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Journal of Power Sources

LEAD ACID**6132901****BATTERY ELEMENT CONTAINING EFFICIENCY IMPROVING ADDITIVES**

Thomas J. Clough, USA, assigned to Ensci Inc.

An assembled battery having one or more positive plates, negative plates and separators and sulfuric acid electrolytes having a fluoro aliphatic surfactant present in the electrolyte that improves the utilization efficiency of the battery.

6132907**METHOD FOR MAKING LEAD-ACID JARS AND CELLS AND BATTERIES USING SUCH JARS**

William H. Kump, Jeffrey M. Henning, USA assigned to GNB Technologies Inc.

A method for making a plurality of lead-acid cells requiring a constant width, a height varying from a maximum to a minimum to accommodate plates of varying height and a cell depth to accommodate a minimum to a maximum number of plates is disclosed, which utilizes blow molding to form a jar precursor which is cut to the height desired, and, in its preferred aspects, including use of a mold and insert sets which simplify tooling and change-over time, as well as a cover and jar design which simplifies the heat sealing of these components.

6153335**BATTERY CELL CONSTRUCTION INCLUDING FIBEROUS MAT SEPARATOR**

David G. Vutetakis, Christopher R. Cestone, Stanley K. Wilkie, USA assigned to Douglas Battery Manufacturing Company

The present invention relates to a lead-acid battery cell construction including a container; a plurality of positive plates positioned in the container; and a plurality of negative plates arranged in alternating order with the positive plates. A plurality of separators are provided with the plate separators being wrapped around the positive or the negative plates such that the vertical side walls of the wrapped plates are covered with at least a single layer of separator material.

FUEL CELL**6132895****FUEL CELL**

Steven D. Pratt, Sivakumar Muthuswamy, Ronald J. Kelley, James Lynn Davis, USA assigned to Motorola Inc.

A very thin fuel cell is formed by stacking a plurality of membrane electrode assemblies (MEA) and a plurality of double sided distribution plates. The distribution plates serve to distribute fuel and oxidant to the MEAs, and they are electrically and thermally conductive and gas impermeable, and have fuel and oxidant distribution channels formed on

opposite sides. The oxidant flowing through the oxidant distribution channels also provides thermal management to the fuel cell, eliminating the need for a separate heat exchange system. The MEAs and the distribution plates are arranged in an alternating stack such that the fuel distribution channel side is in intimate and direct contact with the MEA anode, and such that the oxidant distribution channel is in intimate and direct contact with the MEA cathode. The distribution plate acts as a bipolar plate and also as a heat exchanger.

6136462**HIGH TEMPERATURE FUEL CELLS WITH HEATING OF THE REACTION GAS**

Karl Kriechbaum, Gerhard Filip, Germany assigned to AEG Energietechnik GmbH

The invention relates to a fuel cell system with high-temperature fuel cells, in which some of the heat of the gases flowing out of the anode and cathode is used to that end. The gases that flow into the anode and cathode are brought to a temperature that is required for operation of the fuel cells and is still tolerable for the cells, having an anode and/or cathode loop. It is provided that for the anode and/or cathode loop, at least that time-referred quantity of reaction gases that is required for attaining the electrical output of the fuel cells is furnished. From the gas flowing out of the anode and/or cathode, an equivalent quantity of gas is removed from the gas loop, and the gas quantity introduced into the loop is dimensioned such that by mixing this gas quantity with the gas returned to the loop from the anode and/or cathode, the temperature of the gas flowing into the anode and/or cathode attains a predetermined operating temperature that is optimal for the service life of the cells and for efficiency.

6139985**ELECTRODE ELECTROLYTE INTERLAYERS CONTAINING CERIUM OXIDE FOR ELECTROCHEMICAL FUEL CELLS**

Brian P. Borglum, Norman F. Bessette, USA assigned to Siemens Westinghouse Power Corporation

An electrochemical cell is made having a porous fuel electrode and a porous air electrode, with solid oxide electrolyte therebetween, where the air electrode surface opposing the electrolyte has a separate, attached, dense, continuous layer of a material containing cerium oxide, and where electrolyte contacts the continuous oxide layer, without contacting the air electrode.

6140266**COMPACT AND LIGHT WEIGHT CATALYST BED FOR USE IN A FUEL CELL POWER PLANT AND METHOD FOR FORMING THE SAME**

Thomas J. Corrigan, Leonard J. Bonville Jr., Roger R. Lesieur, Derek W. Hildreth, Maria G. Lukianoff, USA assigned to International Fuel Cells Company, LLC

A fuel gas catalyst bed for use in a fuel cell power plant is formed from a monolithic open cell foam component, the open cell lattice of which forms gas passages through the catalyst bed. The monolithic component has a lattice of internal open cells which are both laterally and longitudinally interconnected so as to produce a diffuse gas flow pattern through the catalyst bed. All areas of the monolithic component which form the gas flow pattern are provided with an underlying high porosity wash coat layer. The porous surface of the wash coat layer is provided with a nickel catalyst layer, or a noble metal catalyst layer, such as platinum, rhodium, palladium, or the like, over which the gas stream being treated flows. The base foam lattice can be a metal such as aluminum, stainless steel, a steel-aluminum alloy, a nickel alloy, a ceramic, or the like material which can be wash coated. The use of an open cell lattice as the basis of a catalyst bed enables the formation of very compact, light weight and high surface area catalyst bed with excellent gas flow-through characteristics.

6140820

MEASURING CELL VOLTAGES OF A FUEL CELL STACK

David E. James, USA assigned to Plug Power Inc.

A system that is usable with a stack of fuel cells that have cell terminals includes scanning units and a circuit. The scanning units are coupled to the stack and establish different groups of the fuel cells. Each scanning unit has a ground that is referenced to a different one of the cell terminals, and each scanning unit is adapted to measure the voltages of the fuel cells in an associated one of the groups and indicate the measured voltages. The circuit is adapted to communicate with the scanning units to receive the indicated voltages.

6143159

ELECTROCHEMICAL AUTOETHERMAL REFORMER

David P. Bloomfield, Arthur N. Rabe, USA assigned to Niagara Mohawk Power Corporation

An electrochemical autothermal reformer (EATR) provides hydrogen. The EATR includes an autothermal reformer region, a reformer anode supply region, and a composite membrane layer separating the reformer anode from the autothermal reformer region. The composite membrane layer includes a mechanically stable porous ceramic support member with a thin gas permeable ceramic substrate layer overlaying the support member. Overlaying the substrate layer is a first thin metallic catalyst layer which promotes the dissociation of H_2 to $2H^+ + 2e^-$. Overlaying the first catalyst layer is a metallic oxide layer capable of conducting $2H^+ + 2e^-$ at elevated temperatures. Overlaying the metallic oxide layer is a second thin

metallic catalyst layer which promotes the recombination of $2H^+ + 2e^-$ to H_2 .

6146779

FLUID FLOW PLATE, FUEL CELL ASSEMBLY SYSTEM, AND METHOD EMPLOYING SAME FOR CONTROLLING HEAT IN FUEL CELLS

Michael M. Walsh, USA assigned to Plug Power Inc.

A fluid flow plate for a fuel cell includes a generally planar-shaped body having a sealed chamber therein containing a heat-transferring fluid. A first portion of the body has an outer surface with at least one flow channel for distributing a first reactant fluid to an active region of the fuel cell. The first portion is operable to absorb heat to vaporize the heat-transferring fluid and a second portion, preferably extending beyond the active region, is operable to release heat for condensing vaporized heat-transferring fluid. Also disclosed is a system, which includes a fuel cell assembly having a plurality of fuel cells and a plurality of planar-shaped heat pipes disposed between the plurality of fuel cells. A housing comprises a chamber for receiving a reactant fluid. The plurality of planar-shaped heat pipes extend into the chamber for transferring heat between the fuel cell assembly and a reactant fluid.

