CLAIMS:

1. A nonaqueous electrolyte solution for a lithium battery, which solution comprises

i) a liquid electrolyte medium;

ii) a lithium-containing salt; and

iii) a flame retardant amount of A) tribromoethylene or tribromoneopentyl alcohol, wherein the flame retardant amount is more than 4 wt% relative to the total weight of the solution for tribromoethylene and wherein the flame retardant amount is more than 10 wt% relative to the total weight of the solution for tribromoneopentyl alcohol; or B) a flame retardant mixture of a) 1,2-dibromoethane and tribromoethylene in a weight ratio of about 0.75:1 to about 3:1, or b) tribromoethylene and 2-phenoxy-2,4,4,6,6-pentafluoro-1,3,5,2λ5,4λ5,6λ5triazatriphosphinine in a weight ratio of 0.75:1 to about 2.25:1.

2. A solution as in Claim 1 wherein iii) is tribromoethylene or tribromoneopentyl alcohol, and wherein the flame retardant amount is more than 15 wt% relative to the total weight of the solution.

3. A solution as in Claim 1 wherein iii) is a flame retardant mixture, and is

1,2-dibromoethane and tribromoethylene, wherein the flame retardant amount is about 6 wt% or more relative to the total weight of the solution; or

tribromoethylene and 2-phenoxy-2,4,4,6,6-pentafluoro-1,3,5,2λ5,4λ5,6λ5triazatriphosphinine, and wherein the flame retardant amount is about 4 wt% or more relative to the total weight of the solution.

4. A solution as in Claim 1 wherein the flame retardant mixture is 1,2-dibromoethane and tribromoethylene, and wherein the flame retardant amount is about 20 wt% or more relative to the total weight of the solution.

5. A solution as in Claim 1 which also comprises 2-phenoxy-2,4,4,6,6-pentafluoro-1,3,5,2λ5,4λ5,6λ5triazatriphosphinine, wherein the brominated flame retardant is tribromoethylene, wherein the weight ratio of tribromoethylene to 2-phenoxy-2,4,4,6,6-pentafluoro-1,3,5,2λ5,4λ5,6λ5triazatriphosphinine is about 0.75:1 to about 2:1, and the flame

retardant amount is about 4 wt% or more flame retardant molecules relative to the total weight of the nonaqueous electrolyte solution.

6. A solution as in any of Claims 1 or 2-5 wherein the liquid electrolyte medium is ethylene carbonate, ethyl methyl carbonate, or a mixture thereof, and/or wherein the lithium-containing salt is lithium hexafluorophosphate or lithium bis(oxalato)borate.

7. A solution as in Claim 1 wherein iii) is tribromoethylene or tribromoneopentyl alcohol, and wherein the solution also comprises

iv) at least one electrochemical additive selected from:

a) unsaturated cyclic carbonates containing three to about six carbon atoms,
b) fluorine-containing saturated cyclic carbonates containing three to about five carbon atoms and one to about four fluorine atoms,
c) tris(trihydrocarbylsilyl) phosphites containing three to about nine carbon atoms,
d) trihydrocarbyl phosphates containing three to about twelve carbon atoms,
e) cyclic sultones containing three to about eight carbon atoms,
f) saturated cyclic hydrocarbyl sulfites having a 5-membered or 6-membered ring and containing two to about six carbon atoms,
g) saturated cyclic hydrocarbyl sulfates having a 5-membered or 6-membered ring and containing two to about six carbon atoms,
h) cyclic dioxadithio polyoxide compounds having a 6-membered, 7-membered, or 8-membered ring and containing two to about six carbon atoms,
i) another lithium-containing salt, and
j) mixtures of any two or more of the foregoing.

8. A solution as in Claim 7 wherein the electrochemical additive is selected from:

a) unsaturated cyclic carbonates containing three to about four carbon atoms,
b) fluorine-containing saturated cyclic carbonates containing three to about four carbon atoms and one to about two fluorine atoms,
c) tris(trihydrocarbylsilyl) phosphites containing three to about six carbon atoms,
d) trihydrocarbyl phosphates containing three to about nine carbon atoms,
e) cyclic sultones containing three to about four carbon atoms,

f) saturated cyclic hydrocarbyl sulfites having a 5-membered ring and containing two to about four carbon atoms,
g) saturated cyclic hydrocarbyl sulfates having a 5-membered ring and containing two to about four carbon atoms,
h) cyclic dioxadithio polyoxide compounds having a 6-membered or 7-membered ring and containing two to about four carbon atoms,
i) another lithium-containing salt, and
j) mixtures of any two or more of the foregoing.

