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LEAD ACID**5840262****PROCESS FOR THE MANUFACTURE OF PURE LEAD OXIDE FROM EXHAUSTED BATTERIES**

Margulis Efim Haifa, ISRAEL assigned to Margulead Ltd

The present invention relates to an improved process for producing lead oxide in a pure state from a spent paste resulting from exhausted acid batteries. The spent paste is first calcined and desulfurized, then leached by a concentrated solution comprising an alkali hydroxide at a temperature above 100°C The separated solution is contacted with a ketone resulting in a suspension from which the alpha-lead oxide constituent is recovered. The solutions of alkali and ketone are recycled in the process. The preferred alkali constituents are selected from sodium hydroxide or potassium hydroxide, preferably containing also a small amount of sulfate of the respective alkali metal of the hydroxide used.

5851695**RECOMBINANT LEAD-ACID CELL AND LONG LIFE BATTERY**

Misra Sudhan S; Wagner Franz North Wales, PA, UNITED STATES assigned to C & D Technologies Inc

A lead-acid cell includes a case, positive and negative plates within the case, microporous separator material between adjacent plates and electrolyte in a starved amount, with the case having jar and covers joined by a weldment along overlapping cover and jars. The positive plates include a grid frame with an intermediate member extending between spaced apart generally peripheral portions of the frame, with pasted active material on the grid frame separated substantially into two portions by the intermediate member. Compressive force is adjustably continuously applied to the positive and negative plates within the case. The plates are suspended within the case at positions removed from the wall of the case, while plate growth is permitted in a manner that plate shorting is avoided.

FUEL CELL**5840437****APPARATUS WITH FUEL CELLS**

Diethelm Rolan Bauma, SWITZERLAND assigned to Sulzer Innotec AG

The apparatus comprises a cell block with fuel cells, a heat insulating sleeve and an afterburner chamber between the sleeve and the cell block. The afterburner chamber is connected at two opposite ends via channels to at least one exhaust outlet for exhaust gases. These channels are each closeable by a blocking member, with the combustion chamber of the auxiliary burner communicating with the channel between the afterburner chamber and one of the blocking members. This blocking member is closed during a starting-up phase, while the other blocking member is open.

5840438**ELECTROCHEMICAL FUEL CELL WITH AN ELECTRODE SUBSTRATE HAVING AN IN-PLANE NONUNIFORM STRUCTURE FOR CONTROL OF REACTANT AND PRODUCT TRANSPORT**

Johnson Mark; Wilkinson David P; Asman Charles; Bos Myles; Potter Robert Phoenix, AZ, UNITED STATES assigned to Ballard Power Systems Inc

In an electrochemical fuel cell, an electrode substrate has an in-plane nonuniform structure. The electrode substrate having an in-plane nonuniform structure enables controlled transport of reactant toward the electrocatalyst layer and controlled transport of reaction product away from the electrocatalyst layer.

5846668**FUEL CELL, ELECTROLYTIC CELL AND PROCESS OF COOLING AND/OR DEHUMIDIFYING SAME**

Watanabe Masahiro Wadamachi, Kofu shi, Yamanashi, JAPAN assigned to Tanaka Kikinzoku Kogyo K K; Watanabe Masahiro

Disclosed herein are an fuel cell and/or an electrolytic cell which comprises a plurality of unit cells, and one or more separator plates having one or more anode gas supply grooves and one or more cathode gas supply

grooves inserted between two adjacent unit cells, at least part of the anode gas supply grooves and the cathode gas supply grooves being overlapped in the direction of the width of the separator plate, and a process of cooling and/or dehumidifying the fuel cell and/or the electrolytic cell by flowing a reaction gas thereto. The most preferable separator plate is such that the anode gas supply grooves and the cathode gas supply grooves are separated by a thin separator wall made of a metal or an electroconductive resin.

5846669

HYBRID ELECTROLYTE SYSTEM

Smotkin Eugene S; Mallouk Thomas E; Ward Michael; Ley Kevin L Chicago, IL, UNITED STATES assigned to Illinois Institute of Technology

A hybrid electrolyte system for fuel cells and other electrochemical reactors comprising an acid electrolyte, a base electrolyte, and a proton permeable dense phase separating the acid electrolyte from the base electrolyte.

5849428

MEMBRANE FOR HYDROGEN AND METHANOL FUEL CELL

Hamlen Robert Bernardsville, NJ, UNITED STATES assigned to The United States of America as represented by the Secretary of the Army

The migration of water and methanol across the hydrophilic membrane of hydrogen and methanol fuel cells from the anode to the cathode compartment decreases the electric energy output of such fuel cells. This migration is minimized by the precipitation in the pores of the membrane of zirconyl phosphate. A method and an apparatus for precipitating zirconyl phosphate in the pores of membranes for hydrogen and methanol fuel cells are provided.

5851689

METHOD FOR OPERATING A FUEL CELL ASSEMBLY

Chen Tan-Ping Walnut Creek, CA, UNITED STATES assigned to Bechtel Corporation

A fuel cell assembly includes a vessel containing a gas-permeable, porous housing. A fuel cell stack, including cells and interconnect plates, is contained

within the porous housing. Each interconnect plate has oxidant and fuel sides adjacent to the cathode and anode of adjacent cells. Fuel is supplied to the fuel side at positions midway between the center and the periphery of the fuel side. Reaction products are withdrawn from the center of the fuel side. Flue gas is withdrawn from the center of the oxidant side. Air is preheated as it passes through the porous housing to the fuel cell stack. The preheated air combusts residual fuel flowing radially outwardly from the periphery of the stack to further heat the air to the stack operating temperature to eliminate any external preheating of the air. Corrugations on the interconnect plates act as flow deflectors and form the electrical contact surfaces for adjacent cells. The fuel cell stack is preferably oriented horizontally and is allowed to thermally expand and contract in a substantially free manner, to minimize damage to the cells, until the fuel cell stack is close to an operating temperature.

