Claims

1. A solid-state battery comprising a cathode, an anode and a solid electrolyte, wherein at least the anode, cathode and/or solid electrolyte is formed from a printable lithium composition comprised of lithium metal powder, a polymer binder compatible with the lithium metal powder, a rheology modifier compatible with the lithium metal powder, and a solvent compatible with the lithium metal powder and with the polymer binder,

the printable lithium composition comprising on a solution basis:

a) the lithium metal powder of 5 to 50 percent;

b) the polymer binder of 0.1 to 20 percent;

c) the rheology modifier of 0.1 to 30 percent;

d) the solvent of 50 to 95 percent,

wherein the solvent is a non-polar solvent.

2. The solid-state battery of Claim 1, wherein the anode and/or cathode is formed by printing the printable lithium composition onto the anode and/or cathode.

3. The solid-state battery of Claim 1, wherein the anode is formed by printing the printable lithium composition onto a current collector.

4. The solid-state battery of Claim 1, wherein the anode and/or cathode is coated with the printable lithium composition.

5. The solid-state battery of Claim 1, wherein the lithium powder is stabilized lithium metal powder.

6. The solid-state battery 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.

7. The solid-state battery of Claim 1, wherein the polymer binder has a molecular weight of 1,000 to 8,000,000 and is selected from the group consisting of unsaturated elastomers,

saturated elastomers, thermoplastics, polyacrylic acid, polyvinylidene chloride, and polyvinyl acetate.

8. The solid-state battery of Claim 1, wherein the solvent is selected from the group consisting of alkanes, toluene, ethylbenzene, cumene, xylene, sulfones, mineral oil, glymes, and isoparaffinic synthetic hydrocarbon solvents.

9. A solid-state battery comprising a cathode, an anode and a solid electrolyte, wherein lithium is deposited onto the solid electrolyte with a lithium printable lithium composition comprised of lithium metal powder, a polymer binder compatible with the lithium metal powder, a rheology modifier compatible with the lithium metal powder and the polymer binder, and a solvent compatible with the lithium metal powder and with the polymer binder,

the printable lithium composition comprising on a solution basis:

a) the lithium metal powder of 5 to 50 percent;

b) the polymer binder of 0.1 to 20 percent;

c) the rheology modifier of 0.1 to 30 percent;

d) the solvent of 50 to 95 percent,

wherein the solvent is a non-polar solvent.

10. The solid-state battery of Claim 9, wherein lithium is deposited onto the solid electrolyte by printing the printable lithium composition onto the solid electrolyte.

11. The solid-state battery of Claim 9, wherein lithium is deposited onto the solid electrolyte by coating the solid electrolyte with the printable lithium composition.

12. The solid-state battery of Claim 9, wherein the lithium powder is stabilized lithium metal powder.

13. The solid-state battery of Claim 9, 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.

14. The solid-state battery of Claim 13, wherein the carbonaceous material is selected from the group consisting of carbon black, carbon nanotubes, graphite, hard carbon, and graphene.

15. The solid-state battery of Claim 9, wherein the polymer binder has a molecular weight of 1,000 to 8,000,000 and is selected from the group consisting of unsaturated elastomers, saturated elastomers, thermoplastics, polyacrylic acid, polyvinylidene chloride, and polyvinyl acetate.

16. The solid-state battery of Claim 9, wherein the solvent is selected from the group consisting of alkanes, toluene, ethylbenzene, cumene, xylene, sulfones, mineral oil, glymes, and isoparaffinic synthetic hydrocarbon solvents.

17. The solid-state battery of Claim 9, wherein the anode is lithiated using the printable lithium composition.