6146781

DIRECT METHANOL FEED FUEL CELL AND SYSTEM

Subbarao Surampudi, Harvey A. Frank, Sekharipuram R. Narayanan, William Chun, Barbara Jeffries-Nakamura, Andrew Kindler, Gerald Halpert, USA assigned to California Institute of Technology

Improvements to non-acid methanol fuel cells include new formulations for materials. The platinum and ruthenium are more exactly mixed together. Different materials are substituted for these materials. The backing material for the fuel cell electrode is specially treated to improve its characteristics. A special sputtered electrode is formed which is extremely porous.

6146782

FUEL CELL ANODE FOR THE OXIDATION OF METHANOL

Hartmut Wendt, Michael Gotz, Germany assigned to Degussa-Huls Aktiengesellschaft

A fuel cell anode for the oxidation of methanol, which contains at least one platinum metal or alloys of platinum metals as the primary, catalytically active component. The anode is characterized in that it also contains transition metal complexes of phthalocyanine or substituted phthalocyanines as cocatalyst, these amplifying the catalytic effect of the platinum metals and their alloys for the anodic oxidation of methanol.

6150047

**POLYMER ELECTROLYTE MEMBRANE
ASSEMBLY FOR FUEL CELLS**

Shiao-Ping S. Yen, Andrew Kindler, Andre Yavrouian, Gerald Halpert, USA assigned to California Institute of Technology

An electrolyte membrane for use in a fuel cell can contain sulfonated polyphenylether sulfones. The membrane can contain a first sulfonated polyphenylether sulfone and a second sulfonated polyphenylether sulfone, wherein the first sulfonated polyphenylether and the second sulfonated polyphenylether sulfone have equivalent weights greater than about 560, and the first sulfonated polyphenylether and the second sulfonated polyphenylether sulfone also have different equivalent weights. Also, a membrane for use in a fuel cell can contain a sulfonated polyphenylether sulfone and an unsulfonated polyphenylether sulfone. Methods for manufacturing a membrane electrode assemblies for use in fuel cells can include roughening a membrane surface. Electrodes and methods for fabricating such electrodes for use in a chemical fuel cell can include sintering an electrode. Such membranes and electrodes can be assembled into chemical fuel cells.

6150048

**METALLIC INTERCONNECTION MATERIAL FOR
SOLID OXIDE FUEL CELL AND METHOD FOR
PREPARING THE SAME**

Rak-Hyun Song, Dong-Ryul Shin, Kwangg-Sun Jeon, Yi-Sup Han, Dokiya Masayuki, Japan assigned to Korea Institute of Energy Research

Disclosed are a metallic interconnection material for solid oxide fuel cells and a preparation method thereof. The metallic interconnection material has two fine microstructural phases in which 5–25% by volume of LaCrO_3 is dispersed at the grain boundaries of Cr particles. It can be prepared by mixing 75–95% by volume of a Cr powder and 5–25% by volume of an LaCrO_3 powder, together with a solvent and a binder, in a mill, molding the mixture into a predetermined shape after drying, and sintering the molded shape at approximately 1500°C for 10 h in an Ar atmosphere with 5 vol.% of hydrogen to give an LaCrO_3 -dispersed Cr alloy. The LaCrO_3 -dispersed Cr alloy shows high electric conductivity by virtue of the growth inhibition of Cr particles during sintering and high chemical stability by virtue of the presence of the rare earth metal, La, meeting meet the requirements for the interconnection materials for solid oxide fuel cells.

6150049

**FLUID FLOW PLATE FOR DISTRIBUTION OF
HYDRATION FLUID IN A FUEL CELL**

Milton H. Nelson, Charles M. Carlstrom Jr., Mathew J. Cusack, John R. Miller, USA assigned to Plug Power Inc.

A hydration system for a fuel cell includes a fluid flow plate having an inlet fluid opening for receiving a hydration fluid, a plurality of reactant flow channels defined in the fluid flow plate, at least one land interposed between the flow channels, and at least one hole defined in and extending through the land. The hole may be fluidly connected to the inlet fluid opening, thereby allowing a portion of the fluid to aid in hydration of a membrane of the fuel cell. A hydration channel also formed in the land may extend from an outlet of the hole to further aid membrane hydration.

6153257

**PROCESS FOR PREPARING A CATHODE
CONTAINING ALKALINE EARTH METAL
OXIDES FOR MOLTEN CARBONATE
FUEL CELLS**

Seong Ahn Hong, Tae Hoon Lim, In Hwan Oh, Suk Woo Nam, Hyung Joon Choi, South Korea assigned to Korea Institute of Science and Technology

The present invention relates to a cathode, which can be used in molten carbonate fuel cells (hereinafter, referred to as an 'MCFC'), and a process for preparing the same. In such a cathode, NiO, which is inexpensive and has relatively good electrochemical performance, has been mainly used. However, NiO has a relatively large solubility in electrolytes of an MCFC, which causes the cells to be short circuited, thereby shortening the life of the cells. However, according to the present invention, a cathode having a longer life than common cathodes for MCFC can be prepared by adding alkaline earth metal oxides, which are basic substances, to NiO, the main material of the cathodes, or impregnating an Ni plate with a solution of the alkaline earth metal oxides, to reduce the solubility of the NiO while maintaining its performance as the cathode.

6153323

**ELECTRODE TREATMENT METHOD FOR
IMPROVING PERFORMANCE IN LIQUID
FEED FUEL CELLS**

Kevin M. Colbow, Jiujun Zhang, David P. Wilkinson, Canada assigned to Ballard Power Systems Inc.

Fuel cell performance in liquid feed fuel cells with an electrode comprising a carbonaceous substrate and an electrocatalyst can be increased by oxidizing the carbon substrate, particularly by electrochemical methods in acidic aqueous solution, prior to incorporation of the electrocatalyst. The treated substrate may thereafter be advantageously impregnated with a proton conducting ionomer to prevent excessive penetration of the applied catalyst into the substrate. The treatment method is particularly effective for direct methanol fuel cell anodes.

6153324**CURRENT-CARRYING COMPONENT FOR A FUSED CARBONATE FUEL CELL WITH ANTICORROSIVE COATING**

Manfred Hiermaier, Reinhard Klose, Joerg Wind, Germany assigned to MTU Motoren-und Turbinen-Union Friedrichshafen GmbH

The invention relates to corrosion proofing of current-carrying components of molten carbonate fuel cells. In particular, the invention relates to a current-carrying component for a molten carbonate fuel cell, particularly an anode current collector or bipolar plate, with a substrate made of stainless steel and with a corrosion proofing coating provided on the substrate to protect the component from the anode gas atmosphere and the molten electrolyte of the fuel cell.

BATTERY MATERIALS**6127065****METHOD OF MANUFACTURING CATHODE ACTIVE MATERIAL AND NON-AQUEOUS ELECTROLYTE SECONDARY BATTERY**

Yoshikatsu Yamamoto, Hisayuki Kato, Hironao Takagishi, Japan assigned to Sony Corporation

A method of manufacturing a cathode active material and a non-aqueous electrolyte secondary battery including the cathode active material and having a large capacity, an excellent cycle characteristic at high environmental temperatures and satisfactory discharging characteristic under a large load are provided. Cobalt salts, lithium salts and aluminum hydroxide salts are mixed with one another and a prepared mixture is baked, so that a cathode active material is obtained which is expressed by $\text{Li}_x\text{CO}_{(1-y)}\text{Al}_y\text{O}_2$ (where 0.05 less than or equal to x less than or equal to 1.10 and 0.01 less than or equal to y greater than 0.10) is obtained.

6129902**MANUFACTURING METHOD OF ACTIVE MATERIALS FOR THE POSITIVE ELECTRODE IN ALKALINE STORAGE BATTERIES**

Hiroyuki Sakamoto, Hidekatsu Izumi, Hirokazu Kimiya, Yoichi Izumi, Isao Matsumoto, Japan assigned to Matsushita Electric Industrial Company Ltd.