BATTERY MATERIALS

5840087

METHOD FOR MAKING LAMINATED RECHARGEABLE BATTERY CELLS

Gozdz Antoni S; Warren Paul C Tinton Falls, NJ, UNITED STATES assigned to Bell Communications Research Inc

Formation of a unitary laminate rechargeable battery comprising electrode and separator/electrolyte elements of polymer composition utilizes apparatus comprising compression rollers of sufficient hardness to resist deformation during laminating contact with such elements. Maximum progressive compression short of lateral deformation of battery elements ensures expulsion of interfacial entrapments and optimum functional contact between laminate elements. Battery structures fabricated with the apparatus may comprise active particulate component ratios in excess of about 75% by weight.

5840443

REDOX POLYMER ELECTRODES FOR ADVANCED BATTERIES

Gregg Brian A; Taylor A Michael Golden, CO, UNITED STATES assigned to Midwest Research Institute

Advanced batteries having a long cycle lifetime are provided. More specifically, the present invention relates to electrodes made from redox polymer films and batteries in which either the positive electrode, the negative electrode, or both, comprise redox polymers. Suitable redox polymers for this purpose include pyridyl or polypyridyl complexes of transition metals like iron, ruthenium, osmium, chromium, tungsten and nickel; porphyrins (either free base or metallo derivatives); phthalocyanines (either free base or metallo derivatives); metal complexes of cyclams, such as tetraazacyclotetradecane; metal complexes of crown ethers and metallocenes such as ferrocene, cobaltocene and ruthenocene.

5840444

**ELECTRODE FOR STORAGE BATTERY
AND PROCESS FOR PRODUCING THE
SAME**

Takehima Hiroki; Hattori Yohei; Okamoto Katsuhiro; Tsuji Masato; Takayanagi Takeo Fujisawa, JAPAN assigned to Matsushita Electric Industrial Company Ltd

The present invention provides an electrode for batteries, especially a pasted electrode, and a process for producing the same which is improved in the adhesiveness between the active material and the electrode core material, utilization of the active material, discharge characteristics and in the charge and discharge cycling life. The resultant electroconductive core material comprises a perforated or non-perforated metal sheet such as punched metal sheet having sintered hollow nickel members separately or entangled fixed on the surfaces thereof. The hollow of the sintered nickel members is formed due to the thermal decomposition and evaporation of the resin fibers which have been applied to the electroconductive core material.

5843393

**CARBON ELECTRODE MATERIAL FOR
ELECTROCHEMICAL CELLS AND
METHOD OF MAKING SAME**

Denton Frank R; Deng Guoping Lawrenceville, GA, UNITED STATES assigned to Motorola Inc

A method of fabricating an amorphous carbon material for use as an electrode in a rechargeable electrochemical cell includes the steps of heating a lignin material until it has fully cured, comminuting the lignin material

before it has carbonized, and subsequently heating the lignin material until it has carbonized.

5846670

**GAS DIFFUSION ELECTRODE FOR
ELECTROCHEMICAL CELL AND
PROCESS OF PREPARING SAME**

Watanabe Masahiro; Tsurumi Kazunori; Hara Noriaki Kofu shi, Yamanashi, JAPAN assigned to Tanaka Kikinzoku Kogyo K K; Watanabe Masahiro

Disclosed are a gas diffusion electrode for an electrochemical cell which comprises a catalyst layer formed by binding, by means of polytetrafluoroethylene, catalyst-supporting carbon black and catalyst-non-supporting carbon black having a fluorinated polyolefine film on substantially whole surface, the catalyst layer being integrated on a substrate, and a process of preparing same. Since the carbon black employed for the formation of the gas network in the catalyst layer of the gas diffusion electrode having the above constitution in accordance with the present invention is completely hydrophobically treated, no electrolyte permeates this portion and the carbon black exhibits high hydrophobicity so that the wet-proofing is maintained even after the long operation period to enable the gas supply to the catalyst particles so as to provide the gas diffusion electrode with a long life and high electrode performances.

5846674

**ELECTRODE FOR RECHARGEABLE
BATTERY WITH NONAQUEOUS
ELECTROLYTE AND PROCESS FOR
PRODUCING THE SAME**

Sakai Shigeru; Mangahara Toru; Umeda Kazuo; Oguchi Kiyoshi; Tsuchiya Mitsuru Iwaki, JAPAN assigned to Furukawa Denchi Kabushiki Kaisha; Dai Nippon Printing Company Ltd

An electrode for a rechargeable battery with a nonaqueous electrolyte is provided wherein the active material layer has a sufficient flexibility, the adhesion between the active material coating and the metal foil collector is good, none of peeling, falling, cracking and other unfavorable phenomena occur in the active material coating in the step of assembling a battery and excellent discharge characteristics can be developed. The electrode for a rechargeable battery with a

nonaqueous electrolyte comprises a metal foil collector and, formed on at least a part of the metal foil collector, an active material layer comprising an active material and a cured reaction-curing binder as essential components.

5848351

POROUS METALLIC MATERIAL HAVING HIGH SPECIFIC SURFACE AREA, METHOD OF PRODUCING THE SAME, POROUS METALLIC PLATE MATERIAL AND ELECTRODE FOR ALKALINE SECONDARY BATTERY

Hoshino Kouji; Mayuzumi Yoshitaka; Kohno Tohru; Komada Norikazu Omiya, JAPAN assigned to Mitsubishi Materials Corporation

PCT No. PCT/JP96/00911 Sec. 371 Date Mar. 10, 1997 Sec. 102(e) Date Mar. 10, 1997 PCT Filed Apr. 2, 1996 PCT Pub. No. WO96/31306 PCT Pub. Date Oct. 10, 1996. The porous metallic material of the present invention has an overall porosity of 80 to 99%, and a skeleton in a three dimensional network structure which is entirely composed of a sintered metal powder having a porosity of 10 to 60%. The specific surface area is very high, for example, 300 to 11000 cm²/cm³. The porous metallic material can be reinforced by a reinforcing plate. The porous metallic material is also suitable for an electrode of an alkaline secondary battery and enables achievement of increases in the life and the amount of the active material contained therein. The porous metallic material can be produced by preparing a foamable slurry containing a metal powder, forming the foamable slurry, drying the formed product, preferably after foaming, and finally burning the dry formed product.

