

CLAIMS

What is claimed is:

1. A powder comprising:
 - a plurality of perforated shells having a size of at least 100nm and comprising openings smaller than 10nm, wherein the shells are electrically conductive and/or comprise an electrically conductive coating, and
 - zinc and/or zinc oxide which resides at least partially within the shells.
2. The powder of claim 1, wherein the shells are at least partly agglomerated.
3. The powder of claim 1, wherein the zinc is at least partly internally coated in the shells.
4. The powder of claim 1, wherein the zinc oxide comprises zinc oxide particles which are at least partly within the shells.
5. The powder of any one of claims 1-4, wherein volumes of the perforated shells are configured to sustain at least a 30% volume increase of Zn oxidation to ZnO.
6. The powder of any one of claims 1-5, wherein the shells are conductive and made of at least one of Ni, Sn, C, TiN or combinations thereof.
7. The powder of any one of claims 1-6, wherein the shells are coated by a carbon-based coating.
8. An electrode made of the powder of any one of claims 1-7, sintered and attached to a current collector.
9. A zinc-air battery comprising at least one of the electrode of claim 8, at least one air electrode and alkaline electrolyte.
10. A method comprising:
 - wetting with a Zn solution a plurality of perforated shells having a size of at least 100nm and comprising openings smaller than 10nm, wherein the shells are electrically conductive material and/or comprise an electrically conductive coating, wherein the wetting is carried out by at least partial penetration of the Zn solution through the openings, and
 - coating Zn at least partly internally in the shells by application of electric current to the shells.

11. The method of claim 10, further comprising sintering a powder of the shells to form an electrode and using the electrode in a zinc-air battery.
12. The method of claim 11, further comprising pressing the powder prior to the sintering.
13. The method of any one of claims 1-12, further comprising electrochemically oxidizing the internally coated Zn to form ZnO particles which are at least partly within the shells.
14. The method of claim 13, wherein the openings are configured to retain at least part of the ZnO within the shells.
15. The method of any one of claims 10-14, wherein volumes of the perforated shells are configured to sustain at least a 30% volume increase during Zn oxidation to ZnO.
16. The method of any one of claims 10-15, further comprising forming the perforated shells from at least one of Ni, Sn, C, TiN or combinations thereof.
17. The method of any one of claims 10-16, further comprising coating the shells by a carbon-based coating.