A process for producing positive electrode active material includes feeding an aqueous nickel salt solution, aqueous solutions of different kinds of metals, aqueous solution containing ammonium ions and aqueous alkali solution each independently and simultaneously into a reaction vessel such that the amount of alkali metal is 1.9–2.3 mol relative to 1 mol of the total amount of nickel and different kinds of metals and the amount of ammonium ions is 2 mol or more relative to 1 mol of the total amount of nickel and different kinds of metals, the pH in the vessel is 11–13, the temperature

in the vessel is 30–60°C and the average residence time is 20–50 h. Further, in the process step of continuously growing the complex metal oxide particles from the salts of a plurality of metal elements through a plurality of successive reaction-deposition stages, the compositions and/or the kinds of the salts of metal element groups used for forming the oxide in the reaction-deposition stages adjacent to each other are made to be different from each other.

6130005**HEAT TREATED SILVER VANADIUM OXIDE FOR USE IN IMPLANTABLE MEDICAL DEVICES, ARTICLES AND METHODS**

Ann M. Crespi, Kaimin Chen, USA assigned to Medtronic Inc.

The invention provides heat-treated silver vanadium oxide for use in the cathodes of electrochemical cells, particularly in implantable medical devices. The heat-treated silver vanadium oxide is capable of being pressed into a pellet having a pressed pellet density of about 3.10 g/cm³ to about 3.45 g/cm³ when about 2 g of the heat-treated silver vanadium oxide are uniaxially pressed into a pellet using a 1.6 cm diameter cylindrical die with a 7500 pound force applied for 5 s.

6130007**BATTERIES WITH ELECTROACTIVE NANOPARTICLES**

Xiangxin Bi, Nobuyuki Kambe, Sujeet Kumar, James T. Gardner, USA assigned to NanoGram Corporation

Batteries based on nanoparticles are demonstrated to achieve high energy densities. Vanadium oxide nanoparticles can have several different stoichiometries and corresponding crystal lattices. The nanoparticles preferably have average diameters less than about 150 nm. Cathodes produced using the vanadium oxide nanoparticles and a binder can be used to construct lithium batteries or lithium ion batteries. The nanoparticles may have energy densities greater than about 900 Wh/kg.

6132639**MANGANESE-NICKEL MIXED HYDROXIDE FOR BATTERY ACTIVE MATERIAL AND PROCESS FOR MANUFACTURING THEREOF**

Kazuhito Komatsu, Sumihiko Makizoe, Tsuneyoshi Kamada, Yasuhiro Ochi, Takashi Okito, Japan assigned to Mitsui Mining and Smelting Company Ltd.

A manganese–nickel mixed hydroxide for battery active material comprising a manganese-containing mixed hydroxide having a coated layer composed of a mixed-oxide of nickel and cobalt, to provide an excellent discharging property and allows one to achieve an improvement in the discharge utilization when it is used as an electrode material for secondary batteries.

6132654**ULTRA-THIN, SINGLE-PLY BATTERY SEPARATOR**

Wei-Ching Yu, USA assigned to Celgard Inc.

A battery separator is made from a microporous polyolefin membrane having a thickness of less than or equal to 0.5 million. The separator is made by extruding a parison, collapsing the parison to form a flat sheet comprising two plies, annealing the sheet, stretching the sheet, and winding the sheet.

6132899**BATTERY SEPARATOR HAVING DIFFERENT SIZE RIBS AND METHOD OF MAKING THE SAME**

James Young, Francis E. Alexander, Daniel E. Weerts, USA assigned to Amtek Research International LLC

A battery separator for use in flooded cell type lead acid batteries comprising a backweb of a porous, acid resistant, embossable material with a plurality of major ribs and submini-ribs extending from at least one planar surface of the backweb and a lesser plurality of stop-ribs extending from the other planar surface. Each major rib overlies at least one submini-rib and a number less than all of the major ribs overlies the stop-ribs. Each major rib is an embossed corrugated structure comprised of alternating ridges and furrows. The ridges and furrows are in non-parallel alignment to the longitudinal dimension of the separator, and preferably perpendicular thereto. The major ribs are formed on a battery separator backweb having a plurality of submini-ribs extending from one planar surface thereof and a lesser plurality of stop-ribs extending from the other planar surface thereof by passing the backweb through the nip formed by a pair of opposed embossing rollers and embossing the backweb in the area of at least one submini-rib and in the area of some of the stop-ribs.

6132905**SOLID COMPOSITE ELECTROLYTES FOR LITHIUM BATTERIES**

Binod Kumar, Lawrence G. Scanlon Jr., USA assigned to The University of Dayton

Solid composite electrolytes are provided for use in lithium batteries which exhibit moderate to high ionic conductivity at ambient temperatures and low activation energies. In one embodiment, a ceramic-ceramic composite electrolyte is provided containing lithium nitride and lithium phosphate. The ceramic-ceramic composite is also preferably annealed and exhibits an activation energy of about 0.1 eV.

6136469**MULTI-POLYACID ELECTROLYTES FOR ELECTROCHEMICAL CELLS AND CELLS USING SAME**

Changming Li, USA assigned to Motorola Inc.

An electrolyte for an electrochemical cell is described comprising two or more polyanion-based compounds of the general formula, where M is selected from the group consisting of ammonia and the elements of groups IA and IIA of the periodic table; X and Y are different and are selected from the group consisting of the elements of groups IIIB, IVB, VB, and VIB of the periodic table, and boron, aluminum, gallium, silicon, germanium, tin, phosphorous, arsenic, antimony, bismuth, selenium, tellurium, polonium, indium, and astatine; O oxygen; and m an integer from 1 to 10, inclusive; x an integer from 0 to 1, inclusive; y an integer from 2 to 13, inclusive; z an integer from 7 to 80, inclusive; and n an integer from 2 to 100, inclusive.

6136474**METHOD FOR PRODUCING ANODE MATERIAL AND NON-AQUEOUS ELECTROLYTE CELL EMPLOYING SUCH MATERIALS**

Toru Kihira, Eishi Endo, Shinichiro Yamada, Masafumi Ata, Yoshihisa Gonno, Kenichi Kitamura, Akinori Kita, Hiroshi Imoto, Japan assigned to Sony Chemicals Corporation

A non-aqueous electrolyte cell equipped with an anode made of a carbonaceous material capable of intercalating and deintercalating light metal ions and imparted with high capacity characteristics and favorable cyclic properties, wherein the carbonaceous material is obtained by irradiating, in a gaseous atmosphere, an electron beam accelerated in high vacuum. The anode made of a carbonaceous material is subjected to electron beam irradiation at a dose ranging from 300 to 1000 kGy.

6136477**NITRATE ADDITIVES FOR NON-AQUEOUS ELECTROLYTE RECHARGEABLE CELLS**

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

A lithium ion electrochemical cell having high charge/discharge capacity, long cycle life and exhibiting a reduced first cycle irreversible capacity, is described. The stated benefits are realized by the addition of at least one nitrate additive to an electrolyte comprising an alkali metal salt dissolved in a solvent mixture that includes ethylene carbonate, dimethyl carbonate, ethylmethyl carbonate and diethyl carbonate. The preferred additive is an organic alkyl nitrate compound.

6139990**MODIFIED GRAPHITE PARTICLES DERIVED FROM SCALY NATURAL ONES, PRODUCTION THEREOF AND SECONDARY BATTERY**

Satoshi Kubota, Hirokazu Koyanagi, Kojiro Tenno, Syun Saito, Japan assigned to Kansai Netsukagaku Kabushiki Kaisha

There are provided modified and rounded graphite particles derived from scaly natural graphite particles by modification so as to bring their form close to a spherical form and satisfying all the following requirements: (a) that the degree of circularity should be not less than 0.86; (b) that, upon microscopic observation, the broken-out section should show a cabbage-like appearance with graphite slices taking various directions and (c) that, upon X-ray diffraction, the peak intensity ratio ($I_{h(1\ 1\ 0)}/I_{h(0\ 0\ 2)}$) between the (0 0 2) face (parallel to graphite layers) and (1 1 0) face (perpendicular to graphite layers), which serves as an index of the randomness of orientation, should be not less than 0.0050. They retain good qualities of the raw material scaly natural graphite particles and are additionally unique in structure and characteristics. A method of producing such modified particles is also provided. Further provided are secondary cells or batteries in which the modified particles showing good slurry characteristics are used as an electrode material and with which the decrease in discharge capacity is small even at high discharge current values.

