(owing to the greater void spaces afforded by the level of compaction). In view of the foregoing, the preferred approach is a combination of graphite and graphitized carbon or, in the alternative, acetylene black. In both instances, the ratio of graphite to graphitized carbon or acetylene black is greater than or equal to 55 wt.% of the total conductors present in the dry mix. However, as compaction drops to less than 60% solids packing, additional carbon may be required.

[0079] According to this approach, the resultant cathode coating will have a solids packing of at least 58%, at least 60% or at least 61%, while it will also have a solids packing of no more than 65%, no more than 64%, no more than 63% or no more than 62%. Likewise, the cathode dry mix will have at least 95 wt.%, at least 96 wt.% or about 97 wt.% of pyrite, while having no more than 3 wt.% or no more than 2 wt.% of conductors. The balance of the dry mix will be binders and processing aids, thus meaning that the mix has no more than 2 wt.%, no more than 1% or less than 1 wt.% of binders and processing aids. Stated differently, the ~~porosity~~ solids packing of the coating may be between 58% to 65% in formulations including acetylene black and between 58% and 70% in formulations including graphitized carbon, although in both cases narrower ranges may present additional benefits. The preferred formulation in either case includes 95 to 98 wt.% pyrite, 1 to 3 wt.% conductor and less than 2 wt.% of binders or other processing aids. The conductor should comprise either acetylene black or graphitized carbon or combinations thereof. If graphite is also included, the graphite should in all cases (i.e., irrespective of whether acetylene black or graphitized carbon or both are present) constitute less than 50 wt.% of the total amount of conductors, with amounts of less than 45 wt.% being preferred. Likewise, mechanically expandable graphite may be preferred over other types of graphite. The combination of each of these traits (solids packing, pyrite amount, conductor amount and binder amount) cooperatively contribute to the superior performance of the cathodes contemplated herein.

[0080] Additionally, it is preferred that the conductors comprise graphitized carbon. More preferably, the conductors comprise two distinct classes of conductors from the list identified above, with one of those two class being either acetylene black or graphitized carbon. Graphite may be mixed with the acetylene black or graphitized carbon, although less graphite should be used, on a weight percentage basis, than the graphitized carbon, the acetylene black or any combination of the two. That is, the weight percentage of the total amount of conductor should be greater than 55 wt.%, of acetylene black or graphitized carbon (or a combination of the two),

AMENDED CLAIMS
received by the International Bureau on 23 November 2010

What is claimed:

1. An electrochemical cell comprising:

a cylindrical housing;

a nonaqueous electrolyte including one or more organic solvents, wherein at least one of the organic solvents is an acyclic ether, a cyclic ether or sulfolane;

a spiral wound electrode assembly disposed within the housing;

wherein the spiral wound electrode assembly includes an anode consisting essentially of lithium or a lithium alloy and a cathode mix coated onto a foil current collector;

wherein the cathode mix comprises greater than 95.0 wt.% of pyrite, less than 2.0 wt.% of a binder and less than or equal to 3.0 wt.% of conductors; and

wherein the conductors include at least one selected from the group:

a) at least 50 wt.% of acetylene black when the coating is provided at a final solids packing percentage is between 58% and 63%; and

b) at least 50 wt.% of graphitized carbon.

2. The electrochemical cell according to claim 1, wherein the graphitized carbon comprises greater than 50 wt.% of the conductors and wherein the cathode mix is coated to a solids packing percentage between 58% and 65%.

3. The electrochemical cell according to claim 1, wherein the graphitized carbon comprises greater than 50 wt.% of the conductors and wherein the cathode mix is coated to a solids packing percentage between 58% and 70%.

4. The electrochemical cell according to claim 1, wherein the cathode mix consists essentially of 95.0-98.0 wt.% pyrite, 1.0-3.0 wt.% conductors and less than 2.0 wt.% of a binder and, optionally, processing aids.

