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LEAD ACID**5856037****BATTERY VENTING SYSTEM AND METHOD**

Casale Thomas J; Ching Larry K W; Baer Jose; Swan David H Aurora, CO, UNITED STATES assigned to Optima Batteries Inc; Aerovironment Inc

Disclosed herein is a venting mechanism for a battery. The venting mechanism includes a battery vent structure which is located on the battery cover and may be integrally formed therewith. The venting mechanism includes an opening extending through the battery cover such that the opening communicates with a plurality of battery cells located within the battery case. The venting mechanism also includes a vent manifold which attaches to the battery vent structure. The vent manifold includes a first opening which communicates with the battery vent structure opening and second and third openings which allow the vent manifold to be connected to two separate conduits. In this manner, a plurality of batteries may be interconnected for venting purposes, thus eliminating the need to provide separate vent lines for each battery. The vent manifold may be attached to the battery vent structure by a spin-welding technique. To facilitate this technique, the vent manifold may be provided with a flange portion which fits into a corresponding groove portion on the battery vent structure. The vent manifold includes an internal chamber which is large enough to completely house a conventional battery flame arrester and overpressure safety valve. In this manner, the vent manifold, when installed, lessens the likelihood of tampering with the flame arrester and safety valve.

5858572**BATTERY HAVING REINFORCED STRUCTURE FOR PREVENTING EXPANSION**

Kim Kyong-jin Seoul, KOREA assigned to Samsung Display Devices Company Ltd

A battery having a reinforced structure capable of preventing expansion of the bottom of the battery case due to internal pressure generated during charging of a secondary battery is provided. A conventional battery has a problem that in order to achieve higher performance and smaller size, the thickness of the

battery case is decreased, and therefore the bottom of the battery case is expanded outward due to increases in the internal pressure caused by gas generated during charging. To solve the above problem, a lower reinforcement plate having a number of protrusions is placed in the battery case and welded to the bottom of the battery case. Accordingly, the lower reinforcement plate prevents expansion of the battery, and performance of the battery can be enhanced.

5858575**HOT DIPPED PB-CA GRIDS FOR LEAD-ACID BATTERIES**

Chen Yu-Lin Menomonee, WI, UNITED STATES assigned to General Motors Corporation

Pb-Ca battery grids are dipped into a bath of molten Pb-Sn or Pb-Ag to prolong the useful life of the battery as determined by the high temperature SAE J240 test.

FUEL CELL**5853674****COMPACT SELECTIVE OXIDIZER ASSEMBLAGE FOR FUEL CELL POWER PLANT**

Lesieur Roger R Enfield, CT, UNITED STATES assigned to International Fuel Cells LLC

A fuel gas selective oxidizer assemblage for use in a fuel cell power plant is formed from a series of repeating components, each of which includes a plurality of separate selective oxidizer gas passages and a plurality of adjacent coolant passages. The selective oxidizer gas and coolant passages are preferably formed by corrugated metal sheets which are interposed between planar metal sheets. One of the planar metal sheets forms a common wall between the selective oxidizer gas passages and the coolant passages so as to provide enhanced heat transfer between the reformat gas in the selective oxidizer gas passages and the coolant. Each of the components includes a first outer planar metal sheet, a medial planar metal sheet, and a second outer planar metal sheet. Each of the planar metal sheets is separated from the next by the corrugated metal gas and coolant passage sheets.

5853909

**ION EXCHANGE MEMBRANE FUEL
CELL POWER PLANT WITH WATER
MANAGEMENT PRESSURE
DIFFERENTIALS**

Reiser Carl Glastonbury, CT, UNITED STATES
assigned to International Fuel Cells LLC

A proton exchange membrane fuel cell device with an internal water management and transfer system includes a plurality of adjacently arranged proton exchange membrane assemblies including a proton exchange membrane component; a pair of porous anode and cathode catalyst layers situated on either side of the proton exchange membrane; and porous plate assemblies interposed between and in contact with each of the adjacent proton exchange membrane assemblies. Oxidant gas is supplied to oxidant gas supply channels, and fuel gas to fuel gas supply channels formed in the porous plate assemblies for distribution to the cathode and anode catalyst layers, respectively. A water coolant circulating system is formed in each of the porous plate assemblies and causes each of the porous plate assemblies to become saturated with coolant water. The reactant flow fields are pressurized to a pressure which exceeds the coolant water circulating pressure by a selected DeltaP so as to ensure that product water formed on the cathode side of each membrane assembly will be pumped through the porous plates into the coolant water flow field and become entrained in the circulating coolant water stream.

5853910

**FUEL CELL POWER GENERATING
APPARATUS AND OPERATION METHOD
THEREFOR**

Tomioka Norihiro; Nakashima Hiroehi; Ueno Masataka; Shiraishi Koichi; Izumisawa Saki Sapporo, JAPAN assigned to Kabushikikaisha Equos Research

A fuel cell power generating apparatus using a fuel cell having a structure such that a cathode and an anode are disposed on opposite sides of a polymer electrolyte membrane, comprising: an air introduction passage (11) for introducing air to the cathode; an air discharge passage (15) for discharging, to the outside of the system, discharge gas containing reactant water generated at the cathode; a circulation passage connected between the air discharge passage and the air introduction passage in order to again introduce at least

a portion of the discharge gas flowing through the air discharge passage to the air introduction passage and thus to the cathode; a valve provided for at least one of the air introduction passage and the air discharge passage; a temperature sensor for measuring the temperature of the discharge gas from the cathode; an ampere meter for measuring the level of an electric current output from the fuel cell; and a control unit for controlling the degree of opening of the valve in accordance with the temperature of the discharge gas and the output level of the electric current measured respectively by the temperature sensor and the ampere meter. A portion of the discharge gas containing reactant water is circulated into the air introduction passage and thus to the cathode of the fuel cell to thereby humidify the electrolyte membrane, so that there is no need to supply water from the outside of the system. The apparatus is particularly suitable to be mounted on a vehicle.