5849045

METHOD FOR PREPARING AND USING ELECTROCONDUCTIVE POLYMER COMPOSITES AS POSITIVE ELECTRODE ACTIVE MATERIALS TO PREPARE SECONDARY BATTERIES

Chen Show-A; Lin Liang-Chang Hsinchu, CHINA (TAIWAN) assigned to National Science Council

An electroconductive polymer composite for use in secondary batteries as positive electrode active materials

is disclosed. It includes 10-99 weight percent of a conjugated electroconductive polymer, such as polyaniline, and 90-1 weight percent of polymeric electrolyte. The latter is composed of 10-90 weight percent of an ionic salt, such as LiClO₄, and 90-10 weight percent of a polymer which can form an electrolyte material with the ionic salt. The polymer, for example, can be polyvinyl alcohol or polyalkylene oxide. A method of using the electroconductive polymer composite to prepare the positive electrode of secondary batteries is also disclosed. It includes the steps of dissolving the above three components in an appropriate solvent (such as 1-methyl-2-pyrrolidinone), casting the resulting solution on an appropriate metallic grid or plate (such as nickel, aluminum or platinum) and removing the solvent therein to form a film which adheres to the metal grid or plate, in which the film is a positive electrode active material and the metallic grid or plate is a current collector. This invention also discloses a non-aqueous secondary battery which uses such positive electrode.

5849433

POLYMER BLEND ELECTROLYTE SYSTEM AND ELECTROCHEMICAL CELL USING SAME

Venugopal Ganesh; Anani Anaba A; Moore Joh; Thomas Simo Duluth, GA, UNITED STATES assigned to Motorola Inc

An electrochemical cell includes first and second electrodes with an electrolyte system disposed therebetween. The electrolyte system is fabricated of a blend of differing grades of a single polymer. One grade may be provided to, for example, absorb an electrolyte active species, while the second grade may be provided to enhance mechanical integrity of the system.

5851504

CARBON BASED ELECTRODES

Barker Jeremy; Olsen Ib I Henderson, NV, UNITED STATES assigned to Valence Technology Inc

Provided by the present invention is a new anode material comprised of a carbon obtained by pyrolyzing a polymer of a conjugated vinyl monomer. The carbon is suitable for a lithium intercalated anode as it offers potential advantages of high capacity. The economics of manufacturing such anodes are also beneficial.

5851599**BATTERY ELECTRODE SUBSTRATE
AND PROCESS FOR PRODUCING THE
SAME**

Harada Keiz; Watanabe Kenichi; Yamanaka Shosaku; Hayashi Kiyoshi; Morishita Nobuyasu; Takeshima Hiroki; Kaiya Hideo; Ikoma Munehisa Itami, JAPAN assigned to Sumitomo Electric Industries Co Ltd; Matsushita Electric Industrial Company Ltd

A battery electrode substrate which is constituted of a porous metallic body structure having communicating pores at a porosity of at least 90% and an Fe/Ni multilayer structure wherein the skeletal portion of the porous metallic body is composed mainly of Fe and has an Ni covering layer on the surface thereof while pores communicating with the inside and outside of Fe skeletal portion exist in the Fe skeletal portion and the inside of the pores is covered with Ni. The electrode substrate is produced by applying an iron oxide powder of at most 20 μm in an average particle size on a porous resin core body; heat treating the core to remove an organic resin component while simultaneously sintering Fe to obtain a porous Fe body; and then covering the Fe skeletal portion with Ni by electroplating. In this process, the iron oxide can be used in combination with carbon powder. Further, a nickel porous sintered body can also be produced using nickel oxide in place of iron oxide.

LITHIUM BATTERIES**5840371****TREATMENT FOR IMPROVED
CONDUCTIVITY OF
COLLECTOR-ELECTRODE INTERFACE
IN LAMINATED LITHIUM-ION
RECHARGEABLE BATTERIES**

Warren Paul C Far Hills, NJ, UNITED STATES assigned to Bell Communications Research Inc

A coating of a vinylidene fluoride polymer on a metal foil is heated at about 350°C to 450°C in a non-oxidizing atmosphere of inert gas to provide a rechargeable battery current collector having an exceptional bonding surface which maintains a long-lasting and highly-conductive laminate interface with an associated polymeric battery electrode composition.

5843592**CURRENT COLLECTOR FOR LITHIUM
ION ELECTROCHEMICAL CELL**

Barker Jeremy; Koksbang Rene Henderson, NV, UNITED STATES assigned to Valence Technology Inc

Electrochemical cells having a current collector that includes a redox polymer film affords overdischarge protection. The redox polymers can reversibly insert anions and/or cations during oxidation and/or reduction thereby rendering the polymers conductive relatively to their neutral state.

5846673**ADDITIVE TO STABILIZE
ELECTROCHEMICAL CELL**

Saidi M Yazici; Gao Feng; Barker Jeremy; Scordilis-Kelley Charicle Henderson, NV, UNITED STATES assigned to Valence Technology Inc

The present invention provides a novel composition and method for preventing decomposition of one or more electrochemical cell components comprising an electrode having an active material, and an electrolyte. The method of the invention, for the first time, effectively overcomes problems which arise between the interaction of cell components and contaminate water retained in a cell. Such contaminate water reacts with the electrolyte which comprises a salt of lithium in a solvent. Solubilizing of the salt in solution with attendant interaction between the salt and water causes formation of hydrogen-containing acids. The method of the invention effectively blocks decomposition of a lithium metal oxide cathode active material, and particularly lithium manganese oxide (LMO, nominally LiMn_2O_4). Such decomposition is prevented by including in the cell a basic compound which forms an electron donor species in the electrolyte solution; and by neutralizing at least a portion of the acid by reacting the donor species with the hydrogen-containing acids thereby preventing decomposition of the lithium manganese oxide by the acid. The preservation of the lithium manganese oxide prevents degradation of other cell components by other mechanism. The basic compound is desirably an organic base, preferably a butylamine.

