

We claim:

1. A method of forming a lithium metal anode for a battery, the method comprising,
providing at least a portion of lithium metal,
adding, via a solid-state process, one or more particulate material(s) on at least a part of the portion of lithium metal,
pressing the portion of lithium metal and the one or more particulate material(s) so as to adhere or embed the one or more particulate material(s) on or in the portion of lithium metal,
wherein the one or more particulate material(s) inhibit or eliminate the formation of a dendrite.
2. The method of claim 1, wherein the step of adding one or more particulate materials(s) is selected from adding the one or more particulate material(s) directly on the portion of the lithium metal via a feeder device or adding the one or more particulate material(s) indirectly on the portion of the lithium metal via a feeder device.
3. The method of claim 2, wherein adding one or more particulate material(s) indirectly further comprises adding the one or more particulate material(s) onto a film layer and affixing the film layer to the portion of lithium metal, transferring the one or more particulate material(s) via a solid-state process from the film layer to the portion of lithium metal.
4. The method of claim 1 further comprising the step of passing the portion of lithium metal through a nip formed between an upper press roller and a lower press roller, resulting in an anode that has one or more particulate material(s) dispersed and embedded throughout the anode.
5. The method of claim 1, wherein the portion of lithium metal is selected from a lithium composite, a lithium alloy, or a lithium metal supported by a polymer substrate.
6. The method of claim 1, wherein the one or more particulate material(s) define(s) at least one of the following properties: (a) the one or more particulate material(s) are at least partially

soluble in non-aqueous electrolytes including liquid and solid electrolytes; (b) the particulate material causes a change in viscosity of an electrolyte after activating; (c) the particulate material causes a change in ionic conductivity after activating; (d) the particulate material causes a change in lithium diffusion coefficient after activating; and (e) the particulate material causes a change in surface topography on a surface of the lithium metal layer after activation.

7. The method of claim 1, wherein the one or more particulate material(s) defines at least one of the following properties: (a) the one or more particulate material(s) are insoluble and dispersible in non-aqueous electrolytes including liquid and solid electrolytes; (b) the particulate material causes a change in viscosity of an electrolyte after activating; (c) the particulate material causes a change in ionic conductivity after activating; (d) the particulate material causes a change in lithium diffusion coefficient after activating; and (e) the particulate material causes a change in surface topography on a surface of the lithium metal layer after activation.

8. The method of claim 1, wherein the one or more particulate material(s) is/are selected from the group consisting essentially of polymers; organic materials that are used in an electrolyte and that dissolve in carbonate and non-carbonate solvents; and metallic and non-metallic lithiophilic materials; and combinations thereof.

9. The method of claim 1, wherein the one or more particulate material(s) is/are defined as a polymer selected from polyacrylonitrile; polyvinylidene difluoride, polyethylene oxide; polyethylene, polypropylene, polyvinyl chloride, polyphthalate, polyimide, polyester, polyurethane, nylon, cellulose, lignin, and polytetrafluoroethylene, and combinations thereof.

10. The method of claim 1, wherein the one or more particulate material(s) is/are defined as an inorganic compound, whether dissolved in a solvent or not, selected from lithium bis(trifluoromethanesulfonyl)imide (LiTFSI), Lithium bis(fluorosulfonyl)imide (LiFSI), lithium hexafluoroarsenate (LiAsF_6), lithium hexafluorophosphate (LiPF_6), lithium tetrafluoroborate (LiBF_4), lithium perchlorate (LiClO_4), lithium bis(oxalato)borate (LiBOB) and lithium(difluoroxyalato) borate (LiDFOB), inclusive of both polarizable and non-polarizable lithium salts; and combinations thereof.

11. The method of claim 1, wherein the one or more particulate material(s) is/are selected from aluminum, silver, gold, zinc, magnesium, silicon, tin, germanium, indium, boron, MnO_2 , Co_3O_4 , SnO_2 , SiO_2 , ZnO , Al_2O_3 , $\text{Li}_{1.3}\text{Al}_{0.3}\text{Ti}_{1.7}(\text{PO}_4)_3$, $\text{Li}_{1.5}\text{Al}_{0.5}\text{Ge}_{1.5}(\text{PO}_4)_3$, $\text{Li}_7\text{La}_3\text{Zr}_{12}\text{O}_{12}$, $\text{Li}_{0.33}\text{La}_{0.557}\text{TiO}_3$, $\text{Li}_2\text{O-SiO}_2\text{-TiO}_2\text{-P}_2\text{O}_5$ and lithiophilic carbonaceous materials including nonstructured carbon material(s), graphene, reduced graphene, N-doped graphene, and surface modified graphene; and combination thereof.
12. The method of claim 1, wherein the one or more particulate material is selected from one or more of the following: NaNO_3 , CsNO_3 , RbNO_3 , KNO_3 , AgNO_3 , NH_4NO_3 , $\text{Ba}(\text{NO}_3)_2$, $\text{Sr}(\text{NO}_3)_2$, $\text{Mg}(\text{NO}_3)_2$, $\text{Ca}(\text{NO}_3)_2$, $\text{Ni}(\text{NO}_3)_2$, $\text{Co}(\text{NO}_3)_2$, $\text{Mn}(\text{NO}_3)_2$, $\text{Al}(\text{NO}_3)_3$, $\text{Ce}(\text{NO}_3)_3$ and/or LiNO_3 .
13. The method of claim 12, wherein the one or more particulate material is defined as 0.01M~10M lithium nitrate (LiNO_3) in a solvent.
14. A lithium metal anode for a battery comprising at least a portion of lithium metal and one or more particulate material(s), wherein the one or more particulate material(s) are adhered or embedded on or in the portion of lithium metal, and wherein the one or more particulate material(s) inhibit or eliminate the formation of a dendrite.
15. The lithium metal anode of claim 14, wherein the one or more particulate material(s) define a size of 100 microns or less.
16. The lithium metal anode of claim 14, wherein the one or more particulate material(s) is/are dispersed and embedded throughout the portion of lithium metal.
17. The lithium metal anode of claim 14, wherein the portion of lithium metal is selected from a lithium composite, a lithium alloy, or a lithium metal supported by a polymer substrate.
18. The lithium metal anode of claim 14, wherein the one or more particulate material(s) define(s) at least one of the following properties: (a) the one or more particulate material(s) are at

least partially soluble in non-aqueous electrolytes including liquid and solid electrolytes; (b) the particulate material causes a change in viscosity of an electrolyte after activating; (c) the particulate material causes a change in ionic conductivity after activating; (d) the particulate material causes a change in lithium diffusion coefficient after activating; and (e) the particulate material causes a change in surface topography on a surface of the lithium metal layer after activation.

19. The lithium metal anode of claim 14, wherein the one or more particulate material(s) is/are selected from the group consisting essentially of polymers; organic materials that are used in an electrolyte and that dissolve in carbonate and non-carbonate solvents; and metallic and non-metallic lithiophilic materials; and combinations thereof.

20. The lithium metal anode of claim 14, wherein the one or more particulate material is defined as 0.01M~10M lithium nitrate (LiNO_3) in a solvent.