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Journal of Power Sources

*LEAD-ACID***6447954****HIGH ENERGY, LIGHT WEIGHT, LEAD-ACID STORAGE BATTERY**

John B. Timmons; Joseph A. Orsino; Ramesh Bhardwaj; USA assigned to Concorde Battery Corporation

Light weight, low resistance electrode plates for lead-acid batteries are formed from a highly conductive non-lead substrate such as aluminum or copper, coated with a continuous layer of a corrosive resistant conductive materials, such as lead, applied from a fused salt bath.

*BATTERY MATERIALS***6440181****METHOD OF SELECTING MANGANESE DIOXIDE FOR USE IN A CATHODE**

William Bowden; Klaus Brandt; James J. Cervera; Hyoun Sook Choe; Rimma A. Sirotna; Joseph Sunstrom; USA assigned to The Gillette Company

A method of making a cathode includes determining a sample of manganese dioxide having a power coefficient greater than about 3.4, and incorporating the sample of manganese dioxide into the cathode. The cathode can be incorporated into a battery, e.g. a cylindrical primary alkaline battery.

6440611**MICROCAPILLARY BATTERY SEPARATOR INCLUDING HOLLOW FIBERS, AND STORAGE BATTERY INCORPORATING SAME**

Kenneth O. MacFadden; Gordon W. Jones; Lixin L. Xue; Ronald P. Rohrbach; Daniel E. Bause; Peter D. Unger; Gary B. Zulauf; USA assigned to Honeywell International Inc.

A battery separator, for placement between conductive plates within a battery, includes a non-woven fiber mat made up of one or more non-woven fibers, which have a specific cross-sectional shape and exhibit a microcapillary action. The fibers are preferred to be made of a thermoplastic selected from the group consisting of polyolefins, fluoropolymers, polyimides, polysulfones, polyesters, polyamides, and mixtures thereof each of the fibers includes an outer surface, a hollow internal cavity, and an extended slot. The hollow internal cavity communicates with the outer surface by way of the extended slot. Capillary forces within the fibers are greater than those on the fiber surface, such that a liquid electrolyte readily moves through the interior of the fiber via a wicking action. As a result, the battery separator tends to direct fluid to adjacent battery plates even when an electrolyte level, within the battery, drops below the tops of the plates.

6444347**GAS DIFFUSION ELECTRODE AND APPLICATION TO CATALYZED ELECTROCHEMICAL PROCESSES**

Ludovic Ouvry; Nathalie Nicolaus; Philippe Parmentier; France assigned to Messier-Bugatti

A gas diffusion electrode comprises a cloth of activated carbon fibers having a first face coated in a hydrophobic material and a second face on which particles of catalyst are fixed directly and are dispersed in substantially uniform manner over the fibers. The electrode can be used in an electrochemical cell of a proton exchange membrane fuel-cell battery, or in an electrochemical reactor, e.g. for making chlorine and caustic soda.

6444367**DURABLE HYDROPHILIC NON-WOVEN MAT FOR RECHARGABLE ALKALINE BATTERIES**

Larry L. Kinn; Ashish Mathur; Gregory Neil Henning; Timothy L. Ritter; USA assigned to Ahlstrom Mount Holly Springs, LLC

A battery separator material comprising a non-woven web of a wettable fiber matrix, wherein the wettable fiber matrix are thermoplastic polymeric fibers blended with at least one hydrophilic melt additive. In alternate embodiments, the non-woven web further includes binder fibers which may be wettable or non-wettable or combinations of both.

6447739**METHOD FOR PRODUCING LITHIUM TRANSITION METALLATES**

Ulrich Krynitz; Wolfgang Kummer; Mathias Benz; Juliane Meese-Marktscheffel; Evelyn Pross; Viktor Stoller; Germany assigned to H.C. Starck GmbH and Company KG

The invention relates to a method for producing lithium transition metalates of the general formula (I): $Li_x(M1_y M2_{1-y})_n O_{nz}$, where M1 represents lithium, cobalt or manganese; M2 represents cobalt, iron, manganese or aluminum and is not equal to M1; n is equal to 2 if $M1 = M$, and 1 in all other cases; x is a number between 0.9 and 1.2; y is a number between 0.5 and 1.0; and z is a number between 1.9 and 2.1. According to the method, an intimate solid mixture is produced of oxygen-containing compounds of the transition metals and oxygen-containing lithium compounds and this mixture calcinated in a reactor, whereby calcination takes place at least partly at an absolute pressure of less than 0.5 bar.

6447950**ELECTRODE FOR BATTERY, METHOD OF MANUFACTURING THE SAME AND BATTERY**

Tadayoshi Iijima; Japan assigned to TDK Corporation

An electrode for a battery in which a collector and an electrode tab are connected with a novel connection structure without impairing electrical connection, and a method of manufacturing the electrode quite simply are provided. Further, a battery having this electrode for the battery is provided. A collector and a tab are connected via a graphite layer. The graphite layer is formed on the surface of the collector to be connected with the tab and/or the surface of the tab to be connected with the collector, the portions to be connected of the collector and the tab are overlapped on each other with the graphite layer interposed between the collector and the tab, and a pressure is applied to the overlapped portions to connect the collector with the tab. It is preferable that the collector is made of a conductive thin film formed on a resin film.