5846675**CURRENT COLLECTOR FOR LITHIUM ION BATTERIES**

Sazhin Sergey V; Khimchenko Mikhail Yu; Tritenichenko Yevgeniy N; Roh Whan-ji; Kang Hong-yoel Suwon, KOREA assigned to Samsung Display Devices Co Ltd

An improved current collector for use with lithium ion batteries includes an aluminum grid of the type used for making conventional current collectors that is plated with a layer of zinc, the outermost portion of which is oxidized to zinc oxide. The current collector is made by first cleaning an aluminum grid in an aqueous basic solution to remove its outer layer of alumina. The cleaned aluminum grid is then plated with zinc by contact with an aqueous solution of zinc oxide. The plated aluminum grid is rinsed and dried in air to oxidize the outer surface of the zinc and form an outer layer of zinc oxide. The resulting zinc-plated current collector can be made into a battery with a higher conductivity at the interface between the current collector and the electrode active materials than a battery made with a conventional aluminum current collector. It also has a rough outer surface which improves its adhesion to the polymeric layers used in constructing a plastic lithium ion battery.

5849429**PURIFICATION PROCESS FOR LITHIUM BATTERY ELECTROLYTES**

Sazhin Sergey; Khimchenko Mikhail Yu; Tritenichenko Yevgeniy N Suwon, KOREA assigned to Samsung Display Devices Company Ltd

A process for purification of lithium battery electrolyte solutions is provided whereby the concentrations of trace amounts of impurities such as water in the electrolyte solutions can be reduced. Such electrolyte solutions generally include at least one lithium salt solute contained in at least one organic solvent. Lithium and a second metal with which lithium is capable of intercalating are first placed in electrical contact with one another and then placed in the electrolyte solution. Preferably, aluminum is used as the second metal and the two metals are provided as separate layers that are pressed together in a rolling mill to form a bimetallic sheet. The solution containing the bimetallic sheet is agitated to encourage the reactions which reduce the levels of impurities such as water in the electrolyte

solution. The resulting purified solution is then filtered to remove any remaining metal or reaction products. The resulting purified electrolyte solution can be used to make lithium batteries having improved cycling characteristics over batteries using unpurified electrolyte solution.

5849434**NON-AQUEOUS ELECTROLYTE LITHIUM SECONDARY BATTERY**

Miura Hitoshi; Terahara Atsushi; Iwasaki Katsuhiko; Kami Kenichiro; Yamamoto Taketsugu Ibaraki, JAPAN assigned to Sumitomo Chemical Company Limited

A non-aqueous electrolyte lithium secondary battery, comprising a cathode containing, as active material, a material that can be doped/undoped with lithium ions, an anode containing, as active material, a carbonaceous material that can be doped/undoped with lithium ions, a separator interposed between the cathode and anode and an electrolyte prepared by dissolving lithium salt in an organic solvent, wherein the anode contains a polymer having carbonate groups represented by the structural formula (I): (*See Patent for Chemical Structure*) (I) said polymer having a number average molecular weight of not less than 300 and not more than 200,000. The lithium secondary battery has cycle life and high-rate capacity which are improved without reducing low-temperature capacity.

5851696**RECHARGEABLE LITHIUM BATTERY**

Saidi M Yazid; Barker Jeremy Henderson, NV, UNITED STATES assigned to Valence Technology Inc

The present invention provides an electrochemical cell or battery, which has a nonmetal negative electrode (anode). That is, no solid metal active material is used in the cell. Rather than the conventional solid lithium metal anode, the active material of the new anode comprises a compound of vanadium oxide. Accordingly, the lithium cell of the invention comprises a positive electrode and a negative electrode, where the negative electrode comprises a compound of vanadium oxide which in a fully discharged state is represented by the nominal general formula V6O13 or Li_yV6O13, y equal to 0; and, in a fully or partially lithiated, fully or partially charged state, is represented by the nominal general formula

LiyV6O13, where y is greater than 0 and less than or equal to 8. The unique negative electrode of the invention demonstrates exceptional performance without the disadvantages of metallic lithium negative electrodes.

5851697

**NEGATIVE ELECTRODE MATERIAL
FOR LITHIUM SECONDARY CELL,
METHOD FOR ITS PRODUCTION, AND
LITHIUM SECONDARY CELL**

Iijima Takashi; Suzuki Kimihito; Sato Maki Kawasaki, JAPAN assigned to Nippon Steel Corporation

A negative electrode material for a lithium secondary cell comprises carbonaceous particles consisting essentially of carbon fiber particles prepared by pulverizing pitch-based carbon fibers, wherein the layer spacing d between the carbon layers is less than 0.338 nm, the average particle size is 5-200 μm , the fiber diameter of the pitch-based carbon fibers is 5-30 μm , and the aspect ratio of the carbon fiber particles is 100 or less, the layer spacing d determined based on X-ray diffraction of the carbon fiber particles. A lithium secondary cell contains such a negative electrode material.

