CLAIMS

1. A system for the regeneration of spent electrolyte from an electrochemical process comprising oxidation of aluminum, the spent electrolyte comprising aqueous alkaline solution comprising dissolved hydroxide ions of aluminum, said system comprises:
    - at least one reservoir;
    - solid-liquid separation means;
    - concentration means;
    - agitation means;
    - inlet for solid and liquid reagent addition;

    wherein said system consumes said aqueous alkaline solution; and

    wherein said system produces a regenerated aqueous alkaline solution, comprising reduced amount of dissolved hydroxide ions of aluminum or wherein said system produces a regenerated aqueous alkaline solution free of dissolved hydroxide ions of aluminum, and

    wherein the system further produces aluminum-containing solid products, and wherein said aluminum-containing solid products comprise layered double hydroxide LDH.
2. The system of claim 1, wherein said dissolved hydroxide ions of aluminum are aluminate $[Al(OH)_4^-]$ ions.
3. The system of claim 2, wherein said aluminum-containing solid products comprise LDH and optionally aluminum tri-hydroxide ATH.
4. The system of claim 1, further comprising temperature control means; distillation and reflux means; membrane separation means or a combination thereof.
5. The system of claim 1, wherein said system is located on-board a vehicle.
6. The system of claim 1, wherein said system is off-board a vehicle.
7. A method for the regeneration of spent electrolyte from an electrochemical process comprising oxidation of aluminum, the spent electrolyte comprising aqueous alkaline solution comprising dissolved hydroxide ions of aluminum, said method comprising:

- providing a system comprising:
  - at least one reservoir;
  - solid-liquid separation means;
  - concentration means;
  - agitation means;
  - inlet for solid and liquid reagent addition;
- introducing, aqueous alkaline solution comprising dissolved hydroxide ions of aluminum into said system;
- producing and separating aluminum-containing solid products comprising, LDH and optionally comprising solid aluminum hydroxides from said solution and reducing the amount of dissolved hydroxide ions of aluminum in said solution, thus producing a regenerated aqueous alkaline solution, comprising reduced amount of dissolved hydroxide ions of aluminum or free of dissolved hydroxide ions of aluminum,

wherein said producing and separating LDH from said solution comprises:

- adding metal B ions to said solution in said reservoir to induce precipitation of LDH;
- separating said LDH from said solution; and
- optionally drying said LDH.

8. The method of claim 7, wherein said hydroxide ions of aluminum is aluminate $[Al(OH)_4^-]$ and said solid aluminum hydroxides is ATH $[Al(OH)_3]$.
9. The method of claim 7, wherein said producing solid aluminum hydroxides from said solution comprises separating, or precipitating and separating, said solid aluminum hydroxides from said solution.
10. The method of claim 9, wherein said precipitating said solid aluminum hydroxides is done using an electrolysis process, a dialysis process, a hydrolysis process, osmosis, phoresis or a combination thereof.
11. The method of claim 10, wherein said hydrolysis process comprises adding water to said solution, thus causing precipitation of solid aluminum hydroxides.
12. The method of claim 7, wherein said producing solid aluminum hydroxides involves the removal of dissolved hydroxide ions of aluminum from said solution

by decomposition of said dissolved hydroxide ions of aluminum to solid aluminum hydroxides and to free alkali hydroxides.

13. The method of claim 7, wherein, prior to said addition of metal B ions said solution undergoes re-digestion, wherein said re-digestion comprises heating and agitating said solution to re-dissolve aluminum solid hydroxide precipitate.
14. A method for the regeneration of spent electrolyte from an electrochemical process comprising oxidation of aluminum, the spent electrolyte comprising aqueous alkaline solution comprising dissolved hydroxide ions of aluminum and metal B ions, said method comprising precipitating LDH from said aqueous alkaline solution, wherein the source of said aqueous alkaline solution comprising hydroxide ions of aluminum, and metal B ions, is a metal alloy comprising aluminum and metal B.
15. The method of claim 14, wherein said precipitation occurs spontaneously.
16. The method of claim 14, wherein during said electrochemical process, aluminum and metal B are dissolved in an alkaline solution such that said aluminum forms aluminum ions and said metal B forms metal B ions, thus forming said alkaline solution comprising dissolved hydroxide ions of aluminum and metal B ions.
17. The method of claim 7, wherein said metal B ion is selected from a group consisting of Ca, Mg, Ba, Sr and compounds of thereof.
18. The method of claim 14, wherein said electrochemical process is the operation of a metal-air battery.
19. The method of claim 18, wherein said metal-air battery comprises a cathode, an anode and an electrolyte solution, wherein said anode comprising said metal alloy comprising aluminum and metal B.
20. The method of claim 7, wherein said metal B ions comprise Mg^{2+} ions.
21. The method of claim 7, wherein said solution further comprises NaOH, KOH, NH_4OH, LiOH or organic base hydroxides.
22. The method of claim 21, wherein the concentration of said KOH or NaOH solution varies between 20 and 45 wt%.
23. The method of claim 7, wherein said method further comprises filtration, centrifugation, solids cake compression, washing, decanting, dewatering, drying, solvent evaporation, or a combination thereof.

24. The method of claim 14, wherein said LDH comprises meixnerite, hydrotalcite (HTC), or a combination thereof.
25. A system for production of energy, said system comprises an energy production unit and the system of claim 1, wherein said energy production unit comprises a cathode, an anode and an electrolyte solution, wherein said anode comprising a metal or a metal alloy and wherein said alloy comprises aluminum and metal B.
26. The system of claim 25, wherein said energy production unit and said system comprise inlets and outlets for introduction and transfer of materials to and from said units.
27. The system of claim 25, wherein said energy production unit is a hydrogen generator or an aluminum-air battery.
28. The system of claim 27, wherein said energy production unit utilizes oxygen from said air.
29. The system of claim 25, wherein during operation energy is produced by said energy production unit while solid LDH is produced in said system and optionally in said energy production unit.
30. The method of claim 14, wherein said metal B ion is selected from a group consisting of Ca, Mg, Ba, Sr and compounds of thereof.
31. The method of claim 14, wherein said metal B ions comprise Mg^{2+} ions.
32. The method of claim 14, wherein said solution further comprises NaOH, KOH, NH_4OH, LiOH or organic base hydroxides.
33. The method of claim 14, wherein said method further comprises filtration, centrifugation, solid cake compression, washing, decanting, dewatering, drying, solvent evaporation, or a combination thereof.
34. The method of claim 14, wherein said LDH comprises Al.
35. The method of claim 7, wherein said LDH comprises meixnerite, hydrotalcite (HTC), or a combination thereof.
36. The method of claim 21, wherein said organic base hydroxides is a choline base.
37. The method of claim 32, wherein said organic base hydroxides is a choline base.