9. A solution as in Claim 7 or 8 wherein the electrochemical additive is selected from:
a) an unsaturated cyclic carbonate in an amount of about 0.5 wt% to about 12 wt%, relative to the total weight of the nonaqueous electrolyte solution,
b) a fluorine-containing saturated cyclic carbonate in an amount of about 0.5 wt% to about 15 wt%, relative to the total weight of the nonaqueous electrolyte solution,
c) a tris(trihydrocarbylsilyl) phosphite in an amount of about 0.1 wt% to about 5 wt%, relative to the total weight of the nonaqueous electrolyte solution,
d) a trihydrocarbyl phosphate in an amount of about 0.5 wt% to about 5 wt%, relative to the total weight of the nonaqueous electrolyte solution,
e) a cyclic sultone in an amount of about 0.25 wt% to about 5 wt%, relative to the total weight of the nonaqueous electrolyte solution,
f) a saturated cyclic hydrocarbyl sulfite in an amount of about 0.5 wt% to about 5 wt%, relative to the total weight of the nonaqueous electrolyte solution,
g) a saturated cyclic hydrocarbyl sulfate in an amount of about 0.25 wt% to about 5 wt%, relative to the total weight of the nonaqueous electrolyte solution,
h) a cyclic dioxadithio polyoxide compound in an amount of about 0.5 wt% to about 5 wt%, relative to the total weight of the nonaqueous electrolyte solution,
i) another lithium-containing salt in an amount of about 0.5 wt% to about 5 wt%, relative to the total weight of the nonaqueous electrolyte solution, and
j) mixtures of any two or more of the foregoing.

10. A solution as in any of Claims 7-9 wherein the electrochemical additive is a saturated cyclic hydrocarbyl sulfate, a cyclic sultone, a tris(trihydrocarbylsilyl) phosphite, or another lithium-containing salt.

11. A solution as in Claim 7 wherein the electrochemical additive is a saturated cyclic hydrocarbyl sulfate in an amount of about 1 wt% to about 4 wt%, a cyclic sultone in an amount of about 0.5 wt% to about 4 wt%, a tris(trihydrocarbylsilyl) phosphite in an amount of about 0.2 wt% to about 3 wt%, or another lithium-containing salt in an amount of about 1 wt% to about 4 wt%, each relative to the total weight of the nonaqueous electrolyte solution.

12. A solution as in Claim 7 or 11 wherein the electrochemical additive is vinylene carbonate, 1,3,2-dioxathiolane 2,2-dioxide, 1,3-propene sultone, 1,3-propane sultone, tris(trimethylsilyl)phosphite, or lithium bis(oxalato)borate.

13. A solution as in Claim 11 or 12 wherein each electrochemical additive is not used with other electrochemical additives.

14. A solution as in any of Claims 7-9 wherein the electrochemical additive is selected from vinylene carbonate, 4-fluoro-ethylene carbonate, tris(trimethylsilyl)phosphite, triallyl phosphate, 1-propane-1,3-sultone, 1-propene-1,3-sultone, 1,3,2-dioxathiolane 2-oxide, 1,3,2-dioxathiolane 2,2-dioxide, 1,5,2,4-dioxadithiane 2,2,4,4-tetroxide, lithium bis(oxalato)borate, and mixtures of any two or more of these.

15. A solution as in Claim 14 wherein the electrochemical additive is selected from:

vinylene carbonate in an amount of about 0.5 wt% to about 3 wt%, relative to the total weight of the nonaqueous electrolyte solution;

vinylene carbonate in an amount of about 8 wt% to about 11 wt%, relative to the total weight of the nonaqueous electrolyte solution;

4-fluoro-ethylene carbonate in an amount of about 0.5 wt% to about 15 wt%, relative to the total weight of the nonaqueous electrolyte solution;

tris(trimethylsilyl)phosphite in an amount of about 0.2 wt% to about 3 wt%, relative to the total weight of the nonaqueous electrolyte solution;

triallyl phosphate in an amount of about 1 wt% to about 5 wt%, relative to the total weight of the nonaqueous electrolyte solution;

1,3-propane sultone or 1,3-propene sultone in an amount of about 0.5 wt% to about 4 wt%, relative to the total weight of the nonaqueous electrolyte solution;

1,3,2-dioxathiolane 2-oxide in an amount of about 1 wt% to about 4 wt%, relative to the total weight of the nonaqueous electrolyte solution;

1,3,2-dioxathiolane 2,2-dioxide in an amount of about 1 wt% to about 4 wt%, relative to the total weight of the nonaqueous electrolyte solution;

1,5,2,4-dioxadithiane 2,2,4,4-tetroxide in an amount of about 1 wt% to about 4 wt%, relative to the total weight of the nonaqueous electrolyte solution;

lithium bis(oxalato)borate in an amount of about 1 wt% to about 4 wt%, relative to the total weight of the nonaqueous electrolyte solution; and

mixtures of any two or more of these.