6447958

NON-AQUEOUS ELECTROLYTE BATTERY SEPARATOR

Yasuo Shinohara; Yoshifumi Tsujimoto; Tsuyoshi Nakano; Japan assigned to Sumitomo Chemical Company Ltd.

A non-aqueous electrolyte battery separator comprising a heat-resistant nitrogen-containing aromatic polymer and a ceramic powder.

6441216

METHOD OF PREPARING LITHIUM COMPLEX SALTS FOR USE IN ELECTROCHEMICAL CELLS

Andrei Leonov; Armin de Meijere; Michael Schmidt; Germany assigned to Merck Patent Gesellschaft mit beschränkter Haftung

The invention relates to a method of preparing lithium complex salts and their intermediaries and to the use of these in electrolytes.

6447952

POLYMER ELECTROLYTES

Ella F. Spiegel; Anthony F. Sammells; Kresimir Adamic; USA assigned to Eltron Research Inc.

This invention provides alkali ion conducting polymer electrolytes with high ionic conductivity and elastomeric properties suitable for use in high energy batteries. The polymer electrolytes are cyclic carbonate-containing polysiloxanes that can be modified with a cross-linker or chain extender, and an alkali metal ion-containing material dissolved in the carbonate-containing polysiloxane. The cyclic carbonate-containing polysiloxanes may be prepared by reacting derivatized polysiloxanes with chain extending and/or cross-linking agents. The invention also provides batteries prepared by contacting an alkali metal anode with an alkali metal intercalating cathode and an alkali ion-conducting polymer electrolyte. As one example, polymers prepared from poly{3[2,3-(carbonyldioxy)propoxy]propyl}methyl

siloxane, a polysiloxane with cyclic carbonate side chains, have shown promising results for battery applications. This polymer was cross-linked with methyltriacetoxysilane and incorporates lithium trifluoromethanesulfonate into the polymer matrix as the ion conductor. Polymers were prepared using various solvent systems and temperatures in order to produce a polymer film with the desired properties for this application. Each polymer made from the precursor poly{3[2,3-(carbonyldioxy)propoxy]propyl}methyl siloxane exhibits a glass transition temperature (T_g) in the range of -100 to -70 °C and ionic conductivity of 6.5×10^{-5} at 25 °C and 5.3×10^{-4} at 60 °C which indicates that this material has distinct possibilities in lithium battery applications. Materials are flexible and readily adhere to the electrode surface. Polymers are synthesized by initially forming alkyl chains which include an ester carbonic acid group. The ester carbonic acid contains the ether oxygen within the single phase polymer matrix which facilitates the ionic dissociation of lithium salts. Ester carbonic acid groups are formed by the transesterification of alkyl diols such as 3-(allyloxy)-1,2-propanediol and 1,2-hexanediol with diethyl carbonate. This reaction produces ester carbonic acids with reactive end groups such as alkyls and alkanes which can then be further reacted to form dihalide end groups. Reactive groups on the ester carbonic acid are then reacted with various polymethyl siloxanes which serve as the polymer backbone for single phase elastomeric polymers which readily dissolve lithium salts.

6447957

METAL FOIL FOR COLLECTOR AND METHOD OF MANUFACTURING THE SAME, COLLECTOR FOR SECONDARY BATTERY AND SECONDARY BATTERY

Hiroyuki Sakamoto; Hiroshi Tada; Toshihisa Tamai; Japan assigned to Toyo Aluminum Kabushiki Kaisha

A collector for a secondary battery includes a metal foil having throughholes shaped or arranged to achieve an increased hole area ratio to improve an active material's adhesion thereto. A throughhole in the metal foil has a largest dimension of at least 1.55 mm, and the foil has a hole area ratio of at least 40%, and a thickness of at least 5 μ m and at most 200 μ m. The throughhole has a peripheral shape including two substantially straight sides that extend along lines intersecting with each other on their respective extensions to form an acute angle at a corner of the throughhole. To form the metal foil, a resist film with a predetermined pattern is arranged on a solid foil, and is used as a mask to etch the foil to provide the plurality of throughholes penetrating the foil.

FUEL-CELL

6444343

POLYMER ELECTROLYTE MEMBRANES FOR USE IN FUEL-CELLS

G.K. Surya Prakash; George A. Olah; Marshall C. Smart; Sekharipuram R. Narayanan; Qungie J. Wang; Subbarao Surumpudi; Gerald Halpert; USA assigned to University of Southern California

A polymer electrolyte membrane composed of polystyrene sulfonic acid (PSSA) cross-linked within a poly(vinylidene fluoride) (PVDF) matrix is provided. This membrane exhibits low methanol crossover which translates to higher fuel and fuel-cell efficiencies. A fuel-cell comprising a PSSA-PVDF membrane is also provided. Further, methods of decreasing the fuel crossover rate, enhancing fuel-cell efficiency, and enhancing electrical performance of a fuel-cell are provided.

