3) adding a cathode active material into the first suspension to form a second suspension;

4) homogenizing the second suspension by a homogenizer at a temperature below or equal to about 15 °C to obtain a homogenized slurry;

5) applying the homogenized slurry on a current collector to form a coated film on the current collector; and

6) drying the coated film on the current collector at a temperature from about 35 °C to about 65 °C to form the cathode,

wherein the aqueous solvent is water; wherein the pH of the homogenized slurry is from about 7 to about 11.6; and wherein the coated film on the current collector is dried for a time period of less than 5 minutes.

[0011] In some embodiments, the binder material is selected from the group consisting of styrene-butadiene rubber, carboxymethyl cellulose, polyvinylidene fluoride, acrylonitrile copolymer, polyacrylic acid, polyacrylonitrile, poly(vinylidene fluoride)-hexafluoropropene, LA132, LA133, latex, a salt of alginic acid, and combinations thereof. In certain embodiments, the salt of alginic acid comprises a cation selected from the group consisting of Na, Li, K, Ca, NH_4, Mg, Al, and combinations thereof.

[0012] In certain embodiments, the conductive agent is selected from the group consisting of carbon, carbon black, graphite, expanded graphite, graphene, graphene nanoplatelets, carbon fibres, carbon nano-fibers, graphitized carbon flake, carbon tubes, carbon nanotubes, activated carbon, mesoporous carbon, and combinations thereof.

[0013] In some embodiments, the aqueous solvent further comprises ethanol, isopropanol, methanol, acetone, n-propanol, t-butanol, n-butanol, dimethyl ketone, methyl ethyl ketone, ethyl acetate, isopropyl acetate, propyl acetate, and combinations thereof.

[0014] In certain embodiments, the cathode active material is selected from the group consisting of $Li_{1+x}Ni_aMn_bCo_cAl_{(1-a-b-c)}O_2$, $LiNi_{0.33}Mn_{0.33}Co_{0.33}O_2$, $LiNi_{0.4}Mn_{0.4}Co_{0.2}O_2$, $LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$, $LiNi_{0.6}Mn_{0.2}Co_{0.2}O_2$, $LiNi_{0.7}Mn_{0.15}Co_{0.15}O_2$, $LiNi_{0.8}Mn_{0.1}Co_{0.1}O_2$, $LiNi_{0.92}Mn_{0.04}Co_{0.04}O_2$, $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$, $LiCoO_2$, $LiNiO_2$, $LiMnO_2$, $LiMn_2O_4$, Li_2MnO_3, and combinations thereof; wherein $-0.2 \leq x \leq 0.2$, $0 \leq a < 1$, $0 \leq b < 1$, $0 \leq c < 1$, and $a+b+c \leq 1$. In some embodiments, the cathode active material is selected from the group consisting of

CLAIMS

What is claimed is:

1. A method of preparing a cathode for a secondary battery, comprising the steps of:

1) dispersing a binder material and a conductive agent in an aqueous solvent to form a first suspension;

2) cooling the first suspension to a temperature from about -5 °C to about 15 °C;

3) adding a cathode active material into the first suspension to form a second suspension;

4) homogenizing the second suspension by a homogenizer at a temperature from about -5 °C to about 15 °C to obtain a homogenized slurry;

5) applying the homogenized slurry on a current collector to form a coated film on the current collector; and

6) drying the coated film on the current collector at a temperature from about 35 °C to about 65 °C to form the cathode,

wherein the aqueous solvent is water and wherein the total processing time for steps 5) and 6) is less than 5 minutes.

2. The method of claim 1, wherein the binder material is selected from the group consisting of styrene-butadiene rubber, acrylated styrene-butadiene rubber, acrylonitrile copolymer, acrylonitrile-butadiene rubber, nitrile butadiene rubber, acrylonitrile-styrene-butadiene copolymer, acryl rubber, butyl rubber, fluorine rubber, polytetrafluoroethylene, polyethylene, polypropylene, ethylene/propylene copolymers, polybutadiene, polyethylene oxide, chlorosulfonated polyethylene, polyvinylpyrrolidone, polyvinylpyridine, polyvinyl alcohol, polyvinyl acetate, polyepichlorohydrin, polyphosphazene, polyacrylonitrile, polystyrene, latex, acrylic resins, phenolic resins, epoxy resins, carboxymethyl cellulose, hydroxypropyl cellulose, cellulose acetate, cellulose acetate butyrate, cellulose acetate propionate, cyanoethylcellulose, cyanoethylsucrose, polyester, polyamide, polyether, polyimide, polycarboxylate, polycarboxylic acid, polyacrylic acid, polyacrylate, polymethacrylic acid, polymethacrylate, polyacrylamide, polyurethane, fluorinated polymer, chlorinated polymer, a salt of alginic acid, polyvinylidene fluoride, poly(vinylidene fluoride)-hexafluoropropene, and combinations thereof.