NICKEL METAL HYDRIDE BATTERIES

5840166

**RARE EARTH METAL-NICKEL
HYDROGEN STORAGE ALLOY, PROCESS
FOR PRODUCING THE SAME, AND
ANODE FOR NICKEL-HYDROGEN
RECHARGEABLE BATTERY**

Kaneko Akihito Kobe, JAPAN assigned to Santoku Metal Industry Company Ltd

PCT No. PCT/JP96/01900 Sec. 371 Date Mar. 7, 1997 Sec. 102(e) Date Mar. 7, 1997 PCT Filed Jul. 9, 1996 PCT Pub. No. WO97/03213 PCT Pub. Date Jan. 30, 1997. A rare earth metal-nickel hydrogen storage alloy having a composition represented by the formula (1) $(R_{1-x}L_x)(Ni_{1-y}My)_z \dots (1)$ (R: La, Ce, Pr, Nd; L: Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, Sc, Mg, Ca; M: Co, Al, Mn, Fe, Cu, Zr, Ti, Mo, Si, V, Cr, Nb, Hf, Ta, W, B, C; $0.05 < x < 0.4$, $0 < y < 0.5$, $3.0 < z < 4.5$), the alloy including in an amount of not less than 30 volume % and less than 95 volume % thereof crystals each containing not less than 5 and less than 25 antiphase boundaries extending perpendicular to C-axis of a crystal grain of the alloy per 20 nm along the C-axis, not less than 60% and less than 95% of added amount of the element represented by L in the formula (1) being arranged in antiphase areas, and a method for producing the same.

5840269

**METHOD OF PREPARING A DOUBLE
LAYERED NICKEL HYDROXIDE ACTIVE
MATERIAL**

Shin Dong Yup; Kim Jin-kyung; Eun Yeong-chan Kyungki do, KOREA assigned to Samsung Display Devices Company Ltd

A method of preparing a double layered nickel hydroxide comprising the steps of spraying a first solution of nickel sulfate solution and aqueous ammonia into a first reaction bath, reacting the first solution with sodium hydroxide for a predetermined time to form a core of nickel hydroxide, injecting the core of nickel hydroxide into a second reaction bath, spraying a second solution of nickel sulfate and aqueous ammonia into the second reaction bath, reacting the second solution and sodium hydroxide with the core of nickel hydroxide and growing the core of nickel hydroxide to form an outer layer on the core of nickel hydroxide, the outer layer having a different physical property from the core, is provided.

5840440

**HYDROGEN STORAGE MATERIALS
HAVING A HIGH DENSITY OF
NON-CONVENTIONAL USEABLE
HYDROGEN STORING SITES**

Ovshinsky Stanford R; Fetcenko Michael; Im Jun Su; Young Kwo; Chao Benjamin S; Reichman Benjamin Bloomfield Hills, MI, UNITED STATES assigned to Ovonic Battery Company Inc

Disordered multicomponent hydrogen storage material characterized by extraordinarily high storage capacity due to a high density of useable hydrogen storage sites (greater than 1023 defect sites/cc) and/or an extremely small crystallite size. The hydrogen storage material can be employed for electrochemical, fuel cell and gas phase

applications. The material may be selected from either of the modified LaNi₅ or modified TiNi families formulated to have a crystallite size of less than 200 Angstroms and most preferably less than 100 Angstroms.

5840442

**METHOD FOR ACTIVATING AN
ALKALINE RECHARGEABLE BATTERY**

Abe Hidetoshi Iwaki, JAPAN assigned to Furukawa Denchi Kabushiki Kaisha

There is provided a battery activating method for an alkaline rechargeable battery, in which the capacity is not decreased even when the battery voltage is decreased by continuous load connection or self discharge. The temperature at the start of charging is set at 30 degrees to 80°C when activation is performed by charging the alkaline rechargeable battery having a nickel electrode, in which the powder of divalent cobalt compound, for example, CoO powder is contained in an active substance mixture, as a positive electrode.

5843372

**HYDROGEN-ABSORBING ALLOY FOR
BATTERY, METHOD OF
MANUFACTURING THE SAME, AND
SECONDARY NICKEL-METAL HYDRIDE
BATTERY**

Hasebe Hiroyuki; Inada Shusuke; Isozaki Yoshiyuki; Inaba Takamichi; Sawa Takao; Horie Hiromichi; Yagi Noriaki; Shizu Hiromi; Kanazawa Yoshiko Kawasaki, JAPAN assigned to Kabushiki Kaisha Toshiba

A hydrogen-absorbing alloy for battery according to the present invention comprises an alloy having the composition represented by a general formula $A_n M_b M_c$ (where, A is at least one kind of element selected from rare earth elements including Y (yttrium), M is a metal mainly composed of at least one kind of element selected from Co, Al, Fe, Si, Cr, Cu, Ti, Zr, Zn, Hf, V, Nb, Ta, Mo, W, Ag, Pd, B, Ga, In, Ge and Sn, $3.5 < a < 5$, $0.1 < b < 1$, $0 < c < 1$, $4.5 < a+b+c < 6$), wherein the alloy has columnar structures in which the area ratio of the columnar structures having the ratio of a minor diameter to a major diameter (aspect ratio) of 1:2 or higher is 50% or more. Further, an average minor diameter of the columnar structures is set to 30 microns or less. With this

arrangement, there can be provided a nickel-metal hydride battery capable of satisfying the three leading characteristics of a high electrode capacity, long life and good rising-up all together.

5851698

**NICKEL-METAL HYDRIDE BATTERIES
HAVING HIGH POWER ELECTRODES
AND LOW-RESISTANCE ELECTRODE
CONNECTIONS**

Reichman Benjamin; Venkatesan Srinivasan; Ovshinsky Stanford R; Fetcenko Michael Bloomfield, MI, UNITED STATES assigned to Ovonic Battery Company Inc

Nickel-metal hydride batteries and electrodes capable of increased power output and recharge rates. The positive and negative electrodes may be formed by pressing powdered metal-hydride active materials into porous metal substrates. The porous metal substrates are formed from copper, copper-plated nickel, or a copper-nickel alloy. The electrode tabs are directly attached to the porous metal substrate via a low electrical-resistance connection which includes welding, brazing, or soldering.