6444344

MATERIAL FOR FUEL-CELL SEPARATOR AND FUEL-CELL SEPARATOR MADE FROM SAID MATERIAL

Kazuo Saito; Atsushi Hagiwara; Japan assigned to Nishinbo Industries Inc.

The present invention provides a material for a fuel-cell separator obtained by molding a mixture containing at least a conductive powder and a binder which is a rubber-modified phenolic resin, and a fuel-cell separator made from the above material. The material for fuel-cell separator alleviates the problems of the prior art, is superior in impact resistance or tenacity, causes no rupture or the like when made into a thin plate and used in a fuel-cell, and is equivalent to conventional products in density and electrical properties.

6444345

FUEL-CELL SYSTEM

Jochen Sang; Germany assigned to Xcellsis GmbH

A fuel-cell system includes at least one fuel-cell unit which is accommodated in a fuel-cell enclosure. A cathode gas delivery line, cold-start gas delivery line, a cathode off-gas return line, anode off-gas return line may also be provided. According to the invention, the system is equipped with at least one Coanda flow amplifier in order to amplify the air stream for the purpose of ventilating the fuel-cell enclosure, a cathode gas stream, a cold-start gas stream, a recirculated cathode off-gas stream or a recirculated anode off-gas stream. The may be equipped with a ventilating means for a housing outside the fuel-cell enclosure. In the housing are components of the fuel-cell system, said ventilating means including a Coanda flow amplifier.

6444346

FUEL-CELLS STACK

Hideo Ohara; Makoto Uchida; Yasushi Sugawara; Japan assigned to Matsushita Electric Industrial Company Ltd.

In a polymer electrolyte membrane type fuel-cell employing a high polymer ion exchange membrane as an electrolyte, a

fuel-cells stack is produced at a low cost by easily constituting flow passages for a fuel gas, an oxidizing agent gas and a cooling water which have been conventionally constituted by a cutting process being hard to process and hard to reduce a cost. The fuel gas passage, the oxidizing agent gas flow passage and the cooling water flow passage are constructed by a combination of a diffuser constituted by a conductive porous body or a corrugated plate and an elastic gasket, whereby a cutting process is not required, and a number of parts can be reduced and an operating performance can be improved by integrally forming the gasket with the separator, so that a cost can be reduced.

6447940

EVAPORATION CONTROL METHOD FOR LIQUID FUEL IN FUEL-CELL SYSTEM

Kenichirou Ueda; Japan assigned to Honda Giken Kogyo Kabushiki Kaisha

An evaporation control method for liquid fuel in a fuel-cell system, the fuel-cell system comprising: a fuel reforming apparatus formed of an evaporator for evaporating liquid fuel, a reforming device for making gas evaporated by the evaporator react by a solid catalyst to form fuel gas, and a CO removing device for removing carbon monoxide from the fuel gas generated by the reforming device; a fuel-cell for making hydrogen in the fuel gas provided from the fuel reforming apparatus react with oxygen provided from an oxidizing agent providing means to generate electric power; and a burner for burning off-gas of an anode of the fuel-cell to generate combustion gas to be a heating source of the evaporator, in which a temperature detector 8 for detecting temperature is provided at a bottom of an evaporation chamber of the evaporator 1 and a supply amount of the liquid fuel to the evaporator 1 is reduced and controlled from a supply amount (command value) corresponding to a required load amount of the fuel-cell 103 in accordance with the detected temperature.

6447941

FUEL-CELL

Norihiro Tomimatsu; Hideyuki Ohzu; Yoshihiro Akasaka; Kazuhiro Yasuda; Masahiro Takashita; Japan assigned to Kabushiki Kaisha Toshiba

Disclosed is a fuel-cell in the form of stacked unit cells each having a power generating section composed of a fuel electrode, an oxidant electrode, and an electrolyte plate held therebetween, which are placed on top of the other. In this fuel-cell, a liquid fuel is introduced into each unit cell by the capillary action and evaporated in each unit cell in a fuel evaporating portion, so that the fuel electrode is supplied with the evaporated fuel.

6447943

FUEL-CELL WITH PROTON CONDUCTING MEMBRANE WITH A PORE SIZE LESS THAN 30 nm

Emanuel Peled; Tair Duvdevani; Avi Melman; Adi Aharon; Israel assigned to Ramot University Authority for Applied Research and Industrial Development Ltd.

The present invention provides improved, low-cost fuel-cells having reduced fuel crossover, reduced sensitivity to metal ion impurities and ability to operate under a broad range of temperatures. Additionally, new effective organic fuels are described for use in such fuel-cells. The invention further provides improved methods for catalyst preparation and a new integrated flow field system for use in H_2/O_2 fuel-cells. The fuel-cell includes a proton conducting membrane having pore diameters which are essentially smaller than 30 nm.