16. A solution as in Claim 14 or 15 wherein the electrochemical additive is selected from vinylene carbonate, 1-propane-1,3-sultone, 1-propene-1,3-sultone, 1,3,2-dioxathiolane 2,2-dioxide, tris(trimethylsilyl)phosphite, and lithium bis(oxalato)borate.

17. A solution as in Claim 14 wherein the electrochemical additive selected from 1-propane-1,3-sultone in an amount of about 0.5 wt% to about 4 wt%, 1-propene-1,3-sultone in an amount of about 0.5 wt% to about 4 wt%, 1,3,2-dioxathiolane 2,2-dioxide, in an amount of about 1 wt% to about 4 wt%, and lithium bis(oxalato)borate in an amount of about 1 wt% to about 4 wt%, each relative to the total weight of the nonaqueous electrolyte solution.

18. A solution as in Claim 16 or 17 wherein each electrochemical additive is not used with other electrochemical additives.

19. A nonaqueous lithium battery comprising a positive electrode, a negative electrode, and the nonaqueous electrolyte solution as in any of Claims 1 or 2-18.

20. A process for producing a nonaqueous electrolyte solution for a lithium battery, which process comprises combining components comprising:

i) a liquid electrolyte medium;

ii) a lithium-containing salt; and

iii) a flame retardant amount of A) tribromoethylene or tribromoneopentyl alcohol, wherein the flame retardant amount is more than 4 wt% relative to the total weight of the solution for tribromoethylene and wherein the flame retardant amount is more than 10 wt% relative to the total weight of the solution for tribromoneopentyl alcohol; or B) a flame retardant mixture of a) 1,2-dibromoethane and tribromoethylene in a weight ratio of about 0.75:1 to about 3:1, or b) tribromoethylene and 2-phenoxy-2,4,4,6,6-pentafluoro-1,3,5,2λ5,4λ5,6λ5triazatriphosphinine in a weight ratio of 0.75:1 to about 2.25:1.

21. A process as in Claim 20 wherein iii) is tribromoethylene or tribromoneopentyl alcohol, and the components also comprise

iv) at least one electrochemical additive selected from:

a) unsaturated cyclic carbonates containing three to about six carbon atoms,

b) fluorine-containing saturated cyclic carbonates containing three to about five carbon atoms and one to about four fluorine atoms,

c) tris(trihydrocarbylsilyl) phosphites containing three to about nine carbon atoms,

d) trihydrocarbyl phosphates containing three to about twelve carbon atoms,

e) cyclic sultones containing three to about eight carbon atoms,

f) saturated cyclic hydrocarbyl sulfites having a 5-membered or 6-membered ring and containing two to about six carbon atoms,

g) saturated cyclic hydrocarbyl sulfates having a 5-membered or 6-membered ring and containing two to about six carbon atoms,

h) cyclic dioxadithio polyoxide compounds having a 6-membered, 7-membered, or 8-membered ring and containing two to about six carbon atoms,

i) another lithium-containing salt, and

j) mixtures of any two or more of the foregoing.

22. A process as in Claim 21 wherein the electrochemical additive is selected from vinylene carbonate, 4-fluoro-ethylene carbonate, tris(trimethylsilyl)phosphite, triallyl phosphate, 1-propane-1,3-sultone, 1-propene-1,3-sultone, 1,3,2-dioxathiolane 2-oxide, 1,3,2-dioxathiolane 2,2-dioxide, 1,5,2,4-dioxadithiane 2,2,4,4-tetroxide, lithium bis(oxalato)borate, and mixtures of any two or more of these.

23. A process as in Claim 20 wherein iii) is tribromoethylene or tribromoneopentyl alcohol, and wherein the flame retardant amount is more than 15 wt% relative to the total weight of the solution.

24. A process as in Claim 20 wherein iii) is a flame retardant mixture, and is

1,2-dibromoethane and tribromoethylene, wherein the flame retardant amount is about 6 wt% or more relative to the total weight of the solution; or

tribromoethylene and 2-phenoxy-2,4,4,6,6-pentafluoro-1,3,5,2λ5,4λ5,6λ5triazatriphosphinine, and wherein the flame retardant amount is about 4 wt% or more relative to the total weight of the solution.

25. A process as in Claim 20 wherein the flame retardant mixture is 1,2-dibromoethane and tribromoethylene, and wherein the flame retardant amount is about 20 wt% or more relative to the total weight of the solution.

26. A process as in Claim 20 or 21 wherein the liquid electrolyte medium is ethylene carbonate, ethyl methyl carbonate, or a mixture thereof, and/or wherein the lithium-containing salt is lithium hexafluorophosphate or lithium bis(oxalato)borate.