6143216

BATTERIES WITH POROUS COMPONENTS

Robert B. Loch, James M. Larson, Brian D. Fredericksen, USA assigned to 3M Innovative Properties Company

Approaches are described for producing porous, polymer electrodes with good characteristics for incorporation into polymer batteries. Two preferred processes are presented. The polymer electrodes can be subjected to additional processing to increase their porosity and electrical conductivity. The polymer electrodes preferably are incorporated into a polymer battery, where the components are laminated together.

6143441

FILLED GLASS FIBER SEPARATORS FOR BATTERIES AND METHOD FOR MAKING SUCH SEPARATORS

George C. Zguris, Frank C. Harmon Jr., USA assigned to Hollingsworth and Vose Company

A multi-layer sheet useful as a separator in a lead acid battery is disclosed. The sheet comprises at least a first layer and a second layer and having been produced by the method consisting of the steps of forming the first layer by depositing a first, substantially binder free furnish consisting essentially of glass fibers onto the wire of a paper making machine and forming the second layer by depositing a second, substantially binder free furnish consisting essentially of glass fibers and silica powder or another suitable silicate powder onto the first layer on the wire of the paper making machine. The silica or silicate powder has a particle size and being present in the second layer in an amount such that, if the second substantially binder free furnish was deposited directly on the wire of the paper making machine

a significant portion of the silica or silicate powder would pass through the wire.

6143446

BATTERY CATHODE

Stuart M. Davis, Alexander A. Leef, Sandrine Colson, Hana Strunc, France assigned to Duracell Inc.

A cathode that includes manganese dioxide and a titanium oxy salt, preferably titanium oxy sulfate, is disclosed.

6146780

BIPOLAR SEPARATOR PLATES FOR ELECTROCHEMICAL CELL STACKS

Alan J. Cisar, Oliver J. Murphy, USA assigned to Lynntech Inc.

The present invention provides a separator for electrochemical cells, comprising a gas barrier having an electrically conducting pathway extending therethrough and a porous, electrically conducting member in electrical contact with each side of the electrically conducting pathway. In another aspect of the invention, a separator for electrochemical cells is provided comprising a porous, electrically conducting sheet and a gas impermeable material disposed within a portion of the sheet to form a gas barrier. In yet another aspect of the invention, a separator for electrochemical cells is provided comprising two porous, electrically conducting sheets and an electrically conducting gas barrier disposed in electrical contact between the sheets.

6150052

ELECTRODE FOR AN ELECTROCHEMICAL CELL INCLUDING STACKED DISKS

Lewis F. Urry, USA assigned to Eveready Battery Company Inc.

An electrode is disclosed that includes a plurality of stacked disks. The electrode is preferably a negative electrode of an alkaline cell and the disks are preferably formed of zinc. By forming the negative electrode of such zinc disks, the discharge capacity of the negative electrode is increased. Consequently, the high-rate service of an alkaline cell having the inventive negative electrode is improved.

6150055

CARBONACEOUS NEGATIVE ELECTRODE MATERIAL FOR NON-AQUEOUS SECONDARY BATTERY, PROCESS FOR PRODUCING THE SAME, AND NON-AQUEOUS SECONDARY BATTERY

Akio Kato, Noritoshi Takao, Tomiyuki Kamada, Japan assigned to Mitsubishi Chemical Corporation

A carbonaceous negative electrode material for non-aqueous secondary batteries having (i) not less than 2×10^{-4} cc/g of pores having a diameter smaller than 8 ANG and (ii) not

more than 15×10^{-4} cc/g of pores having a diameter of 8–18 ANG. The material exhibits a high capacity and a high efficiency.

6153330

**ALKALINE MANGANESE DIOXIDE
ELECTROCHEMICAL CELL HAVING COATED
CAN TREATED WITH SILICON COMPOUNDS**

Kenneth H. Kenyon, Joseph L. Passaniti, USA assigned to Rayovac Corporation

The performance characteristics of alkaline manganese dioxide cells are improved by applying a thin, polymeric coating to the inner surface of an unplated steel positive current collector, and including a silicon compound in the coating. The polymeric coating comprises, in combination, a first film forming binder component and a second component comprising an electrically conductive component such as carbon or a filler. The combination of the coating and the silicon compound reduces the internal resistance of the cell, and may be used on unplated steel.

6153337

**SEPARATORS FOR ELECTROCHEMICAL
CELLS**

Steven A. Carlson, Zhongyi Deng, Qicong Ying, Terje A. Skotheim, USA assigned to Moltech Corporation

This invention pertains to separators for electrochemical cells which comprise a microporous pseudo-boehmite layer; electrolyte elements comprising such separators; electrical current producing cells comprising such separators; and methods of making such separators, electrolyte elements and cells.

LITHIUM BATTERIES

6127804

**LITHIUM ION CHARGING MEANS AND METHOD
USING IONIC RELAXATION CONTROL**

John Wendell Oglesbee, Michael D. Geren, John Edward Herrmann, USA.

This invention combines linear charging techniques with ionic relaxation pulse charging to rapidly charge lithium ion batteries to full capacity. The preferred embodiment incorporates a blocking diode and series resistor to multiplex an ionic relaxation control circuit with a linear regulated charging circuit, thereby utilizing a single, common, shared power transistor.

6132477

**METHOD OF MAKING LAMINATED POLYMERIC
RECHARGEABLE BATTERY CELLS**

Paul C. Warren, USA assigned to Telcordia Technologies Inc.

The dangers of short-circuiting and lithium metal plating during recharging of a unitary laminate lithium-ion intercalation battery cell are alleviated by trimming the periphery of the cell with a transverse slicing cut made at an angle from the perpendicular of the major plane surface of the cell. The resulting angled peripheral edges of the cell provides greater edge separation between electrode layers and reduces the occurrence of metal-plating accumulation of lithium ions at the edge surface of the negative electrode.

6132900

**METHOD OF PRODUCTION OF NON-AQUEOUS
ELECTROLYTE BATTERY AND SEAL PLATE
THEREOF**

Hiroshi Yoshizawa, Kazunori Haraguchi, Takuya Nakashima, Takashi Takeuchi, Yoshitaka Matsumasa, Kikuo Senoo, Takabumi Fujii, Mamoru Iida, Kenji Mizuno, Japan assigned to Matsushita Electric Industrial Company Ltd.

The present invention relates to a construction of an explosion-proof safety vent for small-size non-aqueous electrolyte batteries such as prismatic lithium-ion secondary batteries or with an oval cross section hence with a small area of seal plate, and to a method of producing a seal plate. It aims at securing safety of a battery by allowing an explosion-proof vent to operate without fail with a simple construction at no sacrifice of the capacity. In order to fulfill this aim, it provides an explosion-proof safety vent, wherein upper peripheral edge of an opening of a bottomed cell container made of metal and the periphery of a seal plate made of metal are hermetically sealed by laser welding, a rivet serving as a terminal is inserted in a through hole provided on the central portion of the seal plate and hermetically fixed by crimping via a gasket, an exhaust hole is provided between the terminal and the periphery of the seal plate, and the exhaust hole is closed by a metal foil. With such a simple structure, it allows the vent to operate without fail to prevent accident and also proposes a method of continuously producing seal plates in the form of a hoop.