COMPONENTS AND/OR CHARGERS

5841285

**TEMPERATURE-COMPENSATED
THERMOCHROMIC BATTERY TESTER**

Bailey John C Columbia Station, OH, UNITED STATES assigned to Eveready Battery Company Inc

The battery tester of the present invention includes a heating element coupled to opposite terminals of a battery for generating heat in response to current supplied from the battery, and an indicator provided in proximity to the heating element. The indicator has a visual property that changes in response to the heat generated by the heating element. According to the present invention, at least a portion of the heating element is made of a variable resistivity material having a resistivity that changes in response to ambient temperature. By using a variable resistivity material that has a resistivity that increases as ambient temperature increases, a thermochromic on-label battery tester may be provided that is automatically calibrated to provide an

accurate indication of the remaining battery capacity regardless of the ambient temperatures at which the battery tester may be used.

5841355

OPTIMUM ELECTROLYTE LEVEL SENSING METHOD AND THE AUTOMATIC TOPPING UP APPARATUS FOR STORAGE WET CELL

Bae Sang-Min; Son Young-Joon; Lee Jae-Won Seo Ku, KOREA assigned to Korea Atomic Energy Research Institute

The optimum electrolyte level sensing method and the automatic topping up apparatus for storage wet cell are disclosed. The difference in the conductivities between the distilled water and the electrolyte is utilized. An injection outlet portion, an adjust ring, and two wires are used to detect the optimum electrolyte level to supply distilled water to storage cells. The feedback control to maintain the constant optimum electrolyte level of storage cells is carried out by a single microprocessor.

5841357

BATTERY ELECTROLYTE MONITOR

Henry Ricky Joe; Horne Ernest Gene Katy, TX, UNITED STATES assigned to Stewart & Stevenson Services Inc

A wet cell battery electrolyte level monitor monitors the electrolyte fluid level of individual battery cells on battery powered mobile or stationary equipment. The one piece monitor includes a probe housing with associated circuitry and two wire leads. The monitor wire leads may be permanently or temporarily attached to the battery system voltage and battery system ground. After removing the battery fill cap of a specific cell, the probe is inserted into the fill cap opening on the battery. The monitor's electrolyte level indicator provides an indication that the electrolyte is at the battery manufacturer's recommended level. If the indicator does not illuminate, water needs to be added to the batteries.

5844398

AUTOMATIC BATTERY CHARGING SYSTEM USING LOWEST CHARGE CURRENT DETECTION

Kwan Hing-Hin; Chen Yao-Ching; Chu Cheng-Chih; Chen Shu-Chin; Wang Chun-Sheng Kowloon, HONG KONG

An automatic charging system for charging nickel-metal-hydride batteries is presented. The battery charging system uses a method of detecting the lowest charge current to control its charging process. The system has a constant voltage power supply including a short-circuit protection device, a battery voltage detector, a current detector, a current to voltage converter, a voltage amplifier, an analog to digital converter, a single chip microcomputer, a capacity indicator, a time indicator and a full-charge indicator. The system uses a constant voltage to charge batteries with a floating current according to the quantity of the active ions in the batteries. The battery charge current is converted to a voltage signal which is then amplified and digitized. The microcomputer detects the digitized signal to estimate the magnitude of the charge current. By detecting continuous increase in the charge current, the system determines if the charging process has reached its end and shuts down the power supply at appropriate time. It avoids providing too much input energy and generating extra heat. Therefore, the system has high charging efficiency and is less likely to damage the batteries.

5844399

BATTERY CHARGER CONTROL SYSTEM

Stuart Thomas A Maumee, OH, UNITED STATES assigned to The University of Toledo

A battery charger control system and method for maximizing output power to a battery. This is achieved by ensuring operation at either the maximum allowable input current or the thermal limit imposed by the battery charger using an on-line controller. In the invention, the thermal limit is determined by the junction temperatures of the two main IGBT's. Because direct measurement of these temperatures is impractical, they must be calculated by a computer algorithm that uses various on-line measurements. Test results for a 8 kW battery charger indicate reduction in the bulk charging time from conventional battery chargers of about 26% when charging a set of NiFe batteries.

5844884
BATTERY MONITORING

Szlenski Marek Copenhagen, DENMARK assigned to Nokia Mobile Phones Limited

A battery voltage course is estimated during the actual discharge. The battery voltage is registered at a plurality of different times, and parameters for describing the battery discharge course are determined locally for said times in response to the registered values and the associated times. The registered service life is determined on the basis of the battery discharge course, and the remaining service life may e.g. be the remaining standby time of a radio telephone.

5847546
**SYSTEM AND APPARATUS FOR
 GENERATING A CONTINUOUSLY
 VARIABLE REFERENCE SIGNAL FOR
 CONTROLLING BATTERY CELL
 CHARGING**

Sengupta Upal; Turnbull Robert; Shah Rajesh; Fritz Brian Carl St Joseph, MI, UNITED STATES assigned to Packard Bell NEC

A power supply system, for example, for use with a portable personal computer, includes a smart battery pack and a charging system. The smart battery pack is provided with a dedicated microcontroller for controlling the charging level of the battery charger system. In particular, the status of the battery including the voltage and temperature of the battery is applied to the microcontroller along with a signal representative of the current load demand of the computer system. The micro controller, in turn, provides a control signal in the form of fixed frequency, variable duty cycle pulse width modulated (PWM) signal for controlling the charging level of the battery charger system. The duty cycle of the PWM signal is used to regulate the charging current supplied by the battery charger. In particular, the DC value of the PWM signal is used as a reference to control the charging current of the regulator to provide a variable output charging current with a relatively wide current range. As such, the battery charger is adapted to efficiently utilize the residual capacity of the battery charger system for optimizing charging of the battery packs during all operating conditions of the computer system. Moreover, the use of a PWM signal from the battery pack to control the battery charger enables a

single type of battery charger to be utilized for various battery technologies.

