Claims

1. A dry process for forming a prelithiated electrode comprising:

preparing a dry electrode material mixture comprising:

a) an active component comprising an active electrode material, a binder and a conductive material mixed with

b) a prelithiation printable lithium composition comprising on a dry weight basis 50 to 98 percent by weight lithium metal powder and 2 to 50 percent by weight of a polymer binder compatible with the lithium metal powder and a rheology modifier compatible with the lithium metal powder to form a dry electrode material mixture; and

depositing the dry electrode material mixture to a substrate as a non self-supported layer or interface to form a prelithiated electrode.

2. The process of Claim 1, wherein depositing the dry electrode material mixture to the substrate is performed by a method selected from the group consisting of extruding, roll compaction, electrostatic deposition and combinations thereof.

3. The process of Claim 1, wherein the adhesion promoter is selected from the group consisting of unsaturated elastomers, saturated elastomers, thermoplastics, polyacrylic acid, polyvinylidene chloride, and polyvinyl acetate. poly(ethylene oxide), polystyrene, polyisobutylene, natural rubbers, butadiene rubbers, styrene-butadiene rubber, polyisoprene rubbers, butyl rubbers, hydrogenated nitrile butadiene rubbers, epichlorohydrin rubbers, acrylate rubbers, silicon rubbers, nitrile rubbers, polyacrylic acid, polyvinylidene chloride, polyvinyl acetate, ethylene propylene diene termonomer, ethylene vinyl acetate copolymer, ethylene-propylene copolymers, ethylene-propylene terpolymers, polybutenes, wax and combinations thereof.

4. The process of Claim 1, wherein applying the dry electrode material mixture to the substrate comprises pressing the dry electrode material mixture onto the substrate

at a temperature between about 80 and about 180 °C and at a pressure between about 5000 and about 50000 PSI.

5. The process of Claim 1, wherein the substrate is selected from the group consisting of a current collector, a polymer film and solid electrolytes.

6. The process of Claim 1, wherein the active electrode material is an active anode material, the binder is polyisobutylene or polyvinylidene fluoride, and the conductive material is carbon black.

7. The process of Claim 6, wherein the active anode material comprises a graphite or graphite/silicon oxide mixture.

8. The process of Claim 1, wherein the active electrode material is an active cathode material.

9. The process of Claim 8, wherein the active cathode material is a non-lithiated material selected from the group consisting of MnO_2, V_2O_5, MoS_2, metal fluorides, sulfur, sulfur composites, tin and combinations thereof.

10. The process of Claim 1, wherein the lithium metal powder is stabilized lithium metal powder and has a median particle size of less than 80 microns.

11. The process of Claim 1, wherein the rheology modifier is a conductive material.

12. The process of Claim 11, wherein the conductive material is selected from the group consisting of carbon black, carbon nanotubes, and graphene.

13. The process of Claim 1, wherein the rheology modifier provides improved capacity and is selected from the group consisting of silicon nanotubes, graphite, hard carbon, and graphene.

14. The process of Claim 1, wherein the rheology modifier is selected from the group consisting of carbonaceous materials, silicon-containing materials, tin-containing materials, Group IIA oxides, Group IIIA oxides, Group IVB oxides, Group VB oxides and Group VIA oxides.

15. The process of claim 1, which is a one-step process.

16. The process of claim 1, wherein the temperature of the process is below the melting point of lithium.

17. A prelithiated electrode produced by the process of claim 1.

18. The process of Claim 1 further including forming a solid electrolyte interface layer within 24 hours after applying the dry electrode material mixture to the substrate.

19. A battery having a cathode and an anode formed from the process of Claim 1.

20. A battery of claim 19, wherein the battery has a first cycle efficiency greater than about 80%.

21. The battery of claim 20, wherein the first cycle efficiency is greater than 90%.

22. An electrode material mixture comprising

a) an active component comprising an active electrode material, a binder and a conductive material mixed with

b) a prelithiation printable lithium composition comprising prior to mixing with the active component comprises on a solution basis 0.5 to 50 percent, lithium metal powder, 0.1 to 10 percent polymer binder compatible with the lithium metal powder, 0.1 to 10 percent rheology modifier compatible with the lithium metal powder and about 40 to 95 percent non-polar solvent to form a dry electrode material mixture, wherein the dry electrode material mixture has less than about 20 percent solvent content once dried.

23. The electrode material according to Claim 22, where the dry electrode material has less than about 10 percent solvent content.

24. The electrode material according to Claim 22, where the dry electrode material has less than about 1 percent solvent content.

25. A battery comprising the prelithiated electrode of Claim 22.