6448535

**COOLING DEVICE FOR ELECTRIC VEHICLE
WITH FUEL-CELL**

Ngy Srun Ap; France assigned to Valeo Thermique Moteur

A cooling device for a vehicle with an electric motor powered by a fuel-cell has a first cooling loop suitable for cooling the fuel-cell and traversed by a first cooling fluid, a second cooling loop suitable for cooling at least the electric motor and traversed by a second cooling fluid, and a heat exchanger interposed between the first cooling loop and the second cooling loop.

6447942

ALKALINE FUEL-CELL

Stanford R. Ovshinsky; Srinivasan Venkatesan; Boyko Aladjov; Rosa T. Young; Thomas Hopper; USA assigned to Energy Conversion Devices Inc.

A fuel-cell which has the ability to start up instantly and can accept recaptured energy such as that of regenerative braking by operating in reverse as an electrolyzer. The instant startup fuel-cells have increased efficiency and power availability (higher voltage and current) and a dramatic improvement in operating temperature range of about -20 to 150 °C.

6447944

**SOLID ELECTROLYTE, METHOD OF PRODUCING
SAME AND FUEL-CELL USING SAME**

Yoshio Akimune; Mikiya Shinohara; Fumio Munakata; Japan assigned to Nissan Motor Company Ltd.

A solid electrolyte used in a cell and represented by the following formula: where Ln is at least one element selected from the group consisting of Gd, Sm and Nd; A is Ba; B is Mg; x is 0.1; y is 0.1; and z is 0.2, wherein the solid electrolyte is formed of particles whose mean diameter is within a range of from 4 to 10 μ m, the solid electrolyte being produced by a method comprising: (a) mixing lanthanum oxide, gallium oxide, oxide of at least one rare earth element selected from the group consisting of Gd, Sm and

Nd, barium oxide and magnesium oxide to form a mixture; (b) firing the mixture in air at a temperature ranging from 1100 to 1200 °C for a time ranging from 2 to 8 h to accomplish synthesizing a compound material; (c) pulverizing the compound material; (d) compacting the pulverized compound material; (e) adjusting mean diameter of the pulverized compound material within a range of from 0.5 to 0.8 μ m; and (f) sintering the compacting compound material in air at a temperature ranging from 1400 to 1500 °C for a time ranging from 2 to 8 h to form the solid electrolyte.

LITHIUM BATTERIES

6440610

**NEGATIVE ACTIVE MATERIAL FOR LITHIUM
SECONDARY BATTERY AND MANUFACTURING
METHOD OF SAME**

Kyou-Yoon Sheem; Sang-Young Yoon; South Korea assigned to Samsung SDI Company Ltd.

The present invention relates to a negative active material for a lithium secondary battery and a manufacturing method thereof, wherein the negative active material comprises a crystalline or amorphous carbon core, a catalyst layer formed on the core, and carbon vapor growing fiber or carbon nanotubes. The negative active material not only forms a fine path between active materials but also improves conductivity between neighboring active materials so that a battery having improved high rate and cycle life characteristics can be provided, since carbon vapor growing fiber or carbon nanotubes are formed on a surface layer of the negative active material.

6443999

**LITHIUM CELL WITH HEAT FORMED
SEPARATOR**

Reynald A. Cantave; Fred J. Berkowitz; William T. McHugh; Jane A. Blasi; Ernesto Figueira; USA assigned to The Gillette Company

A primary lithium cell having a wound electrode assembly. The electrode assembly comprises an anode comprising lithium, a cathode comprising a manganese dioxide and an electrolyte permeable separator therebetween. The electrode assembly comprises a cathode sheet, an anode sheet and electrolyte permeable separator sheet therebetween. The sheets are wound into a spiral roll. An exposed edge of each revolution of the separator sheet is then heat treated, for example, by applying a heated platen thereto to mold said exposed edge into a continuous separator membrane. The continuous separator membrane, so formed, covers and seals off said edge of adjacent revolutions of the cathode sheet, and thus provides electrical insulation therefor. The electrode assembly can then be inserted into the cell casing so that the continuous separator membrane abuts a surface of

the casing and provides electrical insulation between the casing and the wound cathode sheet. This reduces the total amount of electrical insulation needed between the cell casing and wound electrodes and thereby frees up void volume which can be used for additional active material, for example, by making the anode and cathode sheets wider.

6444356

LITHIUM BATTERY WITH SECONDARY BATTERY SEPARATOR

Jackson C. Ma; El-Sayed Megahed; Timothy J. Stachowiak; Shirley A. Craanen; Daniel A. Schneider; Joseph P. Nestler; USA

A secondary battery separator comprises a fibrous core coated with a polymer having improved electrode adhesion properties in unitary laminated construction. Vacuum removal of plasticizer without solvent extraction prevents brittleness and results in microporosity in a thin layer of enhanced ion conductivity.

6444368

LITHIUM BATTERY COMPRISING A GEL-ELECTROLYTE

Rifat Ata Mustafa Hikmet; Hans Feil; The Netherlands assigned to Koninklijke Phillips Electronics N.V.