5856034

**METHOD AND DEVICE FOR OPERATING
A FUEL CELL SYSTEM**

Huppmann Gerhard; Kraus Peter Feldkirchen Westerham, GERMANY assigned to MTU Mortoren-und Turbinen-Union

PCT No. PCT/EP95/01923 Sec. 371 Date Apr. 8, 1997 Sec. 102(e) Date Apr. 8, 1997 PCT Filed May 20, 1995 PCT Pub. No. WO96/02951 PCT Pub. Date Feb. 1, 1996. The invention provides a method and apparatus for controlling gas circulation in a fuel cell system in which a stack of fuel cells is surrounded by a protective housing. According to the invention, used cathode gas and burnt combustion gas from the fuel cell stack directly into the interior of a protective housing which surrounds the fuel cell stack. A blower which is arranged inside the housing causes the used cathode gas to mix with the burnt combustion gas and recirculate to the cathode input of the fuel cell stack, where it is further with fresh gas from the exterior.

5856035

**ELECTRICAL CONNECTOR APPARATUS
FOR PLANAR SOLID OXIDE FUEL CELL
STACKS**

Khandkar Ashok C; Elangovan Singaravelu Salt Lake City, UT, UNITED STATES assigned to Gas Research Institute

An apparatus for collecting electrical current from individual fuel cell stacks in a solid oxide fuel cell is provided, in which the current collectors are protected from oxidation through advantageous placement in non-oxidizing surroundings. Fuel cell module configurations employing and taking advantage of the current collecting apparatus are also provided.

5858567

**FUEL CELLS EMPLOYING INTEGRATED
FLUID MANAGEMENT PLATELET
TECHNOLOGY**

Spear Reginald G; Mueggenberg H Harry; Hodge Rex
Sacramento, CA, UNITED STATES assigned to H
Power Corporation

Fuel cell stacks comprising stacked separator/membrane electrode assembly cells in which the separators comprise a series of stacked thin sheet platelets having individually configured serpentine micro-channel reactant gas humidification, active area and cooling fields therein. The individual platelets are stacked with coordinate features precisely aligned in contact with adjacent platelets and bonded to form a monolithic separator. Post bonding processing includes passivation, such as nitriding. Preferred platelet material is 4-25 mil Ti in which the features, serpentine channels, tabs, lands, vias, manifolds and holes, are formed by chemical or laser etching, cutting, pressing or embossing, with combinations of depth and through-etching being preferred. The platelet manufacturing process is continuous and fast. By employing CAD based platelet design and photolithography, rapid change in feature design to accommodate a wide range of thermal management and humidification techniques. 100 cell H₂-O₂/Air PEM fuel cell stacks of this IFMT platelet design will exhibit outputs on the order of 0.75 kW/kg, some 3-6 times greater than current graphite plate PEM stacks.

5858568

FUEL CELL POWER SUPPLY SYSTEM

Hsu Michael S; Ong Robin Y P Lincoln, MA,
UNITED STATES assigned to Ztek Corporation

A power supply system for enhancing the economic viability of different modes of transportation that incorporate fuel cells to generate electricity. For example, the power supply system of the present

invention provides for the off-board use of the electric power generated by an on-board power plant, such as a fuel cell, of a mobile vehicle power system, such as an electric car. Off-board use, or use remote from the vehicle, of the electrical power includes the delivery of power to a remote site. Off-board stations are provided for delivery of fuel to the vehicle and/or for receiving the electrical power generated by the fuel cell. The off-board station and the vehicle are appropriately equipped for quick and easy interconnection such that electrical power is drawn from the fuel cell for off-board use.

5858569

LOW COST FUEL CELL STACK DESIGN

Meacher Joh; Vitale Nicholas G Ballston Lake, NY,
UNITED STATES assigned to Plug Power L L C

The fuel cell stack includes sequential fuel cell membrane elements of polymer membrane with a cathode side and an anode side. The polymer membrane is held in place by an elastomeric gasket which includes flow channels leading to manifold passages which deliver hydrogen or other fuel gas to the anode side of the fuel cell membrane element and deliver air or oxygen to the cathode side of the fuel cell membrane assembly. The fuel cells are separated by fuel separator assemblies comprised of metallic foil with strips of porous graphite thereon. Cooling plates which receive cooling water are interspersed within the stack. The entire stack is held in place by a plastic resin shell. The various elements are compressed together by an upper platen with a limited range of travel which is urged toward the cell by air pressure, an air-filled bladder, an array of compression springs, or by similar methods.