6132903

**LITHIUM SECONDARY BATTERY
COMPRISING A NEGATIVE ELECTRODE
CONSISTING ESSENTIALLY
OF B₂O₃**

Masahisa Fujimoto, Toshiyuki Nohma, Koji Nishio, Japan assigned to Sanyo Electric Company Ltd.

Provided is a lithium secondary battery which has a large discharge capacity and good charge-discharge cycle characteristics comprising a negative electrode in which the lithium ion-occlusion material is an amorphous material consisting essentially of B₂O₃ or an amorphous material

consisting essentially of B_2O_2 and an oxide whose cation-oxygen bond strength is smaller than 335 kJ/mol.

6132904

POLYELECTROLYTIC BATTERY HAVING A POLYELECTROLYTE BASED ON A POLYSTYRENE MAIN CHAIN AND POLYETHYLENE OXIDE SIDE CHAIN

Maruo Kamino, Makoto Uesugi, Masahisa Fujimoto, Toshiyuki Nohma, Koji Nishio, Japan assigned to Sanyo Electric Company Ltd.

A polyelectrolytic battery wherein a porous film having a polyelectrolyte impregnated into its cavities is interposed between a positive electrode and a negative electrode, the porous film having a porosity of not less than 80% and the polyelectrolyte impregnated therein at a ratio of 20–90% by volume of the cavities thereof. Another polyelectrolytic battery includes a positive electrode, a negative electrode including a carbon material, and a polyelectrolytic film interposed between the positive and negative electrodes, the positive and negative electrodes each containing a polyelectrolyte composed of a high polymer having a polystyrene main chain and a side chain of polyethylene oxide and a lithium salt.

6132906

NON-AQUEOUS BATTERY

Naoto Nishimura, Takehito Mitate, Kazuo Yamada, Yoshihiro Tsukuda, Tsutomu Takatera, Japan assigned to Sharp Kabushiki Kaisha

A non-aqueous battery includes a negative electrode containing a carbon material capable of absorbing/desorbing lithium, metallic lithium or an lithium alloy, a positive electrode containing a chalcogenide and a non-aqueous ionic conductor. The non-aqueous ionic conductor contains a diether compound having ether linkages at 1- and 3-positions, 1- and 4-positions or the 2- and 3-positions of a straight-chain hydrocarbon having four carbon atoms.

6136287

LITHIUM MANGANESE OXIDES AND BATTERIES
Craig R. Horne, Sujeet Kumar, Hariklia Dris Reitz, James T. Gardner, Xiangxin Bi, USA assigned to NanoGram Corporation

Lithium manganese oxide particles have been produced with an average diameter less than about 250 nm. The particles have a high degree of uniformity. The particles are formed by the heat treatment of nanoparticles of manganese oxide. The lithium manganese oxide particles are useful as active materials in the positive electrodes of lithium based batteries. Improved batteries result from the use of the uniform nanoscale lithium manganese oxide particles.

6136471

LITHIUM ION SECONDARY BATTERY HAVING FIRMLY ADHERENT LAYERS

Yasuhiro Yoshida, Kouji Hamano, Hisashi Shiota, Shou Shiraga, Shigeru Aihara, Takayuki Inuzuka, Michio Murai, Japan assigned to Mitsubishi Denki Kabushiki Kaisha

Positive and negative active material particles 7a and 9a are adhered to the respective current collectors 6 and 8 by means of a binder resin 11 to prepare positive and negative electrodes 3 and 5. The positive and negative electrode active material layers 7 and 9 are adhered to a separator 4 with the binder resin 11, so that the interlaminar strength between each active material layer 7, 9 and the separator 4 may be not lower than that between the active material layer 7, 9 and the respective current collector 10, 9. A lithium ion-containing electrolytic solution is held in voids 12 made in the active material layers 7, 9 and the separator 4 to complete an electrical connection between the electrodes.

6136472

LITHIUM-CONTAINING SILICON/PHOSPHATES, METHOD OF PREPARATION, AND USES THEREOF INCLUDING AS ELECTRODES FOR A BATTERY

Jeremy Barker, M. Yazid Saidi, USA assigned to Valence Technology Inc.

The invention provides a new electrode active material and cells and batteries which utilize such active material. The active material is represented by the nominal general formula $Li_aM'_bM''_cSi_cP_{(3-c)}O_{12}$, 0 less than or equal to b less than or equal to 2, 0 less than c less than 3. The M' and M'' are each elements selected from the group consisting of metal and metalloid elements. The value of the variable a depends upon the selection of M' and M'' and on the relative proportions designated as b and c .

6136475

LITHIUM SECONDARY BATTERY AND CATHODE COMPOSITION THEREFOR

Masami Tsutsumi, Hiroshi Horiuchi, Tamotsu Yamamoto, Isao Watanabe, Tsutomu Miyashita, Japan assigned to Fujitsu Limited

A lithium secondary battery includes a cathode which can be dischargeably charged with lithium ions, an anode made of lithium metal, a lithium alloy or any other anode material which can be releasably doped with lithium ions, an electrolyte which allows migration of lithium ions between both electrodes, and an endothermic substance which undergoes an endothermic reaction upon a temperature rise of the battery for preventing excessive heat generation. Typically, the endothermic substance is a metal carbonate such as magnesium carbonate, cobalt(II) carbonate, silver carbonate, cadmium carbonate or sodium hydrogencarbonate.

6136476**METHODS FOR MAKING LITHIUM VANADIUM OXIDE ELECTRODE MATERIALS**

Scott M. Schutts, Robert J. Kinney, USA assigned to Hydro-Quebec Corporation, 3M Innovative Properties Company

A method of making vanadium oxide formulations is presented. In one method of preparing lithium vanadium oxide for use as an electrode material, the method involves: admixing a particulate form of a lithium compound and a particulate form of a vanadium compound; jet milling the particulate admixture of the lithium and vanadium compounds; and heating the jet milled particulate admixture at a temperature below the melting temperature of the admixture to form lithium vanadium oxide.

6137265**ADAPTIVE FAST CHARGING OF LITHIUM-ION BATTERIES**

John A. Cummings, Barry K. Kates, USA assigned to Dell USA L.P.

Following the constant-current portion of a rechargeable battery charging scheme with repeated current pulses having a lower current value than that of the constant current portion, for at least part of the period of the pulse, can increase the amount of time that elapses before the voltage of the rechargeable battery is at or above a threshold voltage, thereby decreasing the total charge time for the rechargeable battery. Various current pulse shapes can be used to reduce the total charge time for the rechargeable battery, including, for example, a ramped pulse that begins at a low current level and increases over some or all of the period of the pulse, and a constant current pulse whose current level is reduced from that of the constant-current portion of the rechargeable battery charging scheme by a specified amount. The specified amount of reduction can, for example, be a fixed percentage of the current level of the constant-current portion of the rechargeable battery charging scheme, or it can be based on the parameters of the battery being charged.

6139986**LITHIUM SECONDARY BATTERY**

Teruhisa Kurokawa, Hiroshi Nemoto, Japan assigned to NGK Insulators Ltd.

A lithium secondary battery includes an electricity generating portion in which positive electrode and negative electrode form a laminate through separator films 62 made of porous polymer so that the positive electrode and the negative electrode 61 do not come in direct contact with each other, leads which are, respectively, connected to plural portions of the positive electrode and the negative electrode to make electricity collection, and a low melting point alloy member as a current break mechanism being inserted in a current path of the inside of the battery, which is melted to

break the current path when the temperature of the battery is raised over a predetermined temperature.

6139989**CATHODE FORMED OF GRAPHITE/CARBON COMPOSITE FOR LITHIUM ION SECONDARY BATTERY**

Takamasa Kawakubo (deceased), Masataka Wakihara, Mori Nagayama, Japan assigned to Mitsubishi Pencil Company Ltd.

