CLAIMS

What is claimed is:

1. A battery comprising

an anode;

a cathode; and

wherein at least one of the anode, and the cathode comprise a solid, ionically conducting, electrically insulative polymer material having an ionic conductivity greater than $1x10^{-4}$ S/cm at room temperature and having a crystallinity index of at least about 30%.

2. The battery of claim 1, wherein said battery is rechargeable.

3. The battery of claim 1, wherein said battery is primary.

4. The battery of claim 1, further comprising an electrolyte, wherein the electrolyte comprises the solid, ionically conducting polymer material.

5. The battery of claim 1, further comprising an electrolyte, wherein said electrolyte is alkaline.

6. The battery of claim 1, wherein the solid, ionically conducting polymer can conduct a plurality of OH- ions and has an OH- diffusivity of greater than 10^{-11} cm^2/sec at a temperature in a range of 20 °C to 26 °C.

7. The battery of claim 1, wherein the solid, ionically conducting polymer material is formed from a reactant product comprising a base polymer, an electron acceptor, and a compound including a source of ions.

8. The battery of claim 1, wherein the cathode comprises the solid, ionically conducting polymer material.

9. The battery of claim 1, wherein the anode comprises the solid, ionically conducting polymer material.

10. The battery of claim 1, wherein the cathode comprises an active material selected from the group comprising ferrate, iron oxide, cuprous oxide, iodate, cupric oxide, mercuric oxide, cobaltic oxide, manganese oxide, lead dioxide, silver oxide, oxygen, nickel oxyhydroxide, nickel dioxide, silver peroxide, permanganate, bromate, silver vanadium, carbon monofluoride, iron disulfide, iodine, vanadium oxide, copper sulfide, sulfur or carbon and combinations thereof.

11. The battery of claim 1, wherein the anode comprises an active material selected from the group comprising lithium, magnesium, aluminum, zinc, chromium, iron, nickel, tin, lead, hydrogen, copper, silver, palladium, mercury, platinum or gold, and combinations thereof.

12. The battery of claim 11, wherein said active material is alloyed.

13. The battery of claim 1, wherein the cathode comprises an active material selected from the group of manganese dioxide and oxygen and combinations thereof.

14. The battery of claim 1, wherein the anode comprises zinc.

15. The battery of claim 1, wherein the cathode comprises manganese dioxide, and wherein said anode comprises zinc.

16. The battery of claim 13, wherein the manganese dioxide has a form selected from the group consisting of a ß-MnO_2 (pyrolusite), a ramsdellite, a γ-MnO_2, a ε-MnO_2, a λ-MnO_2, , an electrolytic manganese dioxide (EMD), and a chemical manganese dioxide (CMD) and a combination of the proceeding forms.

17. The battery of claim 1, wherein at least one of the anode and cathode comprises particles of active material and wherein the solid, ionically conductive polymer material encapsulates at least one particle of the active material.

18. The battery of claim 1, wherein at least one of the anode and cathode comprises an electrically conductive additive.

19. The battery of claim 1, wherein at least one of the anode and the cathode comprises a functional additive.

20. The battery of claim 18, wherein the electrically conductive additive is selected from the group comprising a carbon black, a natural graphite, a synthetic graphite, a graphene, a conductive polymer, a metal particle, and a combination of at least two of the preceding components.

21. The battery of claim 19, wherein the functional additive is selected from the group comprising bismuth, ZnO, MgO, CaO, SnO_2, Na_2SnO_3, and $ZnSO_4$.

22. The battery of claim 1, wherein the cathode comprises the polymer material and is in a form of a composite structure which can be formed by a process selected from the group consisting of an injection molding process, a tube extrusion process and a compression molding process.

23. The battery of claim 1, wherein the anode comprises the polymer material and is in a form of a composite structure which can be formed by a process selected from the group consisting of an injection molding process, a tube extrusion process, and a compression molding process.

24. The battery of claim 13, wherein the cathode has a specific capacity greater than 400 mAh/g.

25. The battery of claim 13, wherein the cathode has a specific capacity of greater than 450 mAh/g.

26. The battery of claim 13, wherein the cathode has a specific capacity of greater than 500 mAh/g.

27. The battery of claim 7, wherein the base polymer is oxidatively doped in the presence of an ion source.

28. The battery of claim 7, wherein the ion source is a compound including at least one hydroxyl group or convertible to a compound containing at least one hydroxyl group.

29. The battery of claim 7 wherein the ion source is selected from the group consisting of a Li_2O, Na_2O, MgO, CaO, ZnO, LiOH, KOH, NaOH, $CaCl_2$, $AlCl_3$, $MgCl_2$, LiTFSI(lithium bis-trifluoromethanesulfonimide), LiBOB (Lithium bis(oxalate)borate) or a mixture of the preceding two components.

30. The battery of claim 7 wherein the base polymer is selected from the group comprising a liquid crystal polymer, a polyether ether ketone (PEEK), and a polyphenylene sulphide (PPS), or a semicrystalline polymer with a crystallinity index of greater than 30%, and combinations thereof.

31. The battery of claim 7 wherein the electron acceptor is selected from the group comprising 2,3, dicloro-5,6-dicyano-1,4-benzoquinone, TCNE, sulfur trioxide or chloranil and combinations thereof.