5861222

**GAS DIFFUSION ELECTRODE FOR
MEMBRANE FUEL CELLS AND METHOD
OF ITS PRODUCTION**

Fischer Andreas; Wendt Hartmut; Zuber Ralf
Frankfurt, GERMANY assigned to Degussa
Aktiengesellschaft

A porous gas diffusion electrode for membrane fuel cells on an ion-conducting polymer. The electrode contains a finely divided electrocatalyst which is dispersed in a proton-conducting ionomer and has a total porosity of more than 40 to less than 75%. It supplies considerably improved performance data in comparison to known

electrodes. The electrode can be produced by using pore-forming materials which are dissolved during the re-protonation of the ion-conducting polymers with sulfuric acid or are decomposed by the action of temperature.

5863671

PLASTIC PLATELET FUEL CELLS EMPLOYING INTEGRATED FLUID MANAGEMENT

Spear Reginald; Franklin Jerrold; Hayes William A; Janke David Sacramento, CA, UNITED STATES assigned to H Power Corporation

Improved fuel cell stacks constructed from a plurality of cells, each comprising a series of interrelated mono and bipolar collector plates (BSPs), which in turn are built up by lamination of a core of related non-conductive plastic or ceramic platelets sandwiched between conductive microscreen platelets of metal or conductive ceramic or plastic, with an electrode membrane (EMA) between adjacent BSPs. The platelets, both metal and plastic of the composite BSPs, are produced from sheet material with through and depth features formed by etching, pressing, stamping, casting, embossing and the like. Adjacent plates, each with correspondingly relieved features form serpentine channels within the resultant monolithic platelet/cell stack for integrated fluid and thermal management. The plastic platelets are particularly useful for PEM fuel cells employing H₂ and Air/O₂ as fuel. The platelets are easily made by printing (embossing) processes, and dies made by photolithographic etching for rapid redesign. Each BSP can be individually tailored to each type of membrane, fuel, and intra-cell location within the stack. As materials are cheap and easy to manufacture and assemble, lightweight fuel cells of very high power density are realizable. Industrial applicability includes both stationary and vehicular power supplies, in both micro and macro sizes.

5863672

POLYMER ELECTROLYTE MEMBRANE FUEL CELL

Ledjeff Konstanti; Nolte Roland Bad Krozingen, GERMANY assigned to Fraunhofer-Gesellschaft zur Foerderung der angewandten Forschung e V

PCT No. PCT/DE95/01752 Sec. 371 Date Jun. 4, 1997

Sec. 102(e) Date Jun. 4, 1997 PCT Filed Dec. 5, 1995 PCT Pub. No. WO96/18216 PCT Pub. Date Jun. 13, 1996. The invention relates to a PEM fuel cell comprising at least one strip membrane which itself comprises at least 2, and a maximum of 10,000-surfaced individual cells each comprising an electrode layer applied on both sides of a membrane made of a polymeric solid electrolyte, the individual cells being incorporated in series and being made of plates of non-conductive material, which serve as heat exchangers and as fuel gas supply device, which are contacted on both sides on the strip membrane and separate outwardly-directed conductive structures for voltage derivation.

5863673

POROUS ELECTRODE SUBSTRATE FOR AN ELECTROCHEMICAL FUEL CELL

Campbell Stephen; Stumper Juerge; Wilkinson David; Davis Michael T Maple Ridge, CANADA assigned to Ballard Power Systems Inc

A porous electrode substrate for an electrochemical fuel cell comprises at least one preformed web having low or poor electrical conductivity. The web contains an electrically conductive filler. A method for preparing a porous electrode substrate for an electrochemical fuel cell comprises the step of filling a preformed web, the web having low or poor electrical conductivity, with an electrically conductive filler.

BATTERY MATERIALS

5853798

PROCESS FOR FORMATION OF AN ELECTRODE ON AN ANION EXCHANGE MEMBRANE

Dube James R Boston, MA, UNITED STATES assigned to United Technologies Corporation

The invention is a process for formation of an electrode on a solid polymer anion exchange membrane to increase rates of reaction at a reaction surface of the membrane. The process includes the steps of soaking a polymer anion exchange membrane in a solution containing an anionic entity wherein a desired metal catalyst is contained within the anionic entity so that anions containing the metal catalyst exchange into the

membrane by electrostatic attraction, and exposing the membrane to a reducing agent so the metal catalyst is reduced to a metallic form to become physically secured at a reaction surface of the membrane to thereby form the electrode adjacent the reaction surface. In preparation of an electrode on an anion exchange membrane, the process is concluded by rinsing the membrane in distilled water and then the membrane is cycled through the soaking, exposing and rinsing steps until a desired level of catalyst loading is achieved. In a first preferred process, the polymer anion exchange membrane is a tetrafluoroethylene-fluorinated ethylene propylene (TFE-FEP) based membrane; the anionic entity is chloroplatinic acid; and the reducing agent is sodium borohydride. In a second preferred process, the polymer anion exchange membrane is a polyolefin based membrane; the anionic entity is potassium tetrachloroplatinate; and the reducing agent is sodium borohydride.

5853919

HYDROGEN-ABSORBING ALLOY, ELECTRODE AND ALKALINE SECONDARY BATTERY

Kohno Tatsuok; Kanda Motoya; Tsuruta Shinj
Kawasaki, JAPAN assigned to Kabushiki Kaisha
Toshiba

A hydrogen-absorbing alloy which comprises a first region comprising 50 to 75 mole % of Mg and not more than 50 mole % of Ni, and at least two regions selected from the group consisting of a second region comprising less than 50 mole % (including 0 mole %) of Mg and less than 75 mole % of Ni, a third region comprising not less than 75 mole % of Mg, and a fourth region comprising not less than 75 mole % of Ni.