A high crystallinity powdery graphite is mixed with an organic binder capable of forming a low crystallinity carbon after firing. A high shearing force is applied to the mixture, so that a composition is obtained wherein both the components are dispersed in each other under a mechano-chemical reaction. Then a paste of the composition is extruded so that the high crystallinity graphite is highly oriented. A green extrudate of the composition is fired in an inert atmosphere or a non-oxidation atmosphere at a temperature in a range between 500 and 1100°C, so that the organic binder contained therein is carbonized and a graphite-carbon carbonaceous composite of an amorphous or random layered structure is obtained, which then is ground and used as a cathode for a lithium ion secondary battery.

6139991**ELECTROLYTE SOLUTION FOR LITHIUM SECONDARY BATTERY AND LITHIUM SECONDARY BATTERY USING THE SAME**

Toshikazu Hamamoto, Atsuo Hitaka, Yukio Nakada, Koji Abe, Tsutomu Takai, Japan assigned to Ube Industries Ltd.

An electrolyte solution for a lithium secondary battery comprising a non-aqueous solvent, and an electrolyte and a carbonic ester derivative both dissolved therein, said carbonic ester derivative having the formula (I) (figure), wherein R^1 , R^2 and R^3 independently represent an alkyl group having 1–12 carbon atoms, a cycloalkyl group having 3–6 carbon atoms, or an aryl group having 6–12 carbon atoms, provided that R^2 may be a hydrogen atom and provided that R^1 and R^2 may be connected through a methylene group to form a cycloalkyl group having 3–6 carbon atoms.

6143444**METHOD OF PREPARING AN ELECTRODE FOR LITHIUM BASED SECONDARY CELL**

Whanjin Roh, South Korea assigned to Samsung Display Devices Company Ltd.

A method of preparing an electrode for a lithium based secondary cell including the steps of mixing an active material, a conductive agent, a binder and a plasticizer selected from soybean oil or dibutyl phthalate and applying the active material composition to a current collector is provided.

6146783**MULTI-CELL STORAGE BATTERY**

Thomas Brohm, Friedhelm Bottcher, Germany assigned to Varta Batterie Aktiengesellschaft

A multi-cell storage battery, in particular to a lithium storage battery, which contains a temperature control device and in which groups of one or more individual cells arranged alongside one another are separated from one another by a thermally insulating solid layer, whose coefficient of thermal conductivity lies between 0.01 and 0.2 W/(m K), the thermal resistance of the solid layer being greater by at least a factor λ than the thermal resistance of the individual cell. The individual cell is connected, at least in a region free of insulating material, to a heat exchanger, the thermal resistance of the heat exchanger in the direction toward the neighboring cell being selected to be greater by at least a factor λ than the thermal resistance of the individual cell and, in addition, the thermal resistance of the heat exchanger toward the temperature control medium being selected to be smaller by at least a factor of about 10 than the thermal resistance of the individual cell, and λ being the ratio of the energy content of the individual cell to the amount of energy that is needed to trigger a thermally induced cell failure at a defined upper operating temperature limit.

6146791**HYDROGENATED FULLERENES AS AN ADDITIVE TO CARBON ANODE FOR RECHARGEABLE LITHIUM-ION BATTERIES**

Raouf O. Loutfy, Muhammed Y. Saleh, USA assigned to Materials and Electrochemical Research (MER) Corporation

A rechargeable electrochemical cell comprising a body of aprotic, non-aqueous electrolyte, first and second electrodes in effective electrochemical contact with the electrolyte, the first electrode comprising positive active cathode materials such as a lithiated intercalation compound serving as the cathode and the second electrode comprising a modified carbon material formed of a graphite or carbon based materials, for example, having a hydrogenated fullerene material, such as hydrogenated C₆₀ or C₇₀, adsorbed thereon and serving as the anode; whereby they provide a lithium-ion cell having improved reversible energy storage characteristics and irreversible energy loss characteristics as compared with similar lithium-ion cells having carbon anodes that are not so-modified with hydrogenated fullerene material.

6153332

CATHODE FOR LITHIUM SECONDARY BATTERY
Yasunori Nishida, Kenichiro Kami, Kenji Nakane, Japan assigned to Sumitomo Chemical Company Limited

A lithium secondary battery cathode composition comprising a cathode active material, a conductive substance and

a binder, wherein the binder comprises a fluororesin and a polyolefin resin, and the amount of the fluororesin in the composition is 1–10% by weight and the amount of the polyolefin resin in the composition is 0.1–2% by weight. The cathode using the cathode composition of the present invention has an excellent binding property with a current collector, and the lithium secondary battery of the present invention has a high energy density and improved safety against an external heating, and the industrial value is very high.

6153333**LITHIUM-CONTAINING PHOSPHATE ACTIVE MATERIALS**

Jeremy Barker, USA assigned to Valence Technology Inc.

The invention provides novel lithium-containing phosphate materials having a high proportion of lithium per formula unit of the material. Upon electrochemical interaction, such material deintercalates lithium ions, and is capable of reversibly cycling lithium ions. The invention provides a rechargeable lithium battery, which comprises an electrodeformed from the novel lithium-containing phosphates.

6153336**LITHIUM SECONDARY BATTERY**

Yoshinori Kida, Masahisa Fujimoto, Toshiyuki Nohma, Koji Nishio, Japan assigned to Sanyo Electric Company Ltd.

A lithium secondary battery includes a positive electrode having a complex oxide of lithium and titanium as an active material, the composition of which before initial discharge is represented by Li_xTi_{3-x}O₄ (1 ≤ x ≤ 1.5), a negative electrode having an intercalation compound as an active material, the composition of which before initial discharge is represented by C_yLi (6 ≤ y ≤ 6.5), and a non-aqueous electrolyte. A low voltage lithium secondary battery having about 1.5 V of discharge voltage is provided.

NICKEL METAL HYDRIDE BATTERIES**6136473**

HYDROGEN ABSORBING ELECTRODE, NICKEL ELECTRODE AND ALKALINE STORAGE BATTERY
Kengo Furukawa, Toshiki Tanaka, Hiroe Nakagawa, Yuichi Matsumura, Minoru Kuzuhara, Masuhiro Ohnishi, Noboru Miyake, Masaharu Watada, Masahiko Oshitani, Japan assigned to Yuasa Corporation

This invention relates to a hydrogen absorbing electrode, in which a rare earth element having a basicity weaker than that of La is mixed to a hydrogen absorbing alloy or contained in it for serving as a component element. The invention relates to a nickel electrode, in which a rare earth element is mixed to a nickel hydroxide or contained in it as a solid solution. The invention further relates to an alkaline storage battery, in

which a rare earth element is coated on a surface of a nickel electrode or a surface of a separator.

6150056

ALKALINE STORAGE BATTERY AND METHOD FOR PRODUCING AN ELECTRODE USED THEREFOR

Toru Inagaki, Hiroki Takeshima, Kazushige Sugimoto, Katsuhiko Okamoto, Japan assigned to Matsushita Electric Industrial Company Ltd.

Disclosed is an alkaline storage battery which exhibit exceptional charge/discharge and cycle life characteristics by improved current collection and active material retention of the electrode substrate. The electrode comprises a substrate composed of a conductive core material and fibrous nickel members unitary sintered on both surfaces of the conductive core material, and a layer of an active material filled into the substrate. The fibrous nickel members of the substrate are bent or curved at least at their tip ends inside the active material layer to retain the active material.

6153334

ACTIVE MATERIALS FOR THE POSITIVE ELECTRODE IN ALKALINE STORAGE BATTERY AND THE MANUFACTURING METHOD OF THEM

Hiroyuki Sakamoto, Hidekatsu Izumi, Yoichi Izumi, Isao Matsumoto, Japan assigned to Matsushita Electric Industrial Company Ltd.

