump-purge cycles of the reactor using an inert gas;

(f) performing a fourth number of fourth cycles, wherein each fourth cycle comprises steps (f1)-(f4):

(f1) applying a vaporous or gaseous fourth inorganic oxide precursor to the particles in the reactor by pulsing the vaporous or gaseous fourth precursor into the reactor;

(f2) purging using an inert gas or performing one or more pump-purge cycles of the reactor using an inert gas;

(f3) applying a vaporous or gaseous oxidant to the particles in the reactor by pulsing the oxidant into the reactor;

(f4) purging using an inert gas or performing one or more pump-purge cycles of the reactor using an inert gas; and

(g) repeating steps (e)-(f) at least once.

wherein, the third and fourth precursor are different; in each repeat of step (e) the third number is independently selected from 1-10 or 1-20; and in each repeat of step (f) the fourth number is independently selected from 1-10 or 1-20.

10. A coated particle prepared by the method of any one of claims 1-9.

11. A coated particle comprising drug-containing core enclosed by an inorganic oxide coating, wherein the drug-containing core comprises a drug, and the inorganic oxide coating comprising at least one layer composed of three elements (“three element inorganic oxide layer”), wherein the three elements are: a) aluminum, zinc and oxygen; b) aluminum, silicon and oxygen; or c) silicon, zinc and oxygen.

12. The coated particle of claim 11, wherein the three element inorganic oxide layer is 2 – 50 nm thick.

13. The coated particle of claim 11, wherein the coated drug particle is 5-30% by weight inorganic oxide.

14. The coated particle of claim 11, wherein the three element inorganic oxide layer is composed of: a) aluminum, zinc and oxygen and the ratio of aluminum to zinc varies in the layer; b) aluminum, silicone and oxygen and the ratio of aluminum to silicon varies in the layer; or c) silicon, zinc and oxygen and the ratio of silicon to zinc varies in the layer.

15. The coated particle of any one of claims 10-14, wherein the core has a D50 on a volume average basis of 100 nm – 30 micrometers.