5856044

HIGH CAPACITY ELECTRODE PASTE AND PROCESS FOR FABRICATION

McLin Michael; Massucco Arthur A; Fauteux Denis
Wakefield, MA, UNITED STATES assigned to
Mitsubishi Chemical Corporation

The present invention is directed to a high capacity electrode paste and process for the fabrication of same. The resultant paste has a plurality of electrochemically active particles dispersed in solution. Additionally, during fabrication of the electrode paste, the

electrochemically active material is subjected to a grinding step. After grinding the material to the desired particle sizes, the grinding medium is removed. However, the particles remain dispersed in solution, even after removal of the grinding medium. Accordingly, each of the individual particles have at least a portion of their respective surfaces in contact with the solution.

5857139

PROCESS FOR PREPARING AN ELECTRODE FOR SECONDARY BATTERY EMPLOYING HYDROGEN-STORAGE ALLOY

Lee Jai-Young; Lee Ki-Young; Lee Han-Ho; Kim
Dong-Myung; Yu Ji-Sang; Jung Jae-Han; Lee Soo-Geun
Taejon, KOREA assigned to Korea Advanced Institute
of Science and Technology

The present invention relates to a process for preparing an electrode for secondary battery employing hydrogen-storage alloy systems, more specifically, to a process for preparing an anode material for secondary battery which can be charged/discharged in an electrolyte and has a high discharge efficiency and energy density per unit weight, by sintering a mixture of hydrogen-storage alloy systems. An electrode for secondary battery of the present invention is prepared by the process which comprises the steps of: (i) mixing a hydrogen-storage alloy powder free of Ni with a hydrogen-storage alloy powder containing Ni over 30 atomic %; (ii) cold-pressing the mixed powder at a pressure of 5 to 15 ton/cm²; (iii) sintering the cold-pressed mixture in a quartz tube at 900°C for 5 to 15 min under a vacuum condition of 10-2 to 10-3 torr; and, (iv) quenching the sintered material.

5858264

COMPOSITE POLYMER ELECTROLYTE MEMBRANE

Ichino Toshihiro; Takeshita Yukitoshi; Yamamoto
Fumio; Kato Hiroshi; Mushiake Naofumi; Wani
Takayuki Hoya, JAPAN assigned to Japan Gore-Tex
Inc; Nippon Telegraph and Telephone Corporation

A composite polymer electrolyte membrane which includes an ion-conductive polymer gel contained and supported by a matrix material formed of a porous polytetrafluoroethylene membrane. The porous

polytetrafluoroethylene membrane has an internal structure which defines a three-dimensional network of interconnected passages and pathways throughout the membrane. The composite polymer electrolyte membrane has a tensile break strength of at least 10 MPa in at least two orthogonal planar directions, ion conductivity of at least 1 mS/cm, and is useful as a separator between electrodes of a lithium secondary cell.

5863454

ELECTROCONDUCTIVE POLYMER COMPOSITES FOR USE IN SECONDARY BATTERIES AS POSITIVE ELECTRODE ACTIVE MATERIALS

Chen Show-An; Lin Liang-Chan 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.

5863675

MANGANESE DIOXIDE FOR LITHIUM BATTERIES

Capparella Mark; Bowden William; Fooksa Radek Milford, MA, UNITED STATES assigned to Duracell Inc

Disclosed is a process for treating manganese dioxide

containing ion-exchangeable cations by replacing the ion-exchangeable cations present in the manganese dioxide with lithium by a process comprising first replacing ion-exchangeable cations present in the manganese dioxide with hydrogen. This readily is accomplished by slurring the manganese dioxide in an aqueous acid solution. The resulting acidic manganese dioxide then is neutralized with a basic solution of a lithium containing compound, such as lithium hydroxide. This neutralization step serves to accomplish replacement of the previously introduced hydrogen, by ion-exchange, with lithium. The manganese dioxide then is washed with water, dried, and heat-treated at an elevated temperature, in conventional manner, to convert the gamma manganese dioxide to a mixture of the gamma and beta forms, which then is used as the active cathodic component in an electrochemical cell.

5863676

CALCIUM-ZINCATE ELECTRODE FOR ALKALINE BATTERIES AND METHOD FOR MAKING SAME

Charkey Alle; Coates Dwaine Brookfield, CT, UNITED STATES assigned to Energy Research Corporation

A zinc active material containing a calcium-zincate constituent is formed external of a battery. The zinc active material is used as the active material for a zinc electrode used in the battery.

LITHIUM BATTERIES

5853908

PROTECTIVE DEVICE FOR SECONDARY BATTERIES

Okutoh Tadashi Kawasaki, JAPAN assigned to Nippon Moli Energy Corporation

The invention provides a protective device for batteries having a high energy density such as lithium ion batteries. The protective device includes a current conduction cutoff means having a current-conducting circuit comprising a voltage-detecting means for detecting the voltage of at least one battery being charged, a heat-generating resistance for starting the conduction of a current when the detected voltage exceeds a preset voltage, and a temperature fuse

thermally coupled to the heat-generating resistance. When a state where battery voltage is higher than a preset value continues, a charging circuit for the battery is cut off by the temperature fuse and current output from the battery is disabled. The protective device further includes a battery-discharging means actuated upon detection of the fusing-down of the temperature fuse, so that the battery is disabled, and then placed in a dischargeable state.