The energy density of active materials for a positive electrode comprising an oxide containing Ni as a main metallic element is enhanced and moreover, a method for manufacturing them is provided. The oxide includes Ni as a main metallic element and contains at least Mn in the state of solid solution or eutectic mixture, wherein the average valence of Mn is 3.3 valences or more, the tap density is 1.7 g/cc or more, the half width of a peak at around $2\theta = 37-40^\circ$ of X-ray diffraction using Cu K α ray is 1.2° or less, the ratio B/A of integrated intensity B of a peak at around $2\theta = 18-21^\circ$ to integrated intensity A of a peak at around $2\theta = 37-40^\circ$ is 1.25 or less, and the volume of pores having a pore radius of 40 ANG or less is 60% or more of the total pore volume. The oxide is obtained by growing in the state of keeping the dissolved oxygen concentration in the aqueous solution in the reaction vessel and then oxidizing the oxide.

6154033

METHOD AND APPARATUS FOR ANALYZING NICKEL-CADMIUM BATTERIES

Thirumalai G. Palanisamy, Patrick M. Rudai, Steven Hoening, Harmohan Singh, USA assigned to Honeywell International Inc.

A system and method for comprehensive analysis of a multi-cell battery, such as of the nickel-cadmium type, on

an individual cell level basis and overall battery basis. For an unsealed battery, which affords access to the individual battery cells, tests are carried out to determine the presence of any shorted or reversed cells, and these can be repaired or replaced. The individual cells are then tested for sufficient electrolyte on the basis of comparing the cell internal resistance to a maximum internal resistance for the cell and electrolyte added as needed. A sealed battery, to which there is no access to the individual cells, is first tested for shorted or reversed cells on a battery level basis. A sealed battery that passes this test and an unsealed battery whose individual cells have been found to be satisfactory in its prior tests are subjected to further testing on a battery level basis for: (a) overall internal resistance to determine if it exceeds a given maximum value internal resistance, this indicating that the battery is defective and (b) actual capacity as compared to its rated capacity. A battery whose actual capacity is greater than its rated capacity is tested for a memory effect and the memory effect problem is corrected if found to be present.

COMPONENTS AND/OR CHARGERS

6133707

BATTERY CHARGING AND DISCHARGING CONTROL APPARATUS FOR HYBRID POWERED VEHICLE

Yoshiaki Kikuchi, Toshiyuki Sekimori, Kazuo Tojima, Yoshiyuki Nakayama, Japan assigned to Toyota Jidosha Kabushiki Kaisha

A voltage detector detects the voltage levels of the battery blocks of the battery set. A presence of an overdischarged cell is detected, when a voltage difference between each of the battery blocks reaches or exceeds a predetermined value (for example, 1 V). At this point, a battery ECU sets the SOC value of the battery set at the lower control limit value (for example, 20%). This triggers an HV ECU to control the load such that charging is effectuated in the battery set. If further discharge occurs, the battery set is disconnected from the load by a relay.

6133713

METHOD FOR CHARGING BATTERIES

Daniele C. Brotto, USA assigned to Black and Decker Inc.

A method for charging and monitoring a rechargeable battery is proposed. The charging method includes charging a rechargeable battery, sensing temperature of said battery, and calculating temperature change rate. The method further includes sensing voltage of said battery after the temperature change rate reaches a predetermined value, calculating voltage change rate, and reducing current sent to the battery when the voltage change rate reaches a predetermined value. A second embodiment of

the charging method may include charging a rechargeable battery, sensing temperature and voltage of said battery, and calculating temperature and voltage change rates. The method further includes sensing for a maximum voltage change rate after the temperature change rate reaches a predetermined value, and reducing current sent to the battery when the maximum voltage change rate is sensed. In addition, the method may include sensing for a minimum voltage change rate before sensing for the maximum change rate, wherein sensing for the maximum change rate would begin after the temperature change rate reaches a predetermined value or after the minimum voltage change rate is sensed.

6144188

**METHOD FOR DETECTING FULLY CHARGED
CONDITION OF SECONDARY BATTERY
AND DETECTOR USING
THE SAME**

Yukihiro Okada, Hiromu Matsuda, Yoshinori Toyoguchi, Yoshinori Yamada, Japan assigned to Matsushita Electric Industrial Company Ltd.

The present invention provides a method for detecting a fully charged condition of a secondary battery by which the fully charged condition of a secondary battery can be detected accurately and deterioration in battery characteristic due to overcharging can be restrained irrespective of the charging mode and the surroundings, without the need for a special battery structure. In the method, pulse vibrations generated inside a secondary battery being charged are detected, and when the obtained characteristic value of the pulse vibrations, for example, incidence of generation of the vibrations reaches a predetermined value, the secondary battery is determined to be in fully charged condition.

6147473

**ELECTRIC CAR BATTERY PACK CHARGING
DEVICE AND A METHOD**

Jae-Seung Koo, South Korea assigned to Hyundai Motor Company

Disclosed is a device and method for charging an electric car battery pack that charges by receiving power and discharges to supply power. A battery charging controller controls charging the battery pack at a constant power, and when the voltage of the battery pack is over a first voltage, controls a constant current charging process, and after this, each time a peak value of the battery pack is over a second voltage, controls a sequential reduction of current and performs a constant current charging process, and when the voltage of the battery pack is over a third voltage, controls a constant current charging process at a fourth voltage, and when the charging voltage is over a fifth voltage, controls a termination of the charging process. A

battery charger receives external power according to the control of the battery charging controller, and charges the battery.

6150795

**MODULAR BATTERY CHARGE EQUALIZERS
AND METHOD OF CONTROL**

Nasser H. Kutkut, Herman Wiegman, Raymond Marion, USA assigned to Power Designers LLC

Battery charge equalization is carried out utilizing modules connectable in staggered relation between pairs of batteries in a series connected string of batteries. Each module is standardized and has the same construction as the other modules. The modules may be constructed to provide uni-directional charge distribution down the string from a more highly charged battery to a lower charged battery and from a more highly charged last battery in the string back to a less highly charged first battery in the string, or may be constructed to provide bi-directional charge redistribution up or down the string of batteries. The charge equalizer modules are forward-based and reduce the charging current as the voltages on the two batteries to which the module is connected equalize. Each battery equalizer module may comprise a transformer having a primary and a secondary with the same number of turns, a controllable switching device connected in series with the primary, and a free-wheeling diode connected in series with the secondary winding.

6154007

**BATTERY CHARGING SYSTEM
AND METHOD**

David M. Shaver, Carl W. Gifford, Canada assigned to Black and Decker Inc.

A battery charging system enables rapid recharging of a working battery without immediate access to ac power and without the need for current limit and/or overvoltage protection. The battery charging system makes use of a charging battery having a number of cells that is greater than the number of cells in the working battery. The charging battery produces a charging current that is proportional to the difference in the number of cells in each battery. In this manner, the battery recharging system is capable of rapidly recharging the working battery. The number of cells in the charging battery is selected, however, such that the series voltage of the charging battery cells is less than or equal to the maximum rated voltage of the working battery. Thus, the voltage of the charging battery is greater than the operating voltage of the working battery, but less than or equal to the maximum voltage rating of the working battery. As a result, the charging battery is generally incapable of overcharging the working battery, and therefore does not require current limit and/or overvoltage protection circuitry.

OTHER BATTERIES**6127061****CATALYTIC AIR CATHODE FOR AIR-METAL BATTERIES**

You-Keung Shun, Chou-Lui Lou, China assigned to High-Density Energy Inc.

An air cathode for use in an electrochemical cell or battery having an air permeable and water impermeable layer, an electrically conductive middle layer and a catalytic layer comprising a mixture of carbon particles, particulate materials, having a high surface area, metal hydroxides, and hydrophobic particles.

6130008**ALKALINE STORAGE BATTERY**

Kohji Yuasa, Yasuhiro Nitta, Kaori Gomikawa, Japan assigned to Matsushita Electric Industrial Company Ltd.

An alkaline storage battery with improved cycle life and self-discharge characteristics is disclosed. The battery comprises a positive electrode, a negative electrode, a separator and an alkaline electrolyte. For the separator, a material of a woven or non-woven fabric sheet or a porous film of polyolefine resin of which surfaces have been modified with a hydrophilic compound having a carboxyl group by graft-polymerization. The quantity of carbonates inside the battery is regulated to 150 mg/Ah battery capacity. The quantity of carbonates inside the battery can be regulated to a minimum by optimizing graft polymerization and subsequent washing conditions.