A lithium battery includes a negative-electrode, a positive-electrode, a separator, and a non-aqueous electrolyte solution between the negative and the positive-electrodes. At least, the negative-electrode material and the positive-electrode material are provided with a pattern of holes which accommodate a polymeric material which sticks and presses the negative-electrode, the positive-electrode and the separator together. In order to decrease the tendency of the electrolyte solution to sublime, thereby expanding the packaging material around the battery, the non-aqueous electrolyte solution comprises a solution of lithium salts, solvent molecules and a polymer, forming a gel-electrolyte.

6444369

GELLED POLYMER ELECTROLYTE LITHIUM SECONDARY CELL

Maruo Kamino; Ryuji Ohshita; Hiroshi Nakajima; Makoto Uesugi; Toshiyuki Nohma; Koji Nishio; Japan assigned to Sanyo Electric Company Ltd.

The battery of this invention includes a positive-electrode including a gelled polymeric electrolyte (A) and using spinel type lithium manganese oxide as an active material; a negative-electrode; a gelled polymeric electrolyte (B) in the shape of a film or sheet also serving as a separator, and both the gelled polymeric electrolyte (A) and the gelled polymeric electrolyte (B) are made from a polymer of poly(alkylene oxide) series impregnated with a liquid electrolyte. Since the battery includes the positive-electrode

using the specific gelled polymeric electrolyte (A), a contact area between the positive-electrode active material and the gelled polymeric electrolyte is large, so as to attain large initial discharge capacity (at high rate discharge in particular). Also, since the battery includes the specific gelled polymeric electrolyte (B) as the electrolyte, manganese included in the spinel type lithium manganese oxide is minimally eluted, and hence, the discharge capacity is minimally degraded during charge-discharge cycles due to elution of manganese, resulting in attaining good charge-discharge cycle performance.

6447669

RECYCLING OF GALVANIC CELLS

Michael Jonathan Lain; Great Britain assigned to Accentus Plc

Lithium-ion cells in which the cathode contains a particulate insertion material and a binder are cut open in a dry, inert atmosphere. The cell components are treated with a first organic solvent to dissolve the electrolyte, so that this can be reused. They are then treated with a second organic solvent to dissolve the binder, and the particulate material separated from the solution of binder. The insertion material is then reduced so that it does not contain intercalated lithium. The reduction process may be performed electrolytically.

6444365

GRAPHITE PARTICLES AND LITHIUM SECONDARY BATTERY USING THE SAME AS NEGATIVE-ELECTRODE

Yoshito Ishii; Tatsuya Nishida; Atsushi Fujita; Kazuo Yamada; Japan assigned to Hitachi Chemical Company Ltd.

A graphite particle obtained by assembling or binding together a plurality of flat-shaped particles so that the planes of orientation are not parallel to one another, or a graphite particle in which aspect ratio is 5 or less or specific surface area is $8 \text{ m}^2/\text{g}$ or less or the size of crystallite in the direction of *c*-axis of the crystal is 500 \AA or more and the size of crystallite in the direction of plane is 1000 \AA or less as measured by X-ray broad angle diffraction, or a graphite particle in which pore volume of the pores having a size falling in a range of 10^2 – 10^6 \AA is 0.4 – $2.0 \text{ cm}^3/\text{g}$ per weight of graphite particle or pore volume of the pores having a size falling in a range of 1×10^2 to $2 \times 10^4 \text{ \AA}$ is 0.08 – $0.4 \text{ cm}^3/\text{g}$ per weight of graphite particle is suitable for production of negative-electrode of lithium secondary battery, and a lithium secondary battery obtained therefrom is excellent in rapid charge-discharge characteristics, cycle characteristics, etc.

6447946

LITHIUM-ION BATTERY

Kenji Nakai; Takeshi Nakano; Kensuke Hironaka; Koji Higashimoto; Kenji Hara; Katsunori Suzuki; Tomohiro

Iguchi; Japan assigned to Shin-Kobe Electric Machinery Company Ltd.

A cylindrical lithium-ion battery with high safety, high capacity and high power has a winding group having a positive-electrode, a negative-electrode and at least one separator, and a connecting portion for connecting to respective terminals from the winding group accommodated in a battery container, and which is provided with an inner pressure-reducing mechanism for discharging gas according to an increase in inner pressure inside the battery container. The positive-electrode includes a collector whose both surfaces are applied with composing material including lithium-manganese complex oxide, the thickness of the composing material on the both surfaces of the collector is at least 210 μm and the amount of the active material per one surface of the collector is at least 240 g/m^2 . The compounding ratio of the lithium-manganese complex oxide in the composing material is preferably at least 80 wt. %.

6447955

**LITHIUM SECONDARY BATTERY WITH A
NEGATIVE-ELECTRODE OF HEAT-TREATED
NATURAL GRAPHITE**

Masatoshi Takahashi; Ryuji Ohshita; Koji Ueno; Koji Nishio; Toshihiko Saitoh; Japan assigned to Sanyo Electric Company Ltd.

A lithium secondary battery comprises a natural graphite as a negative-electrode capable of occluding and discharging lithium-ion, in which the natural graphite has been heat treated at a temperature of from 2400 to 3000 $^{\circ}\text{C}$. The heat treatment removes impurities from natural graphite. As a result, the electrolyte solution used for the battery hardly decomposes during charge and discharge and self discharge hardly occurs during storage of the battery.