5849046
**ELECTROCHROMIC THIN FILM
 STATE-OF-CHARGE DETECTOR FOR
 ON-THE-CELL APPLICATION**

Bailey John C Columbia Station, OH, UNITED STATES assigned to Eveready Battery Company Inc

A tester for use in determining the voltage and state-of-charge of a battery. The tester can be permanently mounted on the battery and employs an electrochromic cell which changes visual appearance, for example, color or intensity of color when electrically connected across the terminals of a battery. The electrochromic cell undergoes an oxidation/reduction reaction on direct application of the DC potential of the battery. The color of the electrochromic cell can be compared with a color comparison chart to determine the condition of the battery. The tester can be permanently electrically connected to the battery or, preferably, can be connected momentarily to determine the state of the battery.

OTHER BATTERIES

5841627
**PSEUDO-CAPACITOR DEVICE FOR
 AQUEOUS ELECTROLYTES**

Prakash Jai; Thackeray Michael M; Dees Dennis W; Vissers Donald R; Myles Kevin M Gainesville, FL, UNITED STATES

A pseudo-capacitor having a high energy storage capacity develops a double layer capacitance as well as a Faradaic or battery-like redox reaction, also referred to as pseudo-capacitance. The Faradaic reaction gives rise to a capacitance much greater than that of the typical ruthenate oxide ultracapacitor which develops only charge separation-based double layer capacitance. The capacitor employs lead and/or bismuth/ruthenate and/or iridium system having the formula $A_2(B_{2-x}Pb_x)O_{7-y}$, where $A=Pb, Bi$, and $B=Ru, Ir$, and $0 < x < 1$ or $=1$ and $0 < y < 0.5$ and limits the amount of ruthenate and/or iridium in the electrodes while increasing the energy storage capacity. The ruthenate can be synthesized at low temperatures (40 degrees-80°C) to form a

compound with a high surface area and high electronic conductivity which, in combination with the increased pseudo-capacitance, affords high energy/power density in the pseudo-capacitor. The amount of expensive ruthenate and iridium can be substantially reduced in the pseudo-capacitor by increasing the lead content while improving energy storage capacity.

5843596

METHODS OF FORMING BUTTON TYPE BATTERIES AND TO BUTTON TYPE BATTERY INSULATING AND SEALING GASKETS

Tuttle Mark E Boise, ID, UNITED STATES assigned to Micron Communications Inc

A method of forming a button-type battery includes: a) positioning first and second terminal housing members in facing juxtaposition to one another, and providing an anode, a cathode and an electrolyte intermediate the first and second terminal housing member central portions; b) providing a peripheral insulative sealing gasket intermediate the first and second terminal housing members, the insulative sealing gasket being in the shape of an annulus and having a radial extent which extends radially outward beyond the surrounding peripheral portions of the first and second terminal housing members; c) moving at least one of the juxtaposed first and second terminal housing members in the direction of the other to push the first terminal housing member container wall against the first gasket face and to simultaneously force the second terminal housing member peripheral portion against the second gasket face, and continuing such moving to bend the insulative gasket about the container wall and force it to be received within the first terminal housing member; and d) after the moving step, crimping the container wall and sealing gasket against the peripheral portion of the second terminal housing member to form an enclosed housing. An alternate method includes: i) providing a discrete, pre-formed peripheral insulative sealing gasket in the shape of an annulus; and ii) positioning the discrete, pre-formed sealing gasket within the first terminal housing member, then crimping to seal. A novel gasket construction is also disclosed.

5847188

CARBONATE COMPOUNDS, NON-AQUEOUS ELECTROLYTIC SOLUTIONS AND BATTERIES COMPRISING NON-AQUEOUS ELECTROLYTIC SOLUTIONS

Yokoyama Keiichi; Hiwara Akio; Fujita Shigeru; Oamaru Atsuo Sodegaura, JAPAN assigned to Mitsui Chemicals Inc

A novel carbonate compound represented by the general formula (I):(*See Patent for Tabular Presentation*) PS wherein R1 represents a hydrogen atom, an alkyl group or an alkyl group substituted with one or more halogen atoms, and R2 represent an alkyl group having no hydrogen atom at the alpha-position thereof or an alkyl group substituted with one or more halogen atoms having no hydrogen atom at the alpha-position thereof, with the proviso that R1 is not identical to R2, which has excellent properties as solvent, is disclosed. A non-aqueous electrolytic solution and a battery utilizing the novel carbonate compound are also disclosed.

5849044

METHOD OF FORMING THIN PROFILE BATTERIES

Tuttle Mark E Boise, ID, UNITED STATES assigned to Micron Communications Inc

A method of forming a button-type battery includes: a) providing a sheet of cathode material bonded to solid electrolyte material; b) cutting the cathode material and solid electrolyte material from the sheet into a plurality of composite cathode/solid electrolyte pieces which are individually sized and shaped to constitute the electrolyte and cathode components of a single button-type battery; c) providing a pair of first and second terminal housing members in facing juxtaposition to one another, the first and second terminal housing members having respective peripheries; d) providing one of the composite cathode/electrolyte pieces intermediate the juxtaposed first and second terminal housing members; e) providing an anode intermediate the juxtaposed first and second terminal housing members, the anode being positioned to electrically connect with one of the first or second terminal housing members and the solid electrolyte, and the cathode being positioned to electrically connect with the other of the first or second terminal housing members; f) providing electrically insulative sealing

gasket material intermediate the first and second terminal housing member peripheries; and g) crimping the first and second terminal housing member peripheries together into an enclosed dry battery housing with the gasket material being interposed between the first and second terminal housing members to provide a fluid-tight seal and to provide electrical insulation therebetween.

5849427

HYDRAULICALLY REFUELED BATTERY EMPLOYING A PACKED BED METAL PARTICLE ELECTRODE

Siu Stanley C; Evans James W Castro Valley, CA, UNITED STATES assigned to Lawrence Berkeley Laboratory

A secondary zinc air cell, or another selected metal air cell, employing a spouted/packed metal particle bed and an air electrode. More specifically, two embodiments of a cell, one that is capable of being hydraulically recharged, and a second that is capable of being either hydraulically or electrically recharged. Additionally, each cell includes a sloped bottom portion to cause stirring of the electrolyte/metal particulate slurry when the cell is being hydraulically emptied and refilled during hydraulically recharging of the cell.

