CLAIMS

1. A pharmaceutical composition comprising individual particles comprising an API-containing core enclosed by an inner metal oxide layer and polymer layer adjacent the metal oxide layer, wherein the core has a median particle size, on a volume average basis, between 0.1 µm and 20 µm, the inner metal oxide layer has an average thickness of 0.1 nm to 30 nm and the polymer layer has an average thickness of 0.1 nm to 400 nm.

2. The pharmaceutical composition of claim 1, wherein the inner metal oxide layer conforms the core and is substantially pin-hole free and the outer polymer layer conforms to the inner metal oxide layer and is substantially pin-hole free.

3. The pharmaceutical composition of claim 1, wherein the core has a median particle size, on a volume average basis between 0.1 µm and 10 µm.

4. A method of preparing coated particles comprising an active pharmaceutical ingredient (API)-containing core enclosed by one or more metal oxide layers and one or more polymer layers, the method comprising the sequential steps of:
(a) performing atomic layer deposition to apply a metal oxide layer to particles comprising an API thereby preparing particles comprising an API enclosed by a metal oxide layer; and subsequently
(b) performing molecular layer deposition to apply a polymer layer to the particles comprising a drug enclosed by a metal oxide layer, thereby preparing coated particles comprising an API-containing core enclosed by one or more metal oxide layers and one or more polymer layers.

5. The method of claim 4, wherein the step of performing atomic layer deposition comprises:
(a1) loading the particles comprising the API into a reactor;
(a2) applying a vaporous or gaseous metal precursor to the particles in the reactor;
(a3) performing one or more pump-purge cycles of the reactor using inert gas;

(a4) applying a vaporous or gaseous oxidant to the particles in the reactor; and

(a5) performing one or more pump-purge cycles of the reactor using inert gas.

6. The method of claim 5, wherein steps (a2) - (a5) are performed two or more times to increase the total thickness of the metal oxide layer before step (b) is performed.

7. The method of claim 6, wherein steps (a2) - (a5) are performed 5 – 50 times to increase the total thickness of the metal oxide layer before step (b) is performed.

8. The method of claim 4, wherein the step of performing molecular layer deposition comprises:

(b1) applying vaporous polymer precursor A to the particles comprising an API containing core enclosed by a metal oxide layer in the reactor;

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

(b3) applying vaporous polymer precursor B to the particles in the reactor; and

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