6447956

**GRAPHITE PARTICLES AND LITHIUM
SECONDARY BATTERY USING THE SAME AS
NEGATIVE-ELECTRODE**

Yoshito Ishii; Tatsuya Nishida; Atsushi Fujita; Kazuo Yamada; Japan assigned to Hitachi Chemical Company Ltd.

A graphite particle obtained by assembling or binding together a plurality of flat-shaped particles so that the planes of orientation are not parallel to one another, or a graphite particle in which aspect ratio is 5 or less or specific surface area is 8 m^2/g or less or the size of crystallite in the direction of *c*-axis of the crystal is 500 \AA or more and the size of crystallite in the direction of plane is 1000 \AA or less as measured by X-ray broad angle diffraction, or a graphite particle in which pore volume of the pores having a size falling in a range of 10^2 – 10^6 \AA is 0.4–2.0 cm^3/g per weight of graphite particle or pore volume of the pores having a size falling in a range of 1×10^2 to 2×10^4 \AA is 0.08–0.4 cm^3/g

per weight of graphite particle is suitable for production of negative-electrode of lithium secondary battery, and a lithium secondary battery obtained therefrom is excellent in rapid charge-discharge characteristics, cycle characteristics, etc.

COMPONENTS AND/OR CHARGERS

6437539

**METHOD AND DEVICE FOR BALANCING
CHARGES OF A PLURALITY OF SERIES-
CONNECTED BATTERY CELLS**

Dan Hakan Lennart Olsson; Geoffrey John Dudley; The Netherlands assigned to Agence Spatiale Europeenne

A method and device for balancing the charges of a plurality of series-connected battery cells, the device comprising a current dissipative loop connected across the terminals of each battery cell, the voltage across each battery cell being measured, the average value of the measured voltages being determined, the measured voltage being then compared to the average value, and the measured voltage of each battery cell being adjusted to the average value so as to equalize charges of all battery cells.

6437541

**BATTERY STATE MONITORING CIRCUIT AND
BATTERY DEVICE**

Atsushi Sakurai; Japan assigned to Seiko Instruments Inc.

A battery state monitoring circuit in a battery device has a structure such that both of a detection delay when the battery device enters the respective protective states of over-charge, over-discharge and over-current, and a release delay when the battery device is released from the respective protective states are ensured.

6437542

PRESSURE-BASED BATTERY CHARGING

Bor Yann Liaw; Xiao-Guang Yang; USA

Battery charge control protocols and methodologies to use pressure-based controls and algorithms to properly terminate battery charging processes.

6437543

**METHOD AND SYSTEM FOR EXTENDING
BATTERY LIFE BY MONITORING TEMPERATURE
DURING CHARGING**

Van Oler; David Mai; Ken Kelly; USA assigned to Palm Inc.

A system for controlling battery charging. The system comprises a battery charging device, a temperature sensor, and a controller. The battery may be a Lithium polymer battery, or the like. The temperature sensor senses the battery temperature and outputs a temperature data signal. The

controller inputs the temperature data signal and determines if the temperature data is outside of a range with an upper limit and lower limit. If so, the controller disables the battery charging circuit, wherein the battery is prevented from being charged. In this fashion, the battery's lifetime (e.g. number of charge/discharge cycles) is extended. In another embodiment, the system further comprises a display. The controller outputs a signal to the display, directing it to display a message indicating that the battery is not being charged because the temperature is out of the pre-determined range.

6441585

APPARATUS AND METHOD FOR TESTING RECHARGEABLE ENERGY STORAGE BATTERIES

Kevin I. Bertness; USA assigned to Midtronics Inc.

An improved battery testing system and method is disclosed. The system measures an open circuit voltage and a dynamic parameter of a test battery, and uses those measurements, along with correlation data stored in memory, to determine a physical condition and/or charge state of the battery. The measured dynamic parameter may be scaled based on the rating of the test battery. Also, a high current load pulse may be applied to the test battery and a wait period implemented before the open circuit voltage is measured. In addition, the charge state may be determined from a state of charge value, and categorized into one of several charge state ranges. In one embodiment, the state of charge value is determined from the relative distance along a curve, represented by the correlation data stored in memory, that the measured open circuit voltage is not greater than or equal to such correlation data.

6445161

CYCLIC BATTERY CHARGER USING CONTINUOUS BATTERY DISCHARGE

Ron Papiska; Kevin Dotzler; USA assigned to Denso Corporation

A cyclic battery charger reduces the formation of the ionic barrier in a battery. The battery charger applies a current to the battery for a first period of time. To reduce the ionic barrier, a discharge current is applied to the battery for a second period of time. The charging current and discharging current are applied cyclically to the battery during the entire charging period. The discharge current may be applied by the battery charger, or may be the result of the current drawn from the powered device. The discharge current may be a fraction of the charging current, and is applied to the battery for only a limited time during the charging cycle as compared to the charging current.