5853912

LITHIUM ION ELECTROCHEMICAL CELL WITH SAFETY VALVE ELECTRICAL DISCONNECT

Naing Htun S; Shapiro David Cockeyville, MD, UNITED STATES assigned to SAFT America Inc

An explosion-proof valve electrical disconnect assembly incorporates a vent valve contact disk which seals the can of a compact electrochemical cell and which faces a juxtaposed stripper contact disk welded at the center by a weld nugget at a weld point, forming a rigid, preferably increased thickness, mass. The underlying stripper contact disk is weakened about the weld point, surrounding the weld nugget to ensure pull-through of the stripper contact disk portion immediately adjacent to the weld connection to effect initial electrical separation of the two contact disks. Subsequent rupture of the vent valve contact disk releases high pressure gas internally from the cell. A semi-rigid assembly cup may support a rigid grommet functioning to sandwich the vent valve contact disk and the stripper contact disk facilitated by crimping of the can top about a deformable L-shaped cross-section annular assembly cup. A current responsive PTC element forms a second circuit breaker independent of the first mechanical circuit breaker formed by the two contact disks.

5853914

RECHARGEABLE LITHIUM BATTERY HAVING A SPECIFIC PRESSURE MEANS COMPRISING A POLYMER GEL MATERIAL

Kawakami Soichiro Nara, JAPAN assigned to Canon Kabushiki Kaisha

A rechargeable lithium battery comprising at least a

cathode, a separator, an anode, and an electrolyte or electrolyte solution integrated in a battery housing, characterized in that said rechargeable lithium battery is provided with a pressure means comprising a polymer gel for pressing said anode and cathode.

5853918

LITHIUM SECONDARY BATTERY CONTAINING GRAPHITIZED CARBON ACTIVE MATERIAL

Tanno Satoshi Iwaki, JAPAN assigned to Furukawa Denchi Kabushiki Kaisha

A carbon material composed of a layer structure and a turbostratic structure obtained by subjecting fluid coke to a graphitizing treatment is used as an active material for the negative electrode of a lithium secondary battery. The burning temperature in the graphitizing of the fluid coke is preferably more than 2000°C, and more preferably is more than 2500°C. A lithium secondary battery using the above-mentioned active material for the negative electrode thereof is excellent in flatness of the electric potential and also has decreased capacity loss at the initial stage of charge and discharge cycles.

5856039

NON-AQUEOUS ELECTROLYTE SECONDARY CELL

Takahashi Masatoshi Hyogo, JAPAN assigned to Sanyo Electric Company Ltd

A non-aqueous electrolyte secondary cell includes a positive electrode containing lithium-contained complex oxide, a negative electrode containing a material which can absorb and desorb lithium or lithium ion, and a separator which is filled with an organic electrolyte. The separator is composed of a plurality of laminated blend polymer fine porous films each containing polyethylene and polypropylene, and at least one of the laminated blend polymer fine porous films has a different ratio of polyethylene and polypropylene from the other blend polymer fine porous films. In this construction, a blend polymer fine porous film having a higher ratio of polypropylene increases the piercing strength of the separator, and at the same time a blend polymer fine porous film having a higher ratio of polyethylene increases the shut-down characteristic.

5856043**NON-AQUEOUS ELECTROLYTE
SECONDARY BATTERY**

Ohsaki Takashi; Abe Hiroshi; Murai Takeji Shizuoka
ken, JAPAN assigned to Nikkiso Company Ltd

The present invention relates to a non-aqueous electrolyte secondary battery. The graphitized vapor-grown carbon fibers used as an anode in the present invention have a specific surface area of at most 5 m²/g and an average aspect ratio of 2-30. The non-aqueous electrolyte secondary battery comprises an anode comprising a cathode comprising a lithium-containing complex oxide, an anode comprising the graphitized vapor-grown carbon fibers, and an electrolyte comprising a lithium salt and a solvent. The present invention provides a non-aqueous electrolyte secondary battery having a high capacity maintained over a broad temperature range, good cycle characteristics, a high safety and an improved load characteristics.

5856045**LITHIUM ION ELECTROLYTIC CELL
AND METHOD FOR FABRICATING SAME**

Fauteux Denis; Shi Jie; Massucco Arthur A Acton,
MA, UNITED STATES assigned to Mitsubshi
Chemical Corporation

The present invention relates to secondary electrolytic cells, and more particularly, to lithium ion electrolytic cells with an inorganic binder and an associated process for fabrication of same. A binder material is mixed with an active material for eventual application onto the surface of a first and/or second electrode. The binder material is soluble with the active material yet insoluble with respect to the associated organic electrolyte.

5856046**PRODUCTION OF ELECTRODES**

Heilmann Pete; Steininger Helmut Bad Durkheim,
GERMANY assigned to EMTEC Magnetics GmbH

Electrodes suitable for electrochemical cells are produced by a) applying a mixture comprising alpha) a solid III which can reversibly take up or release lithium ions in an electrochemical reaction and beta) a binder IV, or a compound which can be converted into a binder IV, to an electrically conductive support V by means of

a coating apparatus II with essentially linear relative motion (R) of the support V relative to the coating apparatus II in such a way that an uncoated zone remains on the support V at each of the two margins of the coating apparatus II running parallel to the relative motion (R) and b) cutting the support V at an angle of from 5 to 85° to the normal to the direction of relative motion (R) to give essentially parallel strips.