5849430

STRUCTURE OF AN ELECTRODE OF A SECONDARY BATTERY

Lee Jae-Ho Suwon, KOREA assigned to Samsung Display Devices Company Ltd

Disclosed is a secondary battery, which comprises a cylindrically wound laminate consisting of a positive electrode plate, a negative electrode plate and a separator plate interposed therebetween, the negative electrode plate including an electrolytically active substance, a perforated support plate for supporting the electrolytically active substance and serving as an electron collector, the electrolytically active substance being applied to both side surfaces of the support plate, a protective can for enclosing the cylindrically wound laminate, and an electrolyte, wherein the perforation density of the perforated support plate is made greater in the outer portions more than in the central portion, so

that the binding forces between the support plate and the electrolytically active substance become substantially uniform throughout the support plate and the conductivity of the support plate is considerably increased.

5849431

HIGH CAPACITY SECONDARY BATTERY OF JELLY ROLL TYPE

Kita Yosuke; Shimizu Tatuo; Iwatsu Satoshi; Takahashi Hideya; Katayama Kiyoshi Kanagawa, JAPAN assigned to Sony Corporation

A spirally coiled electrode assembly has positive and negative electrodes each including a web-like collector coated with an active material on opposite surfaces thereof, and separators disposed between the positive and negative electrodes. A plurality of rectangular leads extend from opposite sides of the web-like collectors in directions perpendicular to a direction in which the positive and negative electrodes and the separators are wound. Positive and negative terminals are connected to the rectangular leads extending from the respective opposite sides of the web-like collectors. The spirally coiled electrode assembly, the rectangular leads, and the positive and negative terminals are housed in a cylindrical casing whose opposite ends are closed by respective caps. The positive and negative terminals are fixed to the caps, respectively.

5851244

METHODS OF FORMING THIN PROFILE BATTERIES AND METHODS OF PROVIDING SEALING GASKETS BETWEEN BATTERY TERMINAL HOUSING MEMBERS

Tuttle Mark Boise, ID, UNITED STATES assigned to Micron Communications Inc

A method of forming a button-type battery includes: a) positioning first and second terminal housing members in facing juxtaposition to one another, and providing an anode, a cathode and an electrolyte intermediate the first and second terminal housing member central portions; b) providing a peripheral insulative sealing gasket intermediate the first and second terminal housing members, the insulative sealing gasket being in the

shape of an annulus and having a radial extent which extends radially outward beyond the surrounding peripheral portions of the first and second terminal housing members; c) moving at least one of the juxtaposed first and second terminal housing members in the direction of the other to push the first terminal housing member container wall against the first gasket face and to simultaneously force the second terminal housing member peripheral portion against the second gasket face, and continuing such moving to bend the insulative gasket about the container wall and force it to be received within the first terminal housing member; and d) after the moving step, crimping the container wall and sealing gasket against the peripheral portion of the second terminal housing member to form an enclosed housing. An alternate method includes: i) providing a discrete, pre-formed peripheral insulative sealing gasket in the shape of an annulus; and ii) positioning the discrete, pre-formed sealing gasket within the first terminal housing member, then crimping to seal. A novel gasket construction is also disclosed.

5851693

ORGANIC ELECTROLYTE BATTERIES

Sano Akihiro; Nishino Shuichi; Daio Fumio; Oguro Shusuke; Kondo Masatsugu HIRAKATA, JAPAN assigned to Matsushita Electric Industrial Company Ltd

A general purpose organic electrolyte cell usable for long-periods or usable after long periods of storage even in a high temperature environment exceeding 150°C. The positive and the negative electrodes are separated by using a separator made of porous synthetic resin sheet having a melting point of at least 170°C.

5851694

REDOX FLOW TYPE BATTERY

Miyabayashi Mitsutaka; Sato Kanji; Tayama Toshiyuki; Kageyama Yoshiteru; Oyama Haruo Ibaraki ken, JAPAN assigned to Kashima-Kita Electric Power Corporation

The present invention relates to a liquid-circulating type redox flow battery which comprises (a) said battery being defined by a ratio (H/L) where (H) is the average height of each of said porous electrodes in a flow direction of each of said electrolytic solutions, and (L) is the length of each of said porous electrodes in a direction perpendicular to the flow direction of each of said electrolytic solutions, the ratio (H/L) being in the range of 0.18 to 1.95; and (b) said battery being defined by ratios (Σ Sigmasai/Sa) and (Σ Sigmasci/Sc) where (Σ Sigmasai) is the sum of the cross-sectional area of an inlet for introducing said positive electrolytic solution into said positive cell, (Σ Sigmasci) is the sum of the cross-sectional area of an inlet for introducing said negative electrolytic solution into said negative cell, (Sa) is the average of the cross-sectional area of said porous electrode in a direction perpendicular to the flow direction of said positive electrolytic solution, and (Sc) is the average of the cross-sectional area of said porous electrode in a direction perpendicular to the flow direction of said negative electrolytic solution, each of the ratios (Σ Sigmasai/Sa) and (Σ Sigmasci/Sc) being in the range of 0.001 to 0.04, and said battery being further defined by ratios (Σ Sigmasao/Sa) and (Σ Sigmasco/Sc) where (Σ Sigmasao) is the sum of the cross-sectional area of an outlet for discharging said positive electrolytic solution out of said positive cell, (Σ Sigmasco) is the sum of the cross-sectional area of an outlet for discharging said negative electrolytic solution out of said negative cell, and (Sa) and (Sc) are as denoted above, each of the ratios (Σ Sigmasao/Sa) and (Σ Sigmasco/Sc) being in the range of 0.001 to 0.04.



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