6445162

DETECTING A REMAINING BATTERY CAPACITY AND A BATTERY REMAINING CAPACITY CIRCUIT

Hiroshi Mukainakano; USA assigned to Quallion LLC

A battery circuit, including a secondary battery, a storage capacitor, two switches and two voltage monitor circuits, detects a remaining capacity of the secondary battery and sends out data indicative of the remaining capacity to outside of the battery circuit. A first switch connects a secondary battery to a storage capacitor. A second switch connects the other end of the first switch to the storage capacitor and a load. A storage capacitor voltage monitor circuit measures voltage of the storage capacitor. The first switch is then turned ON and a current from the battery is transferred to the storage capacitor. At this time, the second switch is OFF. Then, the first switch is then turned OFF, and voltage of the storage capacitor indicative of the voltage of the secondary battery is measured. Then, the second switch turns ON and the current flows from the storage capacitor to the external load. The voltage across the capacitor is measured again and the remaining capacity of the battery can be accurately determined.

6441588

BATTERY CHARGING CONTROL METHOD EMPLOYING PULSED CHARGING AND DISCHARGING OPERATION FOR HEATING LOW-TEMPERATURE BATTERY

Kazuhiko Yagi; Takashi Ishikura; Japan assigned to Honda Giken Kogyo Kabushiki Kaisha

A battery charging control method is disclosed, which can reduce the charging time a low-temperature battery without providing an additional heating system. The method includes executing a first pulsed charging and discharging operation when the battery temperature T is lower than a first predetermined temperature (e.g. $0\text{ }^{\circ}\text{C}$), wherein the amount of charging is equal to the amount of discharging; and switching from the first pulsed charging and discharging operation to a second pulsed charging and discharging operation when the battery temperature exceeds the first predetermined temperature, wherein in the second pulsed charging and discharging operation, the amount of discharging is less than the amount of charging. Therefore, it is possible to accomplish not only heating but also charging. When the battery temperature T exceeds a second predetermined temperature (e.g. $10\text{ }^{\circ}\text{C}$), a normal charging operation is performed.

6448776

METHOD FOR MEASURING FITNESS FOR USE OF A STORAGE BATTERY SUBJECT TO ELECTRIC LOADING

Eberhard Meissner; Sigmar Brauningner; Germany assigned to VB Autobatterie GmbH

A method for measuring fitness for use of a storage battery subject to electric loading including determining a load profile (current profile $I(t)$ or power profile $P(t)$) as a function of time t , for the storage battery, recording an actual voltage response $U(t)$ of the storage battery to the

load profile or calculating a voltage response $U(t)$ of the storage battery to the load profile, and determining a fitness for use value SOH for the storage battery based on the difference between a lowest (highest) voltage value U_{\min} (U_{\max}) during application of the load profile to the storage battery, and based on a voltage limiting value U_1 , wherein U_1 is a voltage value which may not be undershot (overshot) by the voltage $U(t)$ at any time t during which the load profile is applied to the storage battery.

OTHER BATTERIES

6436571

BOTTOM SEALS IN AIR DEPOLARIZED ELECTROCHEMICAL CELLS

Joseph Lynn Passaniti; Susan Jean Launder; John Edward Oltman; Robert Brian Dopp; Gregory Scott Moy; Michael Andrew Ward; USA assigned to Rayovac Corporation

An elongate, generally tubular, air depolarized electrochemical cell comprising a cathode, including an air cathode assembly, extending about the tubular circumference, and along the tubular length, of the cell, an anode, a separator between the anode and the cathode, electrolyte, a top closure member, and a bottom closure member. The cathode assembly is fixedly held, by a friction fit, in a slot at the bottom of the cell. The slot can be developed, for example, by inner and outer walls of a cathode can, by inner and outer walls of a bottom closure member, or by an outer wall of a cathode can and an opposing outer wall of a plug on the interior of the cell. Preferably, bottom closure structure of the cell and receives a bottom edge portion of the cathode current collector, and makes electrical contact with, the bottom edge portion, preferably at an inner surface of the cathode current collector. A diffusion member of the cathode assembly is preferably compressed as a seal, at the bottom of the cell, between an outer side wall of the cell and the remainder of the cathode assembly. The diffusion member is also used at least as an assist in sealing the cell against electrolyte leakage from the anode cavity and past the cathode assembly. Various embodiments comprehend a variety of bottom seal members between the bottom wall and the electroactive anode material, typically in combination with a bottom slot receiving the cathode assembly adjacent an outer side wall of the bottom closure member.

6440606

NON-AQUEOUS ELECTROLYTE BATTERY

Hiroshi Yoshizawa; Takayuki Shirane; Yoshiaki Nitta; Kazuhiro Okamura; Japan assigned to Matsushita Electric Industrial Company Ltd.

To present a non-aqueous electrolyte secondary battery using iron compound which is inexpensive and abundant in resource, as the active material for the positive-electrode. An iron compound with particle size of 1–300 nm or less,

being composed of substantially spherical primary particles of pore-free matter, is used as the active material for a positive-electrode, which is used together with a negative-electrode and a non-aqueous electrolyte for composing the battery. By forming the primary particles for composing particles of the iron compound as a pore-free matter, being controlled in a range of 1–300 nm, nano-effects are brought about, and it is also effective to suppress excessive increase of surface area which may lead to promotion of decomposition of electrolyte, and an excellent discharge capacity is realized stably for a long period.