5858324**LITHIUM BASED COMPOUNDS USEFUL
AS ELECTRODES AND METHOD FOR
PREPARING SAME**

Dahn Jeffrey R; Zheng Tao Nova Scotia, CANADA
assigned to Minnesota Mining and Manufacturing
Company

A process for preparing a compound that includes the steps of: (a) preparing a solution comprising (i) a chromium source, (ii) a manganese source, (iii) a lithium source, and (iv) an oxygen source, where the relative amounts of each of the sources is selected to yield, following step (c), a compound having the formula $\text{Li}_{y}\text{Cr}_{x}\text{Mn}_{2-x}\text{O}_{4+z}$ where $y \geq 2$, $0.25 < x < 2$, and $z \geq 0$; (b) treating the solution to form a gel; and (c) heating the gel under an inert atmosphere for a time and at a temperature sufficient to yield a compound having the formula $\text{Li}_{y}\text{Cr}_{x}\text{Mn}_{2-x}\text{O}_{4+z}$ where $y \geq 2$, $0.25 < x < 2$, and $z \geq 0$. The invention also features a compound having the formula $\text{Li}_{y}\text{Cr}_{x}\text{Mn}_{2-x}\text{O}_{4+z}$ where $y > 2$, $0.25 < x < 2$, and $z \geq 0$, and an electrode composition containing this compound.

5858573**CHEMICAL OVERCHARGE
PROTECTION OF LITHIUM AND
LITHIUM-ION SECONDARY BATTERIES**

Abraham Kuzhikalail M; Rohan James F; Foo Conrad
C; Pasquariello David M Needham, MA, UNITED
STATES assigned to EIC Laboratories Inc

This invention features the use of redox reagents, dissolved in non-aqueous electrolytes, to provide overcharge protection for cells having lithium metal or lithium-ion negative electrodes (anodes). In particular, the invention features the use of a class of compounds consisting of thianthrene and its derivatives as redox shuttle reagents to provide overcharge protection.

Specific examples of this invention are thianthrene and 2,7-diacetyl thianthrene. One example of a rechargeable battery in which 2,7-diacetyl thianthrene is used has carbon negative electrode (anode) and spinet LiMn_2O_4 positive electrode (cathode).

5861224

ELECTROLYTE SOLVENT FOR LITHIUM ION ELECTROCHEMICAL CELL

Barker Jeremy; Gao Feng Henderson, NV, UNITED STATES assigned to Valence Technology Inc

Non-aqueous solid electrochemical cells with improved performance can be fabricated by employing an electrolyte having an electrolyte solvent which contains a carbonate having the structure $\text{R}'\text{OCOOR}''$ where R' and R'' are independently selected from branched alkyl groups with 3 to 7 carbons. A preferred solvent includes diisopropyl carbonate. The cells are particularly suited for low and high temperature applications.

NICKEL METAL HYDRIDE BATTERIES

5858061

PROCESS FOR THE RECOVERY OF METALS FROM USED NICKEL/METAL HYDRIDE STORAGE BATTERIES

Kleinsorgen Klaus; Kuml ohler Uwe; Bouvier Alexander; Fuml olzer Andreas Kelkheim, GERMANY assigned to Varta Batterie Atkiengesellschaft

In the recycling of used nickel/metal hydride storage batteries, the battery scrap is dissolved in sulphuric acid after mechanical separation of the coarse constituents by magnetic and air separation. A solvent extraction is performed with the digestion solution, from which the rare earths (from the hydrogen-storage alloys in the negative electrodes) and iron and aluminum have been selected by precipitation, under conditions pH, choice of solvent, volumetric ratio of the phases) which are such that the aqueous phase contains nickel and cobalt in the same atomic ratio as that in which they were present in the scrap. This makes possible a joint recovery by simultaneous electrolysis, in which process the deposition product forms a master alloy which can be used, together with the precipitated rare earths which have been electrometallurgically reprocessed as misch metal, for the production of fresh hydrogen-storage alloys.

5856047

HIGH POWER NICKEL-METAL HYDRIDE BATTERIES AND HIGH POWER ELECTRODES FOR USE THEREIN

Venkatesan Srinivasan; Reichman Benjamin; Ovshinsky Stanford R; Prasad Binay; Corrigan Dennis A Southfield, MI, UNITED STATES assigned to Ovonic Battery Company Inc

Nickel-metal hydride batteries and electrodes are capable of increased power output and recharge rates. The electrodes and batteries produced therefrom exhibit increased internal conductance. 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, and may be additionally plated with a material which is electrically conductive and resistant to corrosion in the battery environment, such as nickel.

5861225

NICKEL BATTERY ELECTRODE HAVING MULTIPLE COMPOSITION NICKEL HYDROXIDE ACTIVE MATERIALS

Corrigan Dennis; Fierro Cristian; Martin Franklin; Ovshinsky Stanford R; Xu Liwe Troy, MI, UNITED STATES assigned to Ovonic Battery Company Inc

A high capacity long cycle life positive electrode which includes an electronically conductive substrate for conducting electricity through the electrode and an electrochemically active nickel hydroxide material in electrical contact with the electronically conductive substrate, the electrochemically active nickel hydroxide material is composed of at least two different solid solution nickel hydroxide materials each having differing compositions. The positioning of the at least two different solid solution nickel hydroxide materials and their relative compositions alter the local redox potential or porosity to force discharge of the electrode in a stepwise fashion from the nickel hydroxide material remote from said conductive network or substrate, through any intermediate nickel hydroxide materials, to the nickel hydroxide material adjacent the conductive network or substrate.