5. The electrochemical cell according to claim 1, wherein the cathode mix comprises at least 96.0 wt.% of pyrite.

6. The electrochemical cell according to claim 1, wherein the solids packing percentage is less than 62%.

7. The electrochemical cell according to claim 1, wherein the cathode mix comprises less than 2.0 wt.% of conductors.

8. The electrochemical cell according to claim 1, wherein the conductor includes lactonic or phenolic functional groups.

9. The electrochemical cell according to claim 8, wherein the conductor includes functional groups at a concentration of less than about 50 μg of functional group/g of conductor.

10. The electrochemical cell according to claim 1, wherein the conductors include at least 55 wt.% of acetylene black and wherein the coating is provided at a final solids packing percentage less than or equal to 63%.

11. The electrochemical cell according to claim 1, wherein all of the conductors consist essentially of 100 wt.% of acetylene black and wherein the coating is provided at a final solids packing percentage less than or equal to 63%.

12. The electrochemical cell according to claim 1, wherein all of the conductors consist essentially of graphitized carbon.

13. The electrochemical cell according to claim 1, wherein the conductors further comprise graphite.

14. The electrochemical cell according to claim 13, wherein the graphite is mechanically expandable graphite.

What is claimed:

1. An electrochemical cell comprising:

a cylindrical housing;

a nonaqueous electrolyte including an organic solvent and a spiral wound electrode assembly disposed within the housing;

wherein the spiral wound electrode assembly includes an anode consisting essentially of lithium or a lithium alloy and a cathode mix coated onto a foil current collector at a final solids packing percentage of at least 58% and no more than 63%;

wherein the cathode mix comprises at least 95 wt. % of pyrite, less than 2 wt. % of a binder and less than or equal to 2 wt. % of conductors; and

wherein the conductors include graphite and at least 50 wt. % of acetylene black.

2. The electrochemical cell according to claim 1, wherein the graphite is mechanically expanded graphite.

3. The electrochemical cell according to claim 1, wherein the cathode mix consists essentially of 95-98 wt. % pyrite, 1-2 wt. % conductors and less than 2 wt. % of a binder and, optionally, processing aids.

4. The electrochemical cell according to claim 1, wherein the cathode mix comprises at least 96 wt. % of pyrite.

5. The electrochemical cell according to claim 1, wherein the solids packing percentage is at least 58% and no more than 60%.

6. The electrochemical cell according to claim 1, wherein the conductor includes lactonic or phenolic functional groups.

7. The electrochemical cell according to claim 1, wherein the conductor includes functional groups at a concentration of less than about 50 μg of functional group/g of conductor.

8. The electrochemical cell according to claim 1, wherein the conductors include at least 55 wt. % of acetylene black.

9. An electrochemical cell comprising:

a cylindrical housing;

a nonaqueous electrolyte including an organic solvent and a spiral wound electrode assembly disposed within the housing;

wherein the spiral wound electrode assembly includes an anode consisting essentially of lithium or a lithium alloy and a cathode mix coated onto a foil current collector at a final solids packing percentage of at least 58% and no more than 63%;

wherein the cathode mix comprises at least 95 wt. % of pyrite, less than 2 wt. % of a binder and less than or equal to 2 wt. % of conductors; and

wherein the conductors include graphitized carbon and graphite.

10. The electrochemical cell according to claim 9, wherein the graphitized carbon comprises at least 50 wt. % of the conductors.

11. The electrochemical cell according to claim 9, wherein the graphite is mechanically expanded graphite.

12. The electrochemical cell according to claim 9, wherein the cathode mix is coated to a solids packing percentage between at least 58% and no more than 60%.

13. The electrochemical cell according to claim 9, wherein the cathode mix comprises at least 96 wt. % of pyrite.

14. The electrochemical cell according to claim 9, wherein the conductor includes lactonic or phenolic functional groups.

15. The electrochemical cell according to claim 9, the conductor includes functional groups at a concentration of less than about 50 μg of functional group/g of conductor.

16. The electrochemical cell according to claim 9, wherein the cathode mix consists essentially of 95-98 wt. % pyrite, 1-2 wt. % conductors and less than 2 wt. % of a binder and, optionally, processing aids.