6444351

SOLID ELECTROLYTE BATTERY

Shuji Goto; Japan assigned to Sony Corporation

A solid-electrolyte battery incorporating an elongated electrode; a positive-electrode lead connected to the positive-electrode such that its long side is substantially in parallel with the widthwise direction of the positive-electrode and formed into a rectangle-like shape; an elongated negative-electrode disposed opposite to the positive-electrode; a negative-electrode lead connected to the negative-electrode such that its long side is substantially in parallel with the widthwise direction of the negative-electrode and formed into a rectangle-like shape; and a solid electrolyte layer formed on at least either surface of the positive-electrode and the negative-electrode, wherein the positive-electrode and the negative-electrode are laminated such that the surfaces on each of which the solid electrolyte layer is formed are disposed opposite to each other and wound in the lengthwise direction so as to be accommodated in a case of the solid-electrolyte battery, and a short side of at least either of the positive-electrode lead or the negative-electrode lead which is connected to the positive-electrode or the negative-electrode such that the short side is disposed opposite to the lengthwise end of the positive-electrode or the negative-electrode is shifted inwards as compared with the lengthwise end of the positive-electrode or the negative-electrode.

6444354

LOW IMPEDANCE FOLDED POLYMERIC LAMINATE RECHARGEABLE BATTERY AND METHOD OF MAKING

Paul C. Warren; USA assigned to Valence Technology Inc.

Single cell laminated polymeric rechargeable battery sheets are folded in irregularly alternating directions about parallel fold axes to provide battery cell structures presenting available terminal locations requiring reduced collector element current travel distance to thereby significantly reduce battery impedance. An embodiment enables the use of equilateral cell sheets which are folded about orthogonal axes in two dimensions to yield battery cells with exceptionally high ratios of active area to collector-origin impedance.

6444357**NON-AQUEOUS ELECTROLYTE SECONDARY BATTERY**

Chika Kambe; Kouichi Zama; Japan assigned to NEC TOKIN Corporation

A plurality of slit-shaped space regions are provided on an anode active material layer on a front surface or a rear surface of an anode sheet so as to reach end planes to make it easy to inject an electrolyte into a scrolled body or a jelly roll of a non-aqueous electrolyte secondary battery through the slit-shaped space regions.

6444359**LIQUID ELECTROLYTE SOLUTION INCLUDING A HALOGENATED AND ALIPHATIC POLYOLEFIN DISSOLVED THEREIN AND SECONDARY BATTERY**

Masaharu Satoh; Hiroshi Yageta; Yutaka Bannai; Masato Shirakata; Norihide Ohyama; Tomokazu Kumeuchi; Japan assigned to NEC Corporation, NEC Moli Energy Corporation

In a secondary battery, wherein a positive-electrode active material layer 2 and a negative-electrode active material layer 3 are allowed to face each other via a liquid electrolyte solution 1, there is used, as the electrolyte solution 1, a basic solvent containing a halogenated polyolefin and an aliphatic polyolefin dissolved therein.

6444364**HIGH PERFORMANCE BATTERY**

Peter Harris; David Adamson; Douglas Woodnorth; Barbara Brys; Martin Howard; USA assigned to The Gillette Company

A battery, such as an alkaline battery, that can provide a high energy output at a high rate and that has a relatively high ratio

of manganese dioxide to cathode volume is disclosed. The battery can provide high energy output at a high rate when the battery is intermittently subjected to a high energy load.

6436581**ALKALINE ELECTROLYTE SECONDARY ELECTRIC CELL**

Stephane Senyarich; Patrick Viaud; France assigned to Saft

An alkaline electrolyte secondary electric cell comprises at least one positive-electrode and one negative-electrode positioned on either side of a separator composed of polyolefin fibers grafted with a vinyl monomer. The cell contains a device for absorbing and retaining nitrogen in a strongly basic medium, with a pH of at least 12. This device is constituted by the separator.

6444360**ELECTROCHEMICAL CELL ACTIVATED WITH A NON-AQUEOUS ELECTROLYTE HAVING A SULFATE ADDITIVE**

Hong Gan; Esther S. Takeuchi; USA assigned to Wilson Greatbatch Ltd.

An alkali metal, solid cathode, non-aqueous electrochemical cell capable of delivering high current pulses, rapidly recovering its open circuit voltage and having high current capacity, is described. The stated benefits are realized by the addition of at least one organic sulfate additive to an electrolyte comprising an alkali metal salt dissolved in a mixture of a low viscosity solvent and a high permittivity solvent. A preferred solvent mixture includes propylene carbonate, 1,2-dimethoxyethane and a sulfate additive having at least one unsaturated hydrocarbon containing a C (sp²)-C (sp³) bond unit having the C (sp³) carbon directly connected to the -OSO₃- functional group.