What is claimed as:

1. A battery, comprising:

a) an anode comprising an anode active material comprising sodium, lithium or an alloy or composite of at least one of sodium or lithium with at least one other metal for providing ions;

b) a cathode comprising a cathode active material comprising elemental sulfur, elemental selenium or a mixture of elemental chalcogens; and

c) an intermediate separator element positioned between the anode and cathode acting to separate liquid or gel electrolyte solutions in contact with the anode and cathode, through which metal ions and their counterions move between the anode and cathode during charge and discharge cycles of the battery;

wherein the cathode~~the liquid or gel electrolyte solutions~~ comprises ~~a nonaqueous polar aprotic solvent or polymer and a conductive salt and at least one of conditions (i), (ii) or (iii) are met:~~

~~(i) at least one of the liquid or gel electrolyte solutions additionally comprise~~ at least one organosulfur species;

~~(ii) the cathode is additionally comprised of at least one organosulfur species;~~

~~(iii) the intermediate separator element comprises a functionalized porous polymer containing at least one organosulfur species;~~

~~wherein the organosulfur species comprises~~ comprising at least one organic moiety and at least one $–S-S_n-$ linkage, n being an integer of 1 or more.

2. The battery of claim 1, wherein the organosulfur species is selected from the group consisting of organic polysulfides and organic polythiolates and mixtures thereof.

3. The battery of claim 1, wherein the organosulfur species contains one or more sulfur-containing functional groups selected from the group consisting of dithioacetal, dithioketal, trithio-orthocarbonate, thiosulfonate $[-S(O)_2-S-]$, thiosulfinate [-S(O)-S-], thiocarboxylate [-C(O)-S-], dithiocarboxylate [-C(S)-

~~10. The battery of claim 1, wherein the liquid or gel electrolyte solution is additionally comprised of a dimetal polythiolate species of formula M-S-S_n-M, wherein each M is independently Li, Na, quaternary ammonium, or quaternary phosphonium, and n is an integer of 1 or more.~~

~~11~~10. The battery of claim 1, wherein the cathode is additionally comprised of at least one electrically conductive additive and/or at least one binder.

~~12~~11. The battery of claim 1, wherein the organosulfur species is pendant to the backbone of the functionalized porous polymer.

~~13~~12. The battery of claim 1, wherein the organosulfur species is crosslinked into or forms part of the backbone of the functionalized porous polymer.

~~14~~13. The battery of claim 1, wherein the organic moiety contains at least two carbon atoms.

~~15. The battery of claim 1, wherein the intermediate porous separator separates the battery to provide an anolyte section associated with the anode and a catholyte section associated with the cathode and wherein the organosulfur species is present in at least one of the anolyte section or the catholyte section.~~

~~16. The battery of claim 1, wherein the non-aqueous polar aprotic solvent or polymer contains one or more functional groups selected from ether, carbonyl, ester, carbonate, amino, amido, sulfidyl [-S-], sulfinyl [-S(O)-], or sulfonyl [-SO_2-].~~

~~17. The battery of claim 1, wherein the conductive salt corresponds to formula MX wherein M is Li, Na or quaternary ammonium and X is $(CF_3SO_2)_2N$, CF_3SO_3, CH_3SO_3, ClO_4, PF_6, NO_3, AsF_6 or halogen.~~

~~18~~14. The battery of claim 1, wherein the organic moiety is oligomeric or polymeric and the organosulfur species comprises at least one –S-S- linkage that is pendant to the backbone of the oligomeric or polymeric organic moiety.

~~19~~15. The battery of claim 1, wherein the organic moiety is oligomeric or polymeric and the organosulfur species comprises at least one –S-S- linkage that in incorporated into the backbone of the oligomeric or polymeric organic moiety.

~~20. An electrolyte, comprising at least one nonaqueous polar aprotic solvent or polymer, at least one conductive salt, and at least one organosulfur species comprised of at least one organic moiety and at least one –S-S$_n$- linkage wherein n is an integer of 1 or more.~~

~~21~~16. A cathode comprising a) elemental sulfur, elemental selenium or a mixture of elemental chalcogens, b) at least one electrically conductive additive, c) and at least one organosulfur species comprising at least one organic moiety and at least one –S-S$_n$- linkage, n being an integer of 1 or more.

~~22~~17. The cathode of claim ~~21~~16, in combination with a current collector.

~~23~~18. The cathode of claim ~~21~~16, wherein the at least one electrode conductivity enhancing agent includes graphite, carbon nanotubes, carbon nanofibers, graphene, carbon black or soot.

~~24~~19. The cathode of claim ~~21~~16, additionally comprising at least one binder.