6132896**ELECTROCHEMICAL CELL WITH CIRCUMFERENTIAL CATHODE CURRENT COLLECTOR**

Walter C. Sunderland, Anthony W. Rorvick, Donald R. Merritt, Craig L. Schmidt, David P. Haas, USA assigned to Medtronic Inc.

An electrochemical cell has a silver vanadium oxide cathode material formed into a pellet shape which expands as the cell is discharged. A cathode current collector circumferentially surrounds the cathode pellet and is in contact with the peripheral edge of the cathode pellet to prevent peripheral cathode expansion. The peripheral cathode current collector maintains a stable cell impedance during cell discharge. The cell has a D-shaped housing in which the cathode is disposed adjacent to a first interior surface, and a lithium anode is disposed adjacent to a second interior surface.

6139987**BIPOLAR BATTERY**

Bon-Soon Koo, Heesook Park Kim, Sung-Baek Cho, Jeong-Ja Choi, Jong-Myong Kim, South Korea assigned to Agency for Defense Development

A bipolar battery includes a plurality of anodes and cathodes alternately stacked and isolated by separators with a through hole being formed at a center portion of each, and with a plurality of insertion holes being formed at peripheral portions of each, an anode connection member and cathode connection member inserted into the insertion holes of the anodes and cathodes, an anode insulation member formed at the bottom of the anode connection member, a cathode insulation member formed on the top of the cathode connection member, an anode contact member facilitating electrical connection of the anodes and an anode connection member, a cathode contact member facilitating electrical connection of the cathodes and a cathode connection member, an outer support member supporting the stacked anodes and cathodes, an electrolyte injection member inserted into the through holes of the anodes, cathodes, and separators for enabling injection of an electrolyte into the stacked anodes and cathodes, and a collector being shared by the cathode of an upper cell and the anode of a lower cell, for thereby easily increasing the current capacity.

6143443**STABILIZED ELECTROLYTE SOLUTIONS, METHODS OF PREPARATION THEREOF AND REDOX CELLS AND BATTERIES CONTAINING STABILIZED ELECTROLYTE SOLUTIONS**

Maria Skyllas Kazacos, Michael Kazacos, Australia assigned to Pinnacle ARB Limited

A method for stabilizing an electrolyte for use in a redox cell, in particular for stabilizing an electrolyte for use in an all-vanadium redox cell, a stabilized electrolyte, in particular an all-vanadium stabilized electrolyte, a redox cell, in particular an all-vanadium redox cell, comprising the stabilized electrolyte, a redox battery, in particular an all-vanadium redox battery, comprising the stabilized electrolyte, a process for recharging a discharged or partially discharged redox battery, in particular an all-vanadium redox battery, comprising the stabilized electrolyte, and a process for the production of electricity from a charged redox battery, and in particular a charged all-vanadium redox battery, comprising the stabilized electrolyte are disclosed. Also disclosed are a redox battery/fuel cell and a process for the production of electricity from a redox battery/fuel cell.

6144185**METHOD AND APPARATUS FOR DETERMINING THE CONDITION OF A BATTERY THROUGH THE USE OF MULTIPLE BATTERY TESTS**

Thomas J. Dougherty, Michael E. Iverson, USA assigned to Johnson Controls Technology Company

A method and apparatus for determining the state of charge of a battery include use of multiple battery tests to provide complementary insight into battery condition before, during,

and after battery charging. Battery testing is performed using a light resistive load, a heavy resistive load, a conductance tester, and a battery charger. During a preliminary charging stage, average battery current and a predicted battery temperature are used to determine whether or not the battery is capable of being substantially fully charged, thereby permitting avoidance of unneeded charging. In the later charging stage, the rate of change of battery cold cranking amps is monitored to detect an end of charge condition.

6146787

SOLID POLYMER BATTERY ELECTROLYTE AND REACTIVE METAL-WATER BATTERY

Mason K. Harrup, Eric S. Peterson, Frederick F. Stewart, USA assigned to Bechtel BWXT Idaho LLC

In one implementation, a reactive metal-water battery includes an anode comprising a metal in atomic or alloy form selected from the group consisting of periodic table group 1A metals, periodic table group 2A metals and mixtures thereof. The battery includes a cathode comprising water. Such also includes a solid polymer electrolyte comprising a polyphosphazene comprising ligands bonded with a phosphazene polymer backbone. The ligands comprise an aromatic ring containing hydrophobic portion and a metal ion carrier portion. The metal ion carrier portion is bonded at one location with the polymer backbone and at another location with the aromatic ring containing hydrophobic portion. The invention also contemplates such solid polymer electrolytes use in reactive metal-water batteries, and in any other battery.

6146790

NON-AQUEOUS ELECTROLYTE SECONDARY CELL

Atsuo Omaru, Akira Yamaguchi, Masayuki Nagamine, Japan assigned to Sony Corporation

In a non-aqueous electrolyte secondary cell, it is possible to control the irreversible capacity degradation, which is caused when it is preserved under the condition of charging. The non-aqueous electrolyte secondary cell includes a positive electrode that is capable of doping and dedoping lithium and a negative electrode and non-aqueous electrolyte. Specifically, a monomethoxy benzene class compound is added to the non-aqueous electrolyte at a concentration ranging from 0.005 to 0.5 M.

6150053

NON-AQUEOUS ELECTROLYTE SECONDARY BATTERY

Toshihide Murata, Yasuhiko Bito, Shuji Ito, Yoshinori Toyoguchi, Toshitada Sato, Japan assigned to Matsushita Electric Industrial Company Ltd.

A non-aqueous electrolyte secondary battery is disclosed, which hardly causes deterioration of its properties at high temperatures. The battery has a chargeable and dischargeable cathode, a chargeable and dischargeable anode, and a non-aqueous electrolyte and includes a substance which produces water with an increase in temperature in any one of the cathode, the anode, the non-aqueous electrolyte, other elements, and voids in the battery. Examples of the substance which produces water include hydroxides and compounds having water of crystallization.

6153328

SYSTEM AND METHOD FOR PREVENTING THE FORMATION OF DENDRITES IN A METAL/AIR FUEL CELL, BATTERY OR METAL RECOVERY APPARATUS

Jeffrey A. Colborn, USA assigned to Metallic Power Inc.

A system and method is disclosed for preventing dendrite formation in a fuel cell, battery or metal recovery system. Typical metal/air fuel cell stacks comprise a plurality of cells electrically coupled together in a serial fashion. Electrolyte is typically pumped through the cells on a continuous basis using an input and output manifold device having a number of channels equal to the number of cells comprising the stack. This parallel connection causes the formation of metallic dendrites in the channels, which can short circuit the fuel cell stack or battery or metal-recovery apparatus. The system and method provides one or more dendrite elimination zones to prevent the formation of dendrites. The dendrite elimination zones are constructed within each cell or within each manifold to prevent the electrochemical reaction associated with dendrites from taking place. The dendrite elimination zones are characterized by the substantial lack of a metal negative electrode, such as zinc, in the volume of the zone, and the substantial presence of a cell positive electrode through the volume or adjacent to the volume.

6153338

NON-AQUEOUS ORGANIC ELECTROLYTES FOR LOW TEMPERATURE DISCHARGE OF RECHARGEABLE ELECTROCHEMICAL CELLS

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

An alkali metal secondary electrochemical cell, and preferably a lithium ion cell, activated with a quaternary solvent system, is described. The solvent system comprises a quaternary mixture of dialkyl carbonates and cyclic carbonates, and preferably dimethyl carbonate, diethyl carbonate, ethylmethyl carbonate and ethylene carbonate. Lithium ion cells activated with this electrolyte have good room temperature cycling characteristics and excellent low temperature discharge behavior.