COMPONENTS AND/OR CHARGERS

5856737

FAST BATTERY CHARGING SYSTEM AND METHOD

Miller Phillip; Becker Ronald D; Koenck Steven E
Cedar Rapids, IA, UNITED STATES assigned to
Norand Corporation

In an exemplary fast charging system, a hand-held computerized terminal with rechargeable batteries therein may be bodily inserted into a charger receptacle. The terminal may have volatile memory and other components requiring load current during charging. The system may automatically identify battery type and progressively increase charging current while monitoring for an increase in battery terminal voltage to ascertain the level of load current. The battery temperature may be brought into a relationship to surrounding temperature such that by applying a suitable overcharge current value and observing any resultant temperature increase, the level of remaining battery charge can be determined. For example, if the battery is found to be relatively fully discharged, a relatively high fast-charge rate may be safely applied while monitoring battery temperature. If the battery is initially relatively fully charged or reaches such a state during fast charge, the system may automatically dynamically select a maintenance charge rate according to battery type and temperature. A preferred system may automatically recharge the batteries of a portable device according to an optimum schedule of essentially maximum safe charging rates as a function of battery temperature, and thereafter safely maintain the batteries at essentially fully charged condition in readiness for maximum duration portable operation.

5858570

COMMUNICATION APPARATUS, ELECTRONIC APPARATUS, AND BATTERY MANAGEMENT METHOD

Akagi Atsuhis Iwate, JAPAN assigned to Sony
Corporation

A communication apparatus which prevents problems caused by the increase of internal resistance in a battery. The apparatus obtains the internal resistance (ΔV) of a battery, and if the internal resistance obtained is over a reference value, a message to change the battery

is displayed to the user. The user exchanges the battery directed by the display, so that the problems due to the increase of the internal resistance can be prevented. Further, the battery voltage during transmission is predicted from the internal resistance, and if the predicted value is lower than a predetermined reference voltage, a message that no residual battery exists is displayed to the user, thereby avoiding the situation where the battery voltage becomes lower than the reference voltage because of the internal resistance at the moment of transmission, resulting in the apparatus being suddenly reset and the conversation cut off without any warning.

5861731

DEVICE AND METHOD FOR DETECTING AND DISPLAYING CHARGE CAPACITY OF A BATTERY

Kim Dong-Ho Taebaek, KOREA assigned to Samsung
Electronics Company Ltd

A battery capacity indicating device includes a plurality of switching parts connected in parallel to a battery, each of which outputs a controlling signal corresponding to a predetermined voltage range when a voltage across the battery terminals falls within the predetermined voltage range, with at least one of the predetermined voltage ranges having finite upper and lower limits; a controlling part for receiving the output controlling signal among other controlling signals and generating from the received controlling signals a displaying signal corresponding to a display range into which the voltage falls; and a displaying part for generating a display indication representative of the display range. A battery capacity indicating method is provided wherein the displaying signals corresponding to the controlling signals are output when they are applied.

5864220

METHOD AND APPARATUS FOR CONTROLLING THE CHARGING OF A RECHARGEABLE BATTERY TO ENSURE THAT FULL CHARGE IS ACHIEVED WITHOUT DAMAGING THE BATTERY

Reipur John; Juul-Hansen Ebbe Klampenborg,
DENMARK assigned to Chartec Laboratories A/S

In order to optimally control the charging of a rechargeable battery of one or more cells to ensure that full and rapid charge is achieved without damaging the

battery, a maximum safe value (or sequence of values during the charging process) for one or more charging parameters is determined during a test charge, and subsequent charges of the battery are performed without exceeding the predetermined maximum value(s) for the charging parameter(s). Among the charging parameters contemplated for use are: the charging voltage potential placed across the battery terminals, the charging current supplied to the battery, the temperature of the battery cell and internal pressure of the battery cell as well as rates of changes of the parameters. In accordance with apparatus for practicing the invention, the value(s) of one or more predetermined maximum parameters are stored, and the corresponding actual charging parameter values are measured during the charging process and compared to the stored values to develop signals for controlling the charging process and thereby maintain the monitored parameter(s) no higher than the predetermined maximum value(s).

5864224

METHOD FOR CHARGING SECONDARY BATTERY AND CHARGER THEREFOR

Takechi Hiroaki; Ono Tomohiro; Suzuki Masahito Iwata, JAPAN assigned to Yamaha Hatsudoki Kabushiki Kaisha

PCT No. PCT/JP95/02650 Sec. 371 Date Oct. 29, 1996 Sec. 102(e) Date Oct. 29, 1996 PCT Filed Dec. 25, 1995 PCT Pub. No. WO96/20511 PCT Pub. Date Jul. 4, 1996. The present invention provides a method for charging a secondary battery and a charger by which it can be prevented that a secondary battery is charged at very high or low temperature, and that the secondary battery is charged for a long time. Therefore, the secondary battery is prevented from being damaged, so that the lifetime can be prolonged. In this method, a generally constant current is supplied from a charging means to the secondary battery. The constant-current charging is stopped when voltage of the secondary battery has reached a peak value after passage of a predetermined time period from start of the supplying of the first current; temperature of the secondary battery has been out of a predetermined range; or a predetermined time period has passed since start of the supplying of the first current.