3. The method of claim 2, wherein the salt of alginic acid comprises a cation selected from Na, Li, K, Ca, NH_4, Mg, Al, or a combination thereof.

4. The method of claim 1, wherein the conductive agent is selected from the group consisting of carbon, carbon black, graphite, expanded graphite, graphene, graphene nanoplatelets, carbon fibres, carbon nano-fibers, graphitized carbon flake, carbon tubes, carbon nanotubes, activated carbon, mesoporous carbon, and combinations thereof.

5. The method of claim 1, wherein the aqueous solvent further comprises ethanol, isopropanol, methanol, acetone, n-propanol, t-butanol, n-butanol, dimethyl ketone, methyl ethyl ketone, ethyl acetate, isopropyl acetate, propyl acetate, and combinations thereof.

6. The method of claim 1, wherein the cathode active material is selected from the group consisting of $Li_{1+x}Ni_aMn_bCo_cAl_{(1-a-b-c)}O_2$, $LiNi_{0.33}Mn_{0.33}Co_{0.33}O_2$, $LiNi_{0.4}Mn_{0.4}Co_{0.2}O_2$, $LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$, $LiNi_{0.6}Mn_{0.2}Co_{0.2}O_2$, $LiNi_{0.7}Mn_{0.15}Co_{0.15}O_2$, $LiNi_{0.8}Mn_{0.1}Co_{0.1}O_2$, $LiNi_{0.92}Mn_{0.04}Co_{0.04}O_2$, $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$, $LiNiO_2$, $LiMnO_2$, $LiMn_2O_4$, Li_2MnO_3, and combinations thereof; wherein $-0.2 \leq x \leq 0.2$, $0 \leq a < 1$, $0 \leq b < 1$, $0 \leq c < 1$, and $a+b+c \leq 1$.

7. The method of claim 1, wherein the cathode active material is selected from the group consisting of $LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$, $LiNi_{0.6}Mn_{0.2}Co_{0.2}O_2$, $LiNi_{0.7}Mn_{0.15}Co_{0.15}O_2$, $LiNi_{0.8}Mn_{0.1}Co_{0.1}O_2$, $LiNi_{0.92}Mn_{0.04}Co_{0.04}O_2$, $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$, $LiNiO_2$, $LiMnO_2$, $LiMn_2O_4$, Li_2MnO_3, and combinations thereof.

8. The method of claim 1, wherein the cathode active material comprises or is a core-shell composite having a core and shell structure, wherein the core and the shell each independently comprises a lithium transition metal oxide selected from the group consisting of $Li_{1+x}Ni_aMn_bCo_cAl_{(1-a-b-c)}O_2$, $LiCoO_2$, $LiNiO_2$, $LiMnO_2$, $LiMn_2O_4$, Li_2MnO_3, $LiCrO_2$, $Li_4Ti_5O_{12}$, LiV_2O_5, $LiTiS_2$, $LiMoS_2$, and combinations thereof; wherein $-0.2 \leq x \leq 0.2$, $0 \leq a < 1$, $0 \leq b < 1$, $0 \leq c < 1$, and $a+b+c \leq 1$.

9. The method of claim 1, wherein the second suspension is homogenized by a planetary stirring mixer, a stirring mixer, a blender, or an ultrasonicator.

10. The method of claim 1, wherein the homogenization is performed under vacuum at a pressure from about 0.5 kPa to about 10 kPa.

11. The method of claim 1, wherein the second suspension is homogenized for about 0.5 hour to about 6 hours.

12. The method of claim 1, wherein the second suspension is homogenized for a time

period of less than 3 hours, less than 2 hours, or less than 1 hour.

13. The method of claim 1, wherein the viscosity of the homogenized slurry is from about 1,000 mPa·s to about 6,000 mPa·s.

14. The method of claim 1, wherein the solid content of the homogenized slurry is from about 30% to about 60% by weight, based on the total weight of the homogenized slurry.

15. The method of claim 1, wherein the homogenized slurry is applied on the current collector using a doctor blade coater, a slot-die coater, a transfer coater, or a spray coater.

16. The method of claim 1, wherein the coated film is dried by a conveyor hot air drying oven, a conveyor resistance drying oven, a conveyor inductive drying oven, or a conveyor microwave drying oven.

17. The method of claim 1, wherein the total processing time for steps 3) – 6) is from about 2 hours to about 6 hours.

18. The method of claim 1, wherein the total processing time for steps 3) – 6) is less than 5 hours or less than 3 hours.