Claims

1. A substrate coated with a printable lithium composition, the printable lithium composition comprising:

a) between ~~about~~ 5% to ~~about~~ 50% by weight of lithium metal powder;

b) between ~~about~~ 0.1% to ~~about~~ 20% by weight of a polymer binder, wherein the polymer binder is compatible with the lithium metal powder;

c) between ~~about~~ 0.1% to ~~about~~ 30% of a carbon-based rheology modifier compatible with the lithium metal powder and the polymer binder, wherein the rheology modifier is dispersible within the composition and provides a three-dimensional structure for ~~preventing degradation and increasing the durability of the substrate~~ reducing the risk of dendrite growth during cycling when coated with the printable lithium composition; and

d) between ~~about~~ 50% to ~~about~~ 95% by weight of a non-polar solvent selected from the group consisting of acyclic hydrocarbons, cyclic hydrocarbons, aromatic hydrocarbons, symmetrical ethers, unsymmetrical ethers and cyclic ethers, and mixtures, blends or cosolvents thereof,

wherein the printable lithium composition has a zero shear viscosity of from $1 \times 10^4$ cps to $1 \times 10^7$ cps to maintain the lithium metal powder in suspension.

2. The substrate of Claim 1, wherein the substrate is an energy storage device substrate and is selected from the group consisting of a current collector, an anode, a cathode, an electrolyte and a separator.

3. The substrate of Claim 1, wherein the printable lithium composition is in the form of a foil or a film.

4. The substrate 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.

5. The substrate of Claim 4, wherein the unsaturated elastomer is selected from the group consisting of butadiene rubber, isobutylene, and styrene butadiene rubber.

6. The substrate of Claim 4, wherein the saturated elastomer is selected from the group consisting of ethylene propylene diene monomer rubber and ethylene-vinyl acetate.

7. The substrate of Claim 4, wherein the thermoplastics is selected from the group consisting of polystyrene, polyethylene and polymers of ethylene oxide.

8. The substrate of Claim 1 further including one or more electrode active materials for forming an electrode.

9. A battery comprising a cathode, an electrolyte, and an anode, wherein the cathode, the electrolyte, the anode, or a combination thereof each may include a substrate coated with a printable lithium composition according to Claim 1.

~~10. A substrate coated with a printable lithium composition, the printable lithium composition comprising:~~

- ~~a. lithium metal powder;~~
- ~~b. a polymer binder, wherein the polymer binder is compatible with the lithium metal powder; and~~
- ~~c. a rheology modifier compatible with the lithium metal powder and the polymer binder, wherein the rheology modifier is dispersible within the composition and provides a three-dimensional structure for preventing degradation and increasing the durability of the substrate when coated with the printable lithium composition.~~

~~11. A battery comprising the substrate according to Claim 10.~~

~~12. A foil or film formed from a printable lithium composition, the printable lithium composition comprising:~~

- ~~a. lithium metal powder;~~
- ~~b. carbon nanotubes to provide a three-dimensional support structure for preventing degradation and increasing the durability of a lithium substrate; and~~
- ~~c. a polymer binder, wherein the polymer binder is compatible with the lithium metal powder.~~

~~13. The foil or film of Claim 12, wherein the foil has a laminated thickness between about 1 micron to about 50 microns.~~

~~14. The foil or film of Claim 13, wherein the laminated thickness of the foil is between about 10 microns and about 20 microns.~~

~~15. A battery comprising a foil or film according to Claim 12.~~