5864237

BATTERY CONDITION DETECTION METHOD

Kawai Toshiyuki; Makino Daisuke; Uchida Mitsunob; Kato Hidetoshi; Sasaki Torahiko Toyohashi, JAPAN assigned to Nippondenso Company Ltd; Nippon Soken Inc Toyota Jidosha Kabushiki Kais

A battery condition detecting method is provided which includes the steps of setting a current required during standard discharge of a battery as a set current, detecting a discharge current and a voltage of the battery, determining a battery voltage when the battery discharges the set current based on the discharge current and the voltage of die battery, and projecting an actual voltage of the battery based on the battery voltage determined.

OTHER BATTERIES

5853916

MULTI-LAYERED POLYMERIC GEL ELECTROLYTE AND ELECTROCHEMICAL CELL USING SAME

Venugopal Ganesh; Anani Anaba A Duluth, GA, UNITED STATES assigned to Motorola Inc

An electrochemical cell 10 includes first and second electrodes 12 and 14 with an electrolyte system 26 disposed therebetween. The electrolyte system includes at least a first and second layer 28 and 30, the second or gelling layer 30 being used to absorb an electrolyte active species.

5856041

SEALED SECONDARY CELL

Inoue Hiroshi; Hamada Shinji; Ito Noboru; Ikoma Munehisa Neyagawa, JAPAN assigned to Matsushita Electric Industrial Company Ltd

A sealed secondary cell maintaining enclosed property and battery performance for a long period in a wide range of environments of use including high temperature, high humidity, and vibration is presented. A terminal pole is composed of a current collector, a flange with a flat top surface, and a pole formed on the flange upper surface projecting at right angle, a rotation

arresting portion of the terminal pole is formed by the flange and lower side of a lid, an annular packing is disposed between the flange upper surface and lid lower side so as to surround the pole, an annular pressing spring is pressed in from above the pole, the annular packing interposed between the flange upper surface and lid lower side is compressed in the vertical direction by the elastic force of the annular pressing spring, the annular pressing spring is stopped on the outer circumferential edge of the pole at a position for sealing and fixing the terminal pole in the lid, and thereby the battery jar is enclosed.

5858574
CELLS AND GAS DEPOLARIZED
BATTERIES AND METHOD FOR
PRODUCING SAME

Grignol Tanya R Los Gatos, CA, UNITED STATES
 assigned to Space Systems/Loral Inc

A bipolar rechargeable battery comprises a vessel with an insulated liner and an interior region for bulk storage of a gas which serves as an electrode active material. A plurality of cells are nested within the vessel, each including a metallic bipolar plate having a circular base and an integral insulated hydrophobic upstanding side wall of truncated conical shape diverging with increased distance from the base. The essential novelty of the present batteries resides in the application of a hydrophobic insulating coating of a chlorotrifluoro olefin polymer, preferably a copolymer of ethylene and chlorotrifluoro ethylene, over the interior and exterior surfaces of the conical side wall of each bipolar plate.

5861221
BATTERY SHAPED AS A MEMBRANE
STRIP CONTAINING SEVERAL CELLS

Ledjeff Konstanti; Nolte Roland Bad Krozingen,
 GERMANY assigned to Fraunhofer Gesellschaft Zur
 Forderung der Angewandten Forschung E V

PCT No. PCT/DE94/00888 Sec. 371 Date Mar. 22,
 1996 Sec. 102(e) Date Mar. 22, 1996 PCT Filed Jul. 27,
 1994 PCT Pub. No. WO95/04382 PCT Pub. Date Feb.
 9, 1995. An electrochemical cell has at least one
 membrane strip that forms a central area and at least
 two, maximum 10,000 flat individual cells. The
 individual cells consist each of an electrode layer applied
 on both sides of a membrane made of a polymer solid

electrolyte and of a corresponding number of flat
 electronically conductive areas. The individual cells are
 connected in series and the central area is provided with
 an appropriate periphery in the cell.

5861701
CHARGED-PARTICLE POWERED
BATTERY

Young Robert D; Hageman John P; Light Glenn M;
 Seale Stephen W San Antonio, TX, UNITED STATES
 assigned to Southwest Research Institute

An improved high energy-density battery for producing
 continuous low-voltage electrical energy is powered by
 direct conversion of the kinetic energy of charged
 particles to electrical potentials. An improved battery
 comprises at least one primary energy source and a
 plurality of cells, each cell comprising a secondary
 electron emitter plate spaced apart from a collector plate.
 Cells are configured to maximize the number of
 relatively low-energy secondary electrons from the
 emitter plates which reaches and is retained by collector
 plates. Heat production is minimized during efficient
 energy conversion of the relatively high-energy of
 primary charged particles to the lower energy but
 relatively high current capacity of large numbers of
 secondary electrons. Material work functions and Fermi
 levels of the emitters and collectors are chosen to favor
 emission of secondary electrons from emitter plates and
 retention of secondary electrons impinging on a collector
 plate, thus increasing efficiency and reducing internal
 battery leakage currents. Relatively low cell voltages and
 low heat losses in the direct conversion process mean
 that the energy sources may be confined in relatively
 small packages suitable for powering (and mounting in
 close proximity to) electronic microcircuits and sensors.

5856042
ELECTROCHEMICAL CELLS USING A
POLYMER ELECTROLYTE

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

A cathode is comprised of a major amount of active
 cathode material and a binding amount of an ionically
 nonconductive prepolymeric composition. Polymer
 electrolyte electrochemical cells can